

**UNIVERSITY OF ALGARVE  
FACULTY OF ECONOMICS**

**POLITICO-ECONOMIC APPROACHES TO PUBLIC FINANCE**

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Public Economics, Political Economy and Planning

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**POLITICO-ECONOMIC APPROACHES TO PUBLIC FINANCE**

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# **ABORDAGENS POLÍTICO-ECONÓMICAS DAS FINANÇAS PÚBLICAS**

**Ana Paula Catarino Barreira**

## **RESUMO**

A presente tese de doutoramento é composta por três partes que abordam a problemática da gestão das finanças públicas numa óptica político-económica. As primeiras duas partes versam sobre a forma como governos instituídos exercem as suas funções orçamentais de gestão da despesa pública e a terceira parte apresenta um modelo que analisa a forma eficiente de fornecimento numa nação do bem público “governo”.

As duas primeiras partes demonstram o comportamento oportunista dos governos através da manipulação da composição da despesa pública ao longo da legislatura, dando origem ao aparecimento de um ciclo orçamental induzido pela ocorrência de períodos eleitorais.

A primeira parte apresenta um modelo teórico com informação completa no sentido em que o governante e os eleitores têm acesso, em simultâneo, à mesma informação referente às escolhas orçamentais, nos períodos pré- e pós-eleitorais. O modelo mostra que no período pré-eleitoral, o governante manipula a composição da despesa pública para aquelas categorias que geram utilidade no período a que se refere a decisão do gasto. Essa manipulação resulta do facto da reeleição ser um acontecimento incerto, o que implica que apenas no caso da permanência no poder o governante retirará utilidade da despesa efectuada nas categorias que geram benefício no período seguinte. Dado que na primeira categoria se enquadram as denominadas despesas públicas correntes e na segunda categoria estão contempladas as designadas despesas públicas de investimento, a composição orçamental é enviesada no período pré-eleitoral em favor da primeira categoria. O governante é apresentado como sendo ideologicamente neutro, podendo o eleitorado evidenciar preferência por uma das categorias de despesa pública. Nesse sentido, se os eleitores não tiverem, no período pós-eleitoral, qualquer enviesamento nas suas preferências não será de esperar qualquer manipulação orçamental por parte do governante.

Usando uma repartição da despesa pública entre categorias que são preferidas pelos eleitores e categorias que favorecem a sociedade no geral, o modelo teórico mostra que quando há um enviesamento nas preferências do eleitorado/sociedade em favor da despesa corrente, os governantes manipulam a composição da despesa pública em favor daquela categoria nos dois períodos da legislatura. Caso o

enviesamento nas preferências do eleitorado/sociedade seja no sentido de favorecer a despesa de investimento, o modelo demonstra a existência de um ciclo político-eleitoral de sinal ambíguo.

A segunda parte propõe uma aplicação empírica do modelo teórico apresentado na primeira parte, usando para tal dados relativos ao conjunto dos países da União Europeia no período compreendido entre 1970 e 2001. Contrastando com alguns estudos que indicam que a ausência de ciclos político-económicos de natureza eleitoral nos países desenvolvidos, a aplicação empírica mostra que nos períodos pré eleitorais os governos centrais da União Europeia manipulam a composição do orçamento público.

Usando uma técnica econométrica recentemente proposta denominada “*Pooled Mean Group Estimator*”, são demonstrados dois resultados. Primeiro, os governos centrais aumentam a percentagem do orçamento público afecto às despesas correntes em detrimento das despesas de capital na proximidade dos períodos eleitorais. Segundo, quanto maior a importância relativa dos eleitores efectivos relativamente à população maior é a manipulação da despesa pública em favor das categorias que vão ao encontro das preferências do eleitorado.

A terceira parte descreve um modelo teórico que procura discutir em que condições terá viabilidade a passagem de um sistema centralizado para um sistema descentralizado de provisão de um governo. O processo de descentralização proposto no modelo pode assumir duas formas: a implementação de comunidades isoladas ou a definição de uma região. Introduzindo um dilema (*trade-off*) entre o benefício da partilha do custo da provisão do bem “governo” e a perda resultante da partilha de um governo com indivíduos com preferências diferentes, o modelo teórico permite concluir que, na ausência de transferências compensatórias entre comunidades e na presença de um sistema de votação por unanimidade, as condições de eficiência e de estabilidade só são garantidas com a total segregação das comunidades ou com a manutenção da centralização. Quando o modelo admite a existência de transferências entre comunidades, por forma a assegurar que nenhuma se encontra numa posição menos favorável em comparação com a centralização, o óptimo de Pareto pode ser obtido quer com a regionalização, quer com a total segregação. No entanto, a condição de estabilidade apenas pode ser assegurada no segundo caso.

**Palavras-Chave:** Finanças Públicas, Política Económica, Escolha Pública, Ciclos Eleitorais, Estimação com Dados em Painel, Descentralização

**Classificação de acordo com o Sistema Internacional:**

- C23 – Modelos com Dados em Painel
- D61 – Atribuição Eficiente: Análise de Custo-Benefício
- D71 – Escolha Social, Clubes e Conselhos
- D72 – Modelos Político-Económicos: Eleições, Legislaturas e Comportamento de Voto
- H41 – Bens Públicos
- H50 – Despesas dos Governos Nacionais e Políticas Relacionadas – Geral

# **POLITICO-ECONOMIC APPROACHES TO PUBLIC FINANCE**

**Ana Paula Catarino Barreira**

## **ABSTRACT**

This PhD dissertation comprises three parts that approach the problem of public finance management from a politico-economic perspective. The first two parts address the way established governments handle budgetary management of public expenditure while the third part presents a model that analyses a way of efficiently providing the public good “government” for a nation.

The first two parts demonstrate the opportunistic behaviour of governments through manipulation of public expenditure composition during tenure, giving rise to a budget cycle induced by the occurrence of election periods.

The first part presents a theoretical model entailing complete information in the sense that the incumbent politician and the electorate have access, simultaneously, to the same information regarding budgetary choices during post-and pre-election periods. The model shows that during the pre-election period, the incumbent manipulates the composition of public expenditure towards categories that generate utility during the period referring to spending decisions. This manipulation results from the fact that re-election is an uncertain event, thus implying that only in the case where the incumbent remains in power is it possible to obtain utility of applied spending in categories generating benefits in the following period. Given that current expenditures correspond to the first category and investment expenditures are contemplated in the second category, the budget composition is biased in pre-election periods in favour of the former. The incumbent is presented as being ideologically neutral, but we discuss the implications of the electorate’s preferences for one of the categories of public expenditure. To begin with, it is shown that, if voters have no preference bias, then budget manipulation is not expected during post-election period. The other possibilities are examined subsequently.

By means of a public expenditure partitioning between categories that are preferred by voters in particular and categories that favour society at large, the model also shows that when voters/society have a preference bias towards current expenditures, the incumbent manipulates public expenditure composition favouring this category during the two tenure periods. If the voters/society preferences are prone to investment expenditures, the model shows a political budget cycle with an ambiguous sign.

The second part proposes an empirical application of the theoretical model proposed in the first part, using data of European Union countries from 1970 through 2001. In contrast to some studies that indicate the absence of political budget cycles induced by electoral motives in developed countries, the empirical study shows that,

in pre-election periods, central EU governments manipulate the composition of public budget.

Through the use of an econometric technique referred to as “Pooled Mean Group Estimator”, two findings can be shown. Firstly, central governments increase the share of current expenditures in the public budget by decreasing capital spending near election periods. Secondly, the greater the relative importance of effective voters in population, the greater the share of expenditure items that are particularly favoured by voters.

The third part describes a theoretical model aiming to discuss the optimal degree of government centralisation. It studies the welfare implications of different institutional architectures, from complete centralisation to varying degrees of subnational autonomy. The decentralised process proposed in the model can assume two forms: the implementation of isolated communities or definition of a region. A trade-off between cost-sharing provision of “government” and the loss that result from sharing it with individuals holding different preferences, is widely pondered. This model allows us to conclude that in the absence of inter-community compensatory transfers and in the presence of a unanimity voting system, stability and efficiency conditions are only guaranteed when communities are completely segregated or when there is centralised administration. When transfers between communities are allowed for, to ensure that none are at a disadvantage compared to centralisation, Pareto’s optimality is feasible through either regionalisation or complete segregation. However, a stable condition can only be ensured in the latter case.

**Keywords:** Public Finance, Political Economy, Public Choice, Electoral Cycles, Panel Data Estimation, Fiscal Federalism

**JEL Codes:**

- C23 – Models with Panel Data
- D61 – Allocative Efficiency; Cost-Benefit Analysis
- D71 – Social Choice; Clubs; Committees
- D72 – Economic Models of Political Processes: Elections, Legislatures and Voting Behaviour
- H41 – Public Goods
- H50 – National Government Expenditures and Related Policies – General

## GENERAL INTRODUCTION

This doctoral dissertation in Economics falls within the research area: public economics, political economy and planning.

This dissertation comprises three parts. Part One entitled “Elections and the public expenditure mix”, introduces the first theoretical model and Part Two presents an empirical application, “Cycles and composition of public expenditure within the European Union”. The second theoretical model is proposed in Part Three, entitled “A political economy analysis of jurisdiction formation”.

The first two parts are related in what concerns their object of analysis while the third part is more independently driven in terms of content and applied methodology.

The model introduced in the first part explains the opportunistic behaviour of a government prior to election periods, tending to manipulate the composition of public expenditure, thus generating a political budget cycle. Some of the theoretical predictions presented in the first part are empirically tested in the second one, using European Union countries as the application field. The latter part discusses the border configuration of territorial partitions from a political perspective, trading the benefits of public good provision cost sharing against the loss in influential power of individuals when partitions are enlarged.

Although the doctoral research has been separated into distinct parts, there is a link between them, namely the importance of institution design and the conflict of interests between policy-makers, voters and the society at large. While the first two parts look at the exercise of political power based on a pre-configured institutional arrangement constrained by a budget that can be managed according to electoral interests, the third part questions established jurisdictional borders, proposing alternative institutional arrangements that may improve society’s welfare.

This dissertation is closely related to two areas of study: public choice theory and social choice theory. Bringing these two areas of study together, allows for a wider analysis of the possibilities conducive to obviating, on one hand, market “failure” and, on other, government “failure”. This twin perspective encompasses the three parts.

In fact, relevant political players in the first two parts of the dissertation are not assumed to be benevolent dictators, as would be the case with the social choice theory. Alternatively, motivation of incumbent politicians is driven by personal interests rather than for “the common good”; discussed self-interests include re-election quests and own income. This approach follows the tradition of the public choice theory, which developed in contra-position to social choice theory.

The third part draws on the theory of social choice as it proposes an organisational structure for the provision of public governance based on a configuration choice by a group of individuals with specific preferences. However, in the government implementation stage, which goes beyond our analysis, individual preferences intercommunicate with preferences from elected policy-makers, whose behaviour are guide by selfish objectives. This determines that the level of satisfaction obtained by individuals will be different from that obtained in the absence of such behaviour, as described in the theoretical model in the first part.

Criticisms of social choice approaches have centred on the ignorance or, at least, under representation of actual policy-making procedures. Yet, it is also true that political intervention can only reasonably exist if new social welfare outweighs expected social welfare before intervention.

From this perspective, understanding how the two research areas relate to efficient economic policy decisions is the key issue addressed in the dissertation.

The impetus of this work is briefly discussed below according to each part, evidencing the driving motivation and briefly presents the main results.

The first part of this dissertation develops as a result of two observations. Firstly, while the public economics literature widely explores budget composition in absolute terms, such as fiscal deficit problems, little analytical attention has been paid in relative terms. Secondly, an important avenue on the political budget cycle literature, relies on the assumption of temporary asymmetry of information between those in government and voters, where the former displays opportunistic behaviour in terms of electoral cycles. Recent developments suppress this assumption from the theoretical models, yet a political budget cycle is still found, though budget mix levels were not observed. The model presented in Part One looks, in this sense, to evaluate whether electorally-induced opportunistic behaviour of governments is sustained when the analysis considers the public expenditure composition.

This model shows that when analysis focuses on the public expenditure mix, namely, consumption expenditure or investment expenditure, an electorally-induced cycle still occurs. Using a general intertemporal utility model in which both voters and incumbent are rational, have complete information and show no bias in favour of any category of public expenditure, a cycle towards consumption expenditure in pre-election periods is to be expected.

The model described in the first part incorporates also the scenario whereby voters and society at large do not share preferences for expenditure categories. The model shows that if voters or society prefer those categories that hold immediate satisfaction, then the expenditure cycle above emerges, both in post-election periods and in pre-election periods. Alternatively, if voters or society evidence a marginal preference for investment expenditure, which carries satisfaction within a time lag, this category

exceeds current expenditure in post-election periods only. Under the second scenario, the cycle's nature is ambiguous in pre-election periods.

These two main theoretical results contain testable empirical implications. Thus, we decided to investigate the empirical relevance of the proposed framework, which constitutes Part Two of the dissertation. The application covers European Union Member States and the sample selection proceeds from two important aspects in the literature. On the one hand, there are some controversial findings concerning political budget manipulation near elections, when studies consider only a set of developed countries. On the other hand, there is a direct relationship between access voters have to information and the country's degree of democratic consolidation.

Previous studies on the political budget cycle mainly take public expenditures as an absolute value rather than a relative one. Designing an empirical model respecting the spirit of the theoretical framework of Part One as much as possible, we look at fiscal biases towards particular expenditure items. In particular, we model in Part Two the share of particular items on total public expense.

The empirical application is based on a panel data of central government expenditure collected from 15 European Union Member States from 1970 to 2001. First, public expenditure is broken down into current and capital outlays, then expenditure is broken down into expenditure items favourable to voters in particular and society at large.

The econometric approach uses a pooled-mean group estimation technique (PMG) recently proposed by Pesaran *et al.* (1999). This technique differs from some more widely used panel data models since estimates dynamic specifications imposing homogeneity restrictions on long-run coefficients while allowing for heterogeneity across countries on short-run coefficients. The homogeneity assumption widely used

by earlier studies imposes bias on the estimated coefficients yielding results of an electoral cycle statistically insignificant. These studies did not allow for panel heterogeneity beyond fixed effects.

By relying on annual budget composition, the evolution of public expenditure shares across categories is systematically analysed.

Firstly, the main goal is to support the theoretical expectations that governments do manipulate budget composition near elections, essentially prone to those categories with immediate visibility. In this sense the initial interest is to evaluate the impact of election terms on public finances in what concerns government's manipulation prone to current expenditures. Secondly, the role of electoral participation on public expenditure biases is investigated, by distinguishing across pro-voter and pro-general society outlays.

Findings support the theoretical model presented in the first part of this dissertation. Namely, elections still play a role in shaping public expenditure cycles in the European Union: central governments increase the share of current expenditure whenever they are closer to electoral contests. Also, budgetary bias towards voters' preferred expenditure categories is positively and directly related to the weight of voters in the society at large.

Besides the electoral cycle, variables like unemployment rate and senior population interests are statistically relevant to explain the budget bias prone to current expenditures. In contrast, however, inflation rate delay by one period evokes a contraction of current expenditures. Other variables such as government ideologies or the parliamentary weight of the largest party are not systematically influential in the composition of public expenditures.

In contrast, when public expenditures are sorted out according to governmental functions, economic and ideological variables do not show statistical significance as far as the second theoretical prediction is concerned. Parliamentary fragmentation seems to favour the government's manipulation of expenditures prone to voters' preferences.

The third part presents a theoretical model on the configuration of jurisdictions. It studies the segregation process, eventually leading to region formations, as opposed to the *status quo* defined by a centralised regime. A political economy perspective underlies the framework.

The model looks into the circumstances under which a group dimension is large enough, based on preferences, to desire solitude or belonging to a region for the provision of a public good defined as "government". In this sense the benefits and costs related to the size of groups in each situation are evaluated and compared with a centralised arrangement. In this model, citizens obtain benefits when the public good provision is shared with other groups, since the per capita financing effort for the public good provision decreases. At the same time, there is an associated cost as utility from the public good decreases when a group has to share access to the public good with other groups. This cost is related to a loss in influential power that will affect each group in determining the public good.

In the model, groups are territorially sorted, each one occupying a different partition, thus assuming that individuals are homogeneous within the group but heterogeneous across groups. In contrast to previous works, the main goal is not to find how a nation can be partitioned into groups of identical size but rather to evaluate the feasibility of several decentralisation processes when communities differ in size.

The analysis also innovates with respect to decision rules. The literature mainly focuses on decision processes governed by majority voting mechanisms. The theoretical model described in Part Three of this dissertation explores the implications from the unanimity rule towards the decentralisation process. It assumes a constitutional prerequisite where any move away from the *status quo* must be preceded by an unanimous vote across all communities. With this referendum framework, the only acceptable decentralisation outcome is one that makes at least one group better off without worsening any other group, a condition resembling very much the Pareto efficiency criterion.

The following conclusions can be drawn from the model.

Firstly, when decentralisation does not contemplate mechanisms that redistribute the net gains of reform from winning to losing communities, the only Pareto efficient solutions are either full segregation or centralisation. Full segregation corresponds to the scenario in which all communities find themselves in isolation. Under these circumstances, it is also shown that the two institutional organisations are stable.

Secondly, when transfers are allowed from communities that gain to communities that lose with decentralisation, the natural institutional arrangement is full segregation. A decentralisation process leading to total isolation of each community ensures, simultaneously, an efficient and stable outcome.

Third, regionalisation appears as a second-best choice, which can only be expected if under the same national space there are, simultaneously, communities of large dimension and communities of very small dimension. Under this special case, regionalisation appears as feasible and is a Pareto movement. However, the

configuration of the region may be unstable, since each community generally prefers to stay in isolation with the possibility of compensatory transfers, if allowed.

# **PART I**

## **Elections and the Public Expenditure Mix**

In social welfare theory, elected incumbents through political performance are modelled following the exclusive interests of the public. The public choice theory questions this approach suggesting that incumbents may have their own personal motivations.

A critique of the welfare theory taken by the public choice theory can be found in Mueller (1997) and Stiglitz (1988).

The study in political decision models, such as the personal motivations of elected incumbents, is supported by Buchanan (1984) as an precautionary attitude given that there is no reason to believe that elected incumbents while in “market” political power behave differently to those in private markets, of selfish act.

Under this framework, the issue Pereira and Pontes (1999, pp.4) rightly raises in their work is,

*“If selfishness drives political actors what is the point of normative public choice theory in advising changes in rules and/or institutions...?”*

The authors answer the question with the following argument.

*“Decision-makers have a great degree of uncertainty on their future positions in society so that they are not able to identify their self interests and therefore they can, more or less unanimously, agree on some principles that serve the general or public interest.”*

Pereira (1997) presents a historical retrospect of public choice theory as well as a description of the normative and positive implications of questions raised when compared to the theory of social welfare.

The theory of public choice determines the rationale for the occurrence of politically-induced economic cycle events intended to satisfy the preferences of

involved agents in public choice; in specific, the presence of political cycles in the public expenditure budget, as those described in Part One of this dissertation.

Macroeconomists use the term *business cycle* to describe repeated fluctuations of aggregated economic activity. Business cycles are of central concern in macroeconomics because fluctuations often lead to uncertainties (Chang (2001).

The political business cycle literature holds two perspectives. One perspective considers the incumbent's acts motivated by opportunistic incentives, that is, the desire to be re-elected causes the incumbent to manipulate economic variables, thus leading to a cycle, disassociated from the political party. The second perspective regards the incumbent as being affiliated to a political party, inducing a cycle, as a result of parties having different preferences regarding economic outcomes. The former perspective is identified as an "opportunistic" political business cycle model and the latter as a "partisan" political business cycle model.

"Opportunistic" political business cycle models are introduced by Kalecki (1943) and further developed by Nordhaus (1975), with "partisan" model variations presented by Hibbs (1978) and Alesina (1987).

The aim of the following Chapter is to briefly review the main contributions made to the study of political business cycles, by examining main assumptions and limitations. A descriptive focus is provided based on an incumbent's opportunistic perspective according to the theoretical model proposed in the Chapter 2. In this sense, the developments in the field, relating to the incumbent's manipulation on budget instruments, are simultaneously evidenced, and commonly referred as political budget cycles.

Drazen (2000) presents a comprehensive historical overview of the political business cycle literature, and whose approach is closely followed. The following

literature review also contemplates an extension of subsequent developments in the field of political business cycles.

The introduction of theoretical developments on political business cycle literature and in particular on political budget cycles constitutes a conceptual framework that helps us to identify the model introduced in Chapter 2 from theoretical models earlier presented.

Part One of the dissertation is organised as follows. Chapter 1 reviews recent works on political business cycles and respective empirical applications. Chapter 2 introduces the theoretical model and describes the nature of the political expenditure cycle. Chapter 3 studies the differentiated preference pattern between voters and society and its impact on budget expenditure mix. Chapter 4 provides the main conclusions of this part.

## 1. Political business cycles – An overview

### 1.1. Partisan political business cycles

#### 1.1.1. The adaptive expectations

Hibbs (1977) introduced the partisan political business cycle model. The model proposed by Hibbs describes the incumbent as being purely oriented by partisan interests, with no opportunistic motives to manipulate economic outcomes. This type of models starts with the observation that there are two-types of parties, a left-wing party, denoted L, and a right-wing party, denoted R. The right-wing and left-wing parties have different positions on economic issues and hence different macroeconomic objectives. Those differences translate into different preferences over inflation and unemployment.

The adaptive expectations regarding inflation are defined as follows:

$$\pi_t^e = \pi_{t-1} + \theta(\pi_{t-1}^e - \pi_{t-1}), \quad (1.1)$$

where  $\theta$  is a coefficient between 0 and 1 representing the speed with which expectations in period  $t$  ( $\pi_t^e$ ) adapt to past inflation ( $\pi_{t-1}$ ).

The formulation of the adaptive expectations to inflation -  $\pi_t^e$  does not depend on the expectations of future policies. This is why expectations are said not to be rational.

The partisan difference in interests can be represented by the following partisan loss function:

$$L_t^j = \alpha^j \frac{\left(x_t - \tilde{x}^j\right)^2}{2} + \frac{\left(\pi_t - \tilde{\pi}^j\right)^2}{2}, \quad (1.2)$$

for party  $j$ , where  $\tilde{\pi}^j$  is party  $j$ 's target rate of inflation,  $\tilde{x}^j$  is party  $j$ 's target for economic activity, and  $\alpha^j$  is the relative weight put on output relating to inflation fluctuations by party  $j$ .

### 1.1.2. The rational expectations

Alesina (1987, 1988) introduced the rational expectations in the partisan political business cycles, replacing the adaptive inflation expectations. In the rational partisan models it is assumed that the incumbents control the rate of inflation by monetary policy and that voters' expectations regarding inflation are generated by a forward looking process. The rational version of the inflation expectations is then given by:

$$\pi_t^e = E_{t-1}(\pi_t),$$

where  $E(\cdot)$  is the expectation operator,  $\pi_t$  is the inflation rate and  $\pi_t^e$  is the expected inflation rate.

Given the rational inflation expectation reinterpretation of the partisan political business cycles, the expected inflation depends on the expectation of who will win the upcoming election. The existence of uncertainty about election outcomes induces then a cycle. Expected inflation for the half-term after the election is the weighted sum of the two parties' policies, weighted by the probability that each will win the election, namely:

$$\pi_t^e = q^L \pi_t^L + (1 - q^L) \pi_t^R,$$

where  $q^L$  is the probability that the left-wing party win in the election, and where  $\pi_t^L$  and  $\pi_t^R$  are the optimal policies of the two parties in the first half of the term,

which depend not only on their policy preferences, but also on the election probability  $q^L$  itself, as optimal policy depends on  $\pi_i^e$ .

The left-wing parties have a reputation of wanting to lower unemployment. When such a party is in power, wage negotiators will sign nominal wage contracts, which have built into them a high-expected rate of inflation. When a right-wing party wins the election, the Alesina's model predicts a recession in output growth and a rise in unemployment, as monetary policy becomes restrictive.

Ideological differences also induce different budget management, since parties of the left, favouring distribution, increase public expenditure and, parties of the right, putting the market in evidence, reduce public expenditure.

Lidbom (2000) finds empirically significant evidence that left-wing parties spend and tax more than right-wing parties. These effects are particularly large when the same party has had a long tenure in office.

Following Alesina's work, Cusack (1995) combines the "partisan" budget manipulation with the preferences of voters. In that perspective, although a party on government has an ideological stance, the governing party shapes its preferences for more or less public expenditure according to the distance that those preferences have from the position of the electorate. In this sense, the government is described as modifying its preferences with the intention of having a higher electoral support. In this new version of the partisan politics, society is split in two groups: poor groups and affluent groups. While poor groups tend to favour greater government intervention in the economy, more affluent groups have a distinct interest in restricting government intervention and holding down the budget manipulation. In this framework, parties on the left represent the interests of the former group while those on the right represent those of the latter.

Alesina and Cukierman (1990) refer the parties that accommodate the same changes on ideological preferences prone to voters' preferences near election times as "catchall parties", concept introduced by Kirchheimer (1966).

## **1.2. Opportunistic political business cycles**

### **1.2.1. The adaptive expectations**

The opportunistic political business cycle model introduced by Nordhaus (1975) is inspired on previous work presented by Kalecki (1943). In Kalecki's work the full employment goal in the economy is described as being unattainable in democratic regimes given the different incentives of capitalists and working class. In this sense, incumbents induce recessions and unemployment in order to restore the power of business leaders and reduce the bargaining power of workers. In Kalecki's model this power is acquired as a direct result of the prolonged full employment in economy.

The model proposed by Nordhaus (1975) entails an opportunistic behaviour by the incumbents, predicting that the incumbents stimulate economic growth to reinforce their chances of re-election. In order to be re-appointed, the opportunistic incumbent increases the output growth in the year and a half before each election. The incumbent's objective is then to maximise her probability of re-election.

As systematised by Chang (2001) the basic Nordhaus's assumptions are:

1. The policy of incumbent is decided by the majority votes in the election;
2. Incumbents are purely office-seeking;
3. Incumbents can and will manipulate an exploitable Phillips curve in order to achieve their electoral goals;

4. Voters in general prefer economic growth and avoid inflation and unemployment.

These assumptions are translated in the model proposed by Nordhaus on an adjusted Phillips curve that describes the structure of the economy, yielding an inflation-unemployment trade-off:

$$x_t = \pi_t - \pi_t^e,$$

where  $x_t$  is the deviation of actual from potential output that is affected by an adaptive expected inflation -  $\pi_t^e$  and where the monetary authority is assumed to control the inflation rate  $\pi_t$ .

In this sense, the model proposed by Nordhaus assumes that the voting behaviour is retrospective, i.e., the incumbents' political evaluation by voters depends merely on its economic performance in the past. Once again, the adaptive expectations to inflation -  $\pi_t^e$  does not depend on the expectations of future policies, thus evidencing voters' myopic look at the functioning of the economy.

Nordhaus's model also used the adaptive inflation expectations given by expression (1.1).

The voters' satisfaction in any period is given by a loss function similar to expression (1.2) of the form:

$$L_t = \alpha \frac{\left(x_t - \tilde{x}\right)^2}{2} + \frac{\left(\pi_t - \tilde{\pi}\right)^2}{2}, \quad (1.3)$$

where  $\tilde{\pi}$  is the electorate's target rate of inflation,  $\tilde{x}$  is the target rate of economic activity (relative to potential output) and  $\alpha$  is the relative weight the electorate puts on output fluctuations relative to inflation fluctuations.

In this model the electorate votes on the basis of the performance of the economy right before elections. Incumbents stimulate aggregate demand near elections in order to reduce unemployment and the inflationary consequences of the policy are felt in the period after elections when an economy contraction is expected. This behaviour increases the incumbent's popularity and consequently the chances of re-election. After elections the incumbent has to induce some austerity to control the inflation that translates into a loss of popularity. Given so, the incumbent's tenure is spelt into two periods: a post-election and a pre-election one.

The major limitations of this kind of model rely on the voters' inability to recognise the systematic and synchronised electoral manipulation of the macroeconomic variables.

A subsequent development of the Nordhaus's model is presented by Tufte (1978). Using also a two-year model, Tufte concludes that real disposable income per capita in election years increases and that unemployment decreases. Simultaneously, Tufte found evidence in the United States that government before elections increases social security and federal grants, thus inducing a politic-economic cycle.

### **1.2.2. The rational expectations**

The assumption that voters are only retrospective in their evaluations of the incumbent performance is questioned by the rational expectation theory. By this theory, being the voters rational, it will be impossible for incumbents to systematically mislead them. In this second wave of models relying on an opportunistic view, it is argued that, even when voters are assumed to be rational in the sense that they look afterwards and learn with the past, the political business cycle

still occurs. According to the rational expectation models the cycle remains as long as the incumbent has privileged information regarding her “competence”. Rogoff and Sibert (1988) and Rogoff (1990) initially proposed this approach.

Rogoff and Sibert introduced the idea that even when voters have a look to the future, temporary information asymmetries induce the driving forces for the existence of a cycle around elections. According to this mechanism, incumbents can get reputation by signalling their competence to voters, who do not have the entire relevant information to truly evaluate the incumbents’ competence.

The authors defined that the more competent an incumbent is, the less revenue she needs to provide a given level of government services. Their article shows that with asymmetric information, the incumbent has an incentive to lower taxes, increase expenditures or create monetary growth in election years to try to exaggerate her competency, an incentive that is not found in off-election years. Pre-electoral manipulation on the budget mix is only entirely understood by voters with a lag, thus after the election.

A major result from Rogoff and Sibert model is stated in Proposition 5, where the conventional notion that those more popular incumbents are less likely to engage in political business cycle is contradicted.

Persson and Tabellini (1990) present a model that is an inflation-unemployment variant of the Rogoff and Sibert’s model. In this model the Nordhaus’s adaptive expectations of inflation are replaced by rational expectations, given as

$$\pi_t^e = E\left(\frac{\pi_t}{I_{t-1}}\right)$$

where  $E(\cdot)$  is the expectation operator and  $I_{t-1}$  is the information set of the voters at the time  $(t-1)$  when expectations are formed, which includes all the relevant information except the level of incumbent's competence.

The degree of incumbent's competence is a result of the level of output achieved with less unexpected inflation. The incumbent remains opportunistic in the sense that she seeks to be re-elected and the model assumes that the incumbent has control over the inflation rate. In this model voters elect the candidate that is rationally expected to generate the highest utility to them.

The Persson and Tabellini's model narrows the political business cycle compared with the Nordhaus's predictions given voter rationality and awareness of incumbents' incentives.

The political business cycles theory finds support in several empirical studies. Alesina and Roubini (1992) find evidence of an increase in the inflation rate around elections.

#### **1.2.2.1. The political budget cycle model**

Emphasising that incumbents have a direct control over the budget variables contrarily to other macroeconomic variables, Rogoff (1990) introduces the idea that incumbent's budget manipulation generates a cycle around elections.

In Rogoff's model the incumbent is described as having two objectives: staying in office and improving social welfare. With that purpose the incumbent manipulates the budget composition, namely by increasing transfers that can be targeted to specific groups in order to get results on voting behaviour. Rogoff showed that by shifting public expenditures towards easily observed consumption expenditures and away

from investment expenditures the incumbent can signal her competence and increase her chance of re-election. The political business cycle translates into a political budget cycle, which arises due to temporary information asymmetries about the incumbent's competence in administering public expenditures. Voters tend to reward incumbents who are competent. Competence, however, is described in this model as being private information, *i.e.*, only the incumbent knows her own competence. Voters evaluate the incumbent's competence merely based on consumption expenditures done in the previous period of elections and only will know the investment expenditures after elections. The incumbents' competency as being not contemporaneously observable by voters, then generates the political budget cycle.

Incumbents can have, in this sense, high or low competency. In Rogoff's model cycles budget manipulation signals that an incumbent has high competency, while incompetent incumbents do not distort policy. Given so, opportunistic incumbents have a positive gain from being reelected, while non-opportunistic incumbents do not.

Putting it in another way, it can be stated that the greatest budgetary distortions are induced by the competent incumbents, for which results a cost, *i.e.*, a cost of identifying the most competent incumbent.

The model presented by Rogoff also posits that voters maximise a utility function that includes the consumption of private and public goods. The public goods production function takes the following form:

$$g_t + k_{t+1} - \tau_t + \epsilon_t$$

where  $g$  is the public consumption good,  $k$  is the public investment good,  $\tau$  is the lump-sum taxes and  $\epsilon$  is a stochastic "competence" shock.

As can be seen, public investment decided at time  $t$  only becomes visible at time  $t + 1$ . This visibility lag introduces the incentive for the incumbent to engage in

political budget cycles around elections, since voters in pre-election period observe  $g_t$  and  $k_t$ , but not  $k_{t+1}$  and hence voters only know  $\epsilon$  at time  $t + 1$ , which correspond to the post-election period.

Rogoff's model introduces, through this way, an incentive for the incumbent to spend more on public consumption goods in order to more heavily sign her competence. The model is then described as being a signalling model. The signalling mechanism allows for an increase on incumbent's utility by an ego-rent obtained when she gets re-appointed.

#### **1.2.2.2. The extensions of the political budget cycle model**

Gonzalez (1999) and Shi and Svensson (2000), who extend the Rogoff's model evaluate explicitly the effect of the degree of democracy on the magnitude of the fiscal cycles. Gonzalez considers the fiscal model including two further variables beside Rogoff's ones: the cost of removing a policymaker from office (the "degree of democracy") and "transparency", meaning the probability that voters learn the incumbent's competence costlessly, that is, independent of signalling. If removing an incumbent from office is not too costly, then an electoral budget cycle emerges.

Besides the new measures, the model proposed by Gonzalez defines the incumbent as inducing asymmetric information regarding the budget composition. In every period  $t$ , she must decide on the allocation between a "consumption" good  $g_t$  and a "capital" good,  $k_t$ , where the production of public capital has a one-period delay, while the consumption good can be quickly produced and distributed to the citizens in every period. Voters evaluate the incumbent's competence through the following expression:  $g_t + k_{t+1} = \epsilon_t$ . Given that, the capital good takes one period to mature,

voters cannot observe it until it is in place and rendering its service. This implies that voters do not observe the value of  $k_{t+1}$  and consequently, do not know the incumbent's skill  $-\epsilon$  before casting their vote, as in Rogoff's model. The only signal on the incumbent's competence available to the public is given by the amount of the consumption good  $g_t$ .

As in Rogoff's model, the incumbent receives an exogenous rent from being in office, meaning that she prefers to remain in office if it was allowed.

Through the inclusion of the two new variables in Rogoff's model, Gonzalez found that when there is a positive correlation between the degree of democracy and transparency, political budget cycles arise only at intermediate levels of democracy, where both measures are at intermediate levels.

The Gonzalez's model also points out that the less competent incumbent may be willing to mimic the decisions of her skilled counterpart, aiming to take advantage of the information asymmetry if by doing so she can get re-appointment. That behaviour will imply that the competent incumbent in order to distinguish himself from the incompetent type will select a level of  $g_t$  that the incompetent incumbent would never wish to mimic. At the end, the two types of incumbents select a budget bias towards consumption goods.

Shi and Svensson (2000) present a model in which a higher deficit in election years is expected. The main incentives for having an increase on public expenditures were the rents that incumbent retrieves by remaining in power and the number of informed voters in society. The higher the rent obtained by the incumbent when in office, the higher will be her incentive to remain in power, and, in this sense, the stronger will be the inherent incentives to influence the voters' perceptions prior to the election. The signalling mechanism is captured in Shi and Svensson's model by the share of

informed voters. The more voters fail to distinguish pre-electoral manipulations from incumbent competency, which is a result of a high number of uninformed voters, the higher will be the incumbent's expected benefit from the public expenditure manipulation in pre-election periods.

As in Rogoff's model, pre-electoral budget manipulation is driven by asymmetric information, resulting in strategic signalling. The incumbent's ability to manipulate the budget only can be observed with a lag, which biases in her favour the voter's appreciation of competence. Competence is not an observable characteristic of the incumbent, so the voters must extract information about the incumbent's type of competence from observed economic outcomes, in this case through the budget use to produce public goods. The information is made available only to some voters before casting their votes. The informed voters have information regarding public expenditures, taxes and the amount of borrowing for the time in which incumbent is in power. As in previous models, when in power, incumbents retrieve an ego-rent from being in office. This means that in Shi and Svensson's model, voters compensate incumbents for the existence of a cycle, given their incomplete information.

Schultz (1995) notes that opportunistic manipulation of the public expenditures can be very costly and the incumbent's incentives to manipulate the economy can vary from elections to elections depending on their political needs. Specifically, he argues that the incumbent will not necessarily manipulate the economy if her expected probability of winning next election is relatively high, thus reducing the opportunistic incentive.

Tabellini and Alesina (1990) and Persson and Svensson (1989) already pointed out the argument that incumbents who expect to be replaced manipulate the budget more. In their models, an incumbent that might lose elections for other incumbent with

different preferences may end up choosing a level of public expenditures that is too high in order to prevent less preferable expenditures by the opposing party in the next period. At the end of the process, the economy finds an accumulation of debt.

In a very recent contribution, Persson and Tabellini (2000) propose a model to investigate how elections affect incumbents' career concerns and shape their behaviours during elections. In their model, elections are regarded as a mechanism device through which the most competent policy maker is selected. Since the election functions as a means of selection, incumbents have incentives to "perform well" when elections approach so that they can get recognised by their good work. This new approach complements Rogoff's one, since the incumbent's signalling incentive is balanced with a career concern that refrains the incumbent's excessive tendency to manipulate the budget composition.

### **1.2.3. Reconciliation of political influences upon policy outcomes and policy instruments**

Drazen (2000) presents a model that reconciles the two opportunistic views of the electoral cycle incorporating in the same model the components related with the output of the economy (political business cycle), and the fiscal components (political budget cycle).

In Drazen's model the utility of a voter  $i$  is given as:

$$U^i(x_t, \pi_t, g_t, k_t) = - \left[ \alpha_i \frac{(x_t - \tilde{x})^2}{2} + \frac{(\pi_t - \tilde{\pi})^2}{2} \right] + g_t + v(k_t),$$

where  $g$  is a public consumption good and  $k$  is a public investment good. The remaining variables retain the meaning of expression (1.3).

The model considers two periods, so that expected utility of voter  $i$  is:

$$E(\Omega^i) = E_t \left( \sum_{t=1}^2 \beta^{t-1} U^i(\cdot) \right),$$

where  $\beta < 1$  is the voter's discount rate.

The supply of public consumption goods is given by:  $g_t = \epsilon - k_{t+1}$ , where  $\epsilon$  is the “competence” of the incumbent currently in office. Competence is a given characteristic of an incumbent. The incumbents can be of two types: high competence  $\epsilon^H$  and low competence  $\epsilon^L < \epsilon^H$ . Competence  $\epsilon$  is not observed by the voters. A more competent incumbent is a better economic manager, able to increase a country's level of output. In the absence of any information, voters assign a probability  $0 < \gamma < 1$  to an incumbent being high competence, where  $\bar{\epsilon} = \gamma \epsilon^H + (1 - \gamma) \epsilon^L$ .

The incumbent's expected utility is given by:

$$\Omega^P = E\Omega^V + \sum_{t=1}^2 \beta^{t-1} q_t (\Theta - \zeta),$$

where  $q_t$  is the probability of being in office in period  $t$ . An incumbent places a value on being in office, denoted by  $\Theta$ , and she has an opportunistic behaviour by manipulating the economy to improve her re-election chances.

The manipulation takes two forms. First, and most importantly, there is direct manipulation via fiscal policy (choice of  $g$ ), where concern for social welfare puts a limit on how far she is willing to go. Second, she may put pressure on the central bank to lower interest rates, but there are costs of doing so. Those costs are summarised by  $\zeta$  that reflects the cost the incumbent has to support in the future, finding less cooperation from the monetary authority.

The Drazen's model considers two periods, with an election at the end of the first period. In the first period the incumbent observes  $\epsilon$  and chooses  $g_1$  and  $k_2$ . Voters observe  $g_1$  and  $k_1$  (but not  $\epsilon$  or  $k_2$ ) and use this observation to form an inference about competence. Then, based on their beliefs about competence, they then vote whether to retain the incumbent or replace him with a challenger of unknown competence, so that the expected competence of the challenger is  $\bar{\epsilon}$ .

Actual incumbent is retained if voters' expected utility with the current incumbent is higher than expected utility under the challenger. In the second period, after elections, the elected incumbent chooses his first-best policy, as there is no election.

When  $\epsilon$  is observed, pre-electoral fiscal policy can have no effect on the election outcome. On the contrary, when the incumbent competence is not observed, voters' beliefs about competence are a function of observed fiscal policy. These beliefs in turn determine the probability that an incumbent is re-elected. Beliefs about competence before an election rely then on signals. A high spending level signals an incumbent with high competence, leading to her re-election.

Under these circumstances, voters will always re-elect an incumbent they believe to be of high competence and vote to remove an incumbent whom they believe is of low competence.

#### **1.2.4. Comparison between the adaptive and the rational opportunistic political business cycle models**

The manipulation of budgets is much easier than the induction of macroeconomic outcomes such as inflation or unemployment. The basic difference is that governments control their budgets whereas they can only hope to have more indirect

impact on the economy. Surely, increasing expenditures just before the election must appear a much simpler and rewarding strategy than trying to produce a business cycle through appropriate fiscal and monetary policies.

As a synthesis, it can be stated that a major innovation introduced with the rational voter models is that they rely on policies rather than on outcomes. Moreover, the rational perspective allowed to predict a shorter political business cycle compared with the myopic counterpart, given that voters' rationality will constrain the incumbents' incentive to manipulate excessively the policies tools, thus lowering the cycle width.

Given this difference on the governments' capability to manipulate directly and exclusively the macroeconomic variables, some of the main results of the rational political business literature have been recently re-equated, since there is not exclusively the incumbents' political manipulations of the economy that influence the macroeconomic variables evolution.

Wolfers (2000) questions the rational behaviour of the electorate in the sense that voters are unable to distinguish between competency and luck, thus re-electing incumbents after national booms and dump them during national recessions. Since voters do not have information regarding the part of the economics expansion not induced by the incumbents' action, voters irrationally can be rewarding luck instead of competency.

#### **1.2.5. Rational expectations with full informed voters**

As previously described, the incumbents' opportunistic behaviour has been explained mainly through the Rogoff's perspective that incumbents have a temporary

information advantage and, in that sense, mistake the electorate by signalling their competence. Pétry and Imbeau (1999) question this approach arguing that when the electorate becomes fully responsive no longer support budget manipulation. As a consequence, voters tend to punish, rather than to reward, governments that opportunistically manipulate the budget mix.

However, a cycle can still be expected with an ultra-rational set-up where voters are fully informed, as Baleiras (1997-a, 1997-b) and Baleiras e Vasco (2000) showed. The driven force for the budget manipulation prior pre-electoral periods is introduced in the model by the re-election probability that does not guarantee to the incumbent that she will remain in power another tenure. This means that the incumbent's re-appointment, as being an uncertain event, induces the increase of expenditures in the pre-election periods given that she has a discounted utility in the post-election periods, even when incumbents are presented as being ideologically neutral. Only when the incumbent is re-appointed again benefits from the remaining budget left to spend in the post-election periods. The constraining force for the incumbents' natural incentive to use the entire budget in the pre-electoral period is introduced by the voters' preferences even when they are defined as being neutral regarding budget manipulation. Those models also contemplate another constraint to the incumbent's incentive to spend entirely the two-periods budget in the pre-election period, represented by the incumbent's interest in a job outside politics in case of defeat in elections.

Gonzalez (2001-b) also introduces full information hypothesis. In that model it is assumed that the incumbent will obtain utility from capital good that she chooses in post-election period, even if not re-elected. In this sense, the model apart from Baleiras' and Baleiras and Vasco's works since in the latter papers the incumbent only

retrieves utility, from her investment expenditure decisions, after elections and only if she was re-appointed. If the opposite occurs, the incumbent only can expect utility from income achieved through outside incumbency activity.

### **1.2.6. Empirical evidences**

Studies that have empirically proven the existence of political budget cycles on national or local public accounts are reviewed in this sub-section. The empirical confirmation that political budget cycles do occur in several contexts, gave the necessary incentive to develop the model described in Chapter 2.

Schucknecht (1996) using a panel of 35 developing countries over the period 1970-92 found that incumbents in developing countries have more space to engage into political business cycles given that in those countries incumbents retain more power over monetary and fiscal policy compared with consolidated democracies. The author found an electoral cycle manipulation on the fiscal variables but no significant sign of manipulation on output. In his 1998's work Schucknecht uses a sample of 24 developing countries for the 1973-1992 period and finds that the electoral cycle effect in those countries are essentially felt on public expenditure rather than on taxes. The public investment manipulation around elections is identified as being frequent.

Gonzalez (2000-b) as well as Shi and Svensson (2000) find an evidence of political budget cycles related to elections proximity.

The first author finds that electoral budget cycle arises when removing an incumbent from office is not too costly. Gonzalez introduces two variables in her model: one evaluates the effect of removing an incumbent from office and the other,

designed as transparency is the probability that voters learn incumbent's competence costlessly.

Gonzalez concludes that in more democratic countries, opportunistic budget cycles are of small magnitude and highly irregular over time<sup>1</sup>.

Gonzalez shows that if citizens do not have full information, incumbents have a greater incentive to distort the budget composition from capital goods to consumption goods, amplifying the cycle width.

Shi and Svensson (2000) also find the existence of a political budget cycle, especially in developing countries.

These authors use a panel of 123 developed and developing countries over a 21 year period and show that expenditures increase and revenues decrease before elections, which lead to a larger deficit in election years. The induced deficit by elections is twice more as large in developing countries when compared to developed ones. This difference is explained by the authors through two reasons: the higher the rents of remaining in power and the lower the share of informed voters, the stronger the incentives to attempt to manipulate fiscal policy prior election periods. The sample of developed and developing countries presents remarkable differences on these two variables, which explains the differences found on the political budget cycle width.

At local level, Baleiras and Costa (2004) provide an empirical test on public expenditure manipulation based on a panel data sample of Portuguese municipalities. Empirical evidence supports the existence of public investment cycles induced by political leaders.

Khemani (2000) also analyses electoral cycles in India but find a different result. Using a three-period model: the pre-election period, the election period and the post

election period as well as sub-national government's data, he shows that governments increase expenditures on the capital account and at the same time reduce expenditures on the current account in pre-election period. This difference relies on the fact that in pre-election year a set of constructions are initiated, namely roads, that gives to the incumbent immediate political reward. In this particular case, investment expenditures generate satisfaction both to voters and to incumbent in pre-election period. The author states that this behaviour is according to incumbents' career concern, which make an effort to provide public services that voters can usufruct in the election year. However, investment on roads is only one of the several areas where public entities have responsibilities. In fact, it is a particular investment expenditure case, since its visibility is quite fast.

Pétry and Imbeau (1999) also find electoral manipulation in the Canadian provinces but on social services expenditures.

Focusing on electoral policy cycle and using two types of government's expenditures: general public goods and geographically concentrated goods, Chang (2001) evaluates the incumbents' incentive to spend more in one of these goods under majoritarian systems and proportional systems. He finds that the expenditures on public goods are higher in proportional systems, and the level of the geographically concentrated expenditures has preponderancy in majoritarian systems. In his study, Chang covers data of government's budget spending for 17 OECD countries from 1973 to 1995.

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<sup>1</sup> Gonzalez (2000-a) also tested empirically her predictions using data from Mexico. The author found strong systematic use of public spending in infrastructures as a means to achieve votes.

## 2. Cycles on public expenditure mix

The focus of the present Chapter is on the incumbent's budget manipulation, namely of the consumption expenditures and the investment expenditures, with an electoral goal. More precisely, the Chapter intends to analyse the existence of political cycles in the expenditure mix. The prior expectation is that consumption expenditures increase and investment expenditures decrease before elections. This expectation derives from the differentiated time visibility associated to these two types of expenditure.

While consumption expenditure occurs and generates utility in the year of incumbent's decision, investment expenditure becomes visible to voters and gives utility to the incumbent with at least a one-year delay. This lag difference between these expenditure categories derives from the fact that, despite the investment expenditures being contracted at a certain year, they take time to be implemented. Thus, the investment expenditures benefits are only attainable in subsequent year(s).

Political budget cycle models usually present the budget manipulation as a result of incumbents' need to signal their competence to voters (this is why these models are also referred to as signalling models). By increasing consumption expenditures in pre-election periods, the incumbent expects to improve her re-election chances, which leads to a cycle. In these models voters do not know *a priori* the investment expenditures to be made after elections take place.

In this sense, such models assume information asymmetry. The incumbent has all the knowledge and voters do not have a prospective view. Chapter 1 reviewed some examples of this type of models.

This information asymmetry is usually related to voters' myopic view, since they cannot predict future. Even when voters are modelled as having a rational forward-looking behaviour, an opportunistic political expenditure cycle is also expected because there are some incumbents' characteristics, namely competence, that voters cannot directly observe.

However, even when voters have complete information regarding the incumbent's opportunistic behaviour a cycle can still be expected as Baleiras (1997-a, 1997-b) and Baleiras e Vasco (2000) have proven.

The present theoretical model proposes an extension of those authors' works. Their works present a political expenditure cycle as an outcome of budgetary resources manipulation during an incumbent's tenure. Splitting the tenure time into two periods, the incumbent spends more on the pre-election period than on the post-election period. They ignore the expenditure composition at any given period.

In the model that is presented here, the incumbent has two budgets to manage during her tenure time: one in the pre-election periods and other in the post-election periods. The goal is to evaluate the expenditure mix of both budgets, i.e. how consumption and investment outlays are set in each period taking voters and incumbent's preferences into consideration. It is shown that the incumbent has no incentive to distort voters' preferences in the post-election period. This incentive appears in the pre-election periods only as shown in Proposition 1.

## **2.1. Theoretical model**

In contrast to previous works described in Chapter 1, Baleiras (1997-a, 1997-b) as well as Baleiras and Vasco (2000) developed a model that eliminates the usual

assumption underlying political budget cycles. That assumption is the signaling mechanism in order to influence voters about the incumbent's competency. Despite this motive those authors have surprisingly proven its existence.

The model presented by those authors relies on a two-period budget, which must be managed in order to maximise the incumbent's inter-temporal utility. In this framework, the incumbent has an incentive to be re-elected which gives her a reason to consider voters' welfare, but simultaneously, she is concerned about the other state of nature, the case of defeat. In this last scenario, the income available in case of non re-election becomes of her concern too.

In contrast to most studies previously referred to, Baleiras' and Baleiras and Vasco's models assume that voters and the incumbent are fully informed. In other words, voters know the budget available after the pre-electoral fiscal decision and the incumbent foresees entirely her re-election chances.

Here, a theoretical model that considers a reinterpretation of Baleiras' and Baleiras and Vasco's articles is proposed. In this extension, the basic assumptions are maintained. However, budget decision is not exclusively a choice between pre-election and after-election period expenditures, but it is also a choice about its composition. In this sense, in each period, the incumbent must decide how much to spend on consumption goods as well as on capital goods.

It is well known, as already mentioned, that consumption expenditures have a much closer visibility to voters. In contrast, investment expenditures usually pay political dividends with some lag. The basic purpose is to evaluate if this expenditure behaviour gives rise to an inter-temporal cycle on budget composition.

More precisely, the intention is to verify if, even under the full information assumption, and given the investment expenditures visibility delay, the incumbent still

has an incentive to engage into an asymmetric expenditure management, increasing consumption expenditures before elections and decreasing it right afterwards. This incentive arises since the incumbent will only get satisfaction from investment expenditure after elections and only if she will be re-elected.

Formally, each electoral tenure is made of two periods (1 and 2)<sup>2</sup> and the incumbent must decide, in each period, the budgetary shares of consumption ( $g_A$ ) and investment expenditures ( $g_B$ ), with  $g_A + g_B = 1$ , for simplicity.

Any decision an incumbent makes on consumption expenditure pays back political dividends immediately, i.e., during the same period the expenditure is incurred.

In contrast, any investment expenditure, decided in one period, becomes visible to voters only in the following period. Putting it another way, investment expenditures only give utility to the incumbent with a one-period delay.

Consider the budgetary choices of period 2 (the pre-electoral period). Any euro spent in consumption gives the incumbent for sure some utility in the very same period. However, any euro spent on investment during period 2 will only give the incumbent some utility in the following period if she is re-elected—an uncertain event. This delay phenomenon occurs also in period 1. However, as the investment expenditure decided in period 1 will become visible in period 2, the incumbent's utility from that expenditure is certain.

The incumbent decides expenditure composition at the beginning of each period and her utility is represented by  $v(g_i)$  which is twice continuously differentiable, with

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<sup>2</sup> Several PBC models, essentially those where asymmetric information prevails, include a positive discount rate. Since the theoretical model relies on full information assumption and seeking for simplicity, the insertion of a positive discount rate was set aside. However, it could be also considered in the model without changing results qualitatively.

$v' > 0, v'' < 0$  for  $i = A, B$ . This satisfaction can only be enjoyed while the incumbent is in office.

Voters' assessment of the incumbent's performance is explained by the following expression:  $s = a[w(g_A^1) + w(g_A^2)] + (1-a)[w(g_B^1) + w(g_B^2)]$ , with  $w' > 0, w'' < 0$ .

Parameter  $a$  ( $a \in [0,1]$ ) captures the voters' preferences for budget composition between consumption and investment expenditures. When  $a > 0.5$  ( $a < 0.5$ ) it represents a bias for consumption (investment) expenditures.

Re-election probability,  $\pi$ , is a function of voters' satisfaction level:  $\pi = \pi(s)$ ,  $\pi \in [0,1]$  and  $\pi' > 0$ .

If it is assumed that voters prefer no budget distortion or, equivalently, that no cycle should occur during the two-tenure period, the wider the cycle (i.e. the difference between  $g_A$  and  $g_B$  choices) in each period, the smaller is  $s$  and thus the lower will be the incumbent's re-election chances. In contrast, the more likely the defeat scenario [probability  $1 - \pi(s)$ ], the wider the cycle becomes.

In this context, the best income an incumbent may achieve in case of electoral defeat (outside income) becomes increasingly important.

Outside income is denoted by  $y$  in which  $y = y(s)$ , with  $y' > 0$ . This income is endogenous and depends on the entrepreneurial community's evaluation of the incumbent's performance while in office. The entrepreneurial community reward the incumbent's performance by ensuring her an outside office job. That community is part of the electorate, thus sharing voters' preferences. The greater the assessment prospective employers (that is to say voters) retrieve from the incumbent's budgetary decisions, the higher will be the reward an incumbent could expect in case of election

defeat through outside income. In synthesis, outside income is an increasing function of the voters' satisfaction level.

As  $s$  decreases,  $\pi$  and  $y$  decrease as well. These are the two disciplinary pressures against the incumbent's self-interest to overspend in public consumption ( $g_A > 0.5$ ).

While in office, the incumbent chooses twice the budget composition, one in period 1 and another in period 2. Given the visibility lag of investment expenditure, the utility from these choices spans for three periods: periods 1 and 2 of the current tenure and the post-electoral future (period 3). Naturally, the latter utility is contingent upon the electoral outcome.

Formally, the fiscal choice of period 1 generates an ego-return  $v(g_A^1)$  in period 1 and an ego-return  $v(g_B^1)$  in period 2; the fiscal choice of period 2 induces ego-return  $v(g_A^2)$  in period 2 and an expected ego-return  $\pi v(g_B^2)$  in period 3. Moreover, period 3 utility in case of electoral defeat is given by  $(1-\pi)x(y)$ . So, the incumbent's inter-temporal utility function is:

$$U = v(g_A^1) + v(g_B^1) + v(g_A^2) + \pi v(g_B^2) + (1-\pi)x(y).$$

Knowing that  $g_B = 1 - g_A$ , in each period, the above expression can be rewritten as:

$$U = v(g_A^1) + v(1 - g_A^1) + v(g_A^2) + \pi v(1 - g_A^2) + (1-\pi)x(y)$$

The incumbent's problem becomes an optimisation problem with just two choice variables,  $g_A^1$  and  $g_A^2$ . In this sense, the incumbent will have to find the utility maximising levels of consumption expenditures in each period.

Equivalently,

$$\begin{aligned} \underset{g_A^1, g_A^2}{Max} U &= v(g_A^1) + v(1 - g_A^1) + v(g_A^2) + \pi(s)v(1 - g_A^2) + (1 - \pi(s))x(y(s)) \\ s.t. \quad s &= a[w(g_A^1) + w(g_A^2)] + (1 - a)[w(1 - g_A^1) + w(1 - g_A^2)] \end{aligned} \quad (2.1)$$

It is further assumed that  $v(1 - g_A^2) > x(y)$  which means the incumbent prefers the ego-rent from investment expenditure to the outside income. Although a technical necessity, this assumption squares well with the informal perception that most politicians prefer re-election runs to retreats if allowed to do so.

## 2.2. Political budget cycle

Given the incumbent's budgetary decision and the manner how it gives her utility, in each period, as described above, it is reasonable to ask if under these conditions there is an incentive for the incumbent to engage into budget composition manipulation and how.

The intuition tells that, given the voters' full information and unbiased preferences, the incumbent gains nothing from budget manipulation in period 1. This is so since the incumbent neither improves her reputation near voters nor faces any uncertainty on investment expenditure utility in period 2.

However, in period 2, the incumbent has an incentive to incur into a *political budget cycle*. This results from the fact that investment expenditures, in period 2, flow probabilistically into the next period utility. In this framework, the incumbent has thus an incentive to spend on consumption expenditures rather than on investment expenditures. Despite the loss on re-election chances that this behaviour generates, the incumbent still has a motive to prefer to spend more on consumption goods.

The following Proposition shows formally these results:

**Proposition 1—the inter-temporal political expenditure cycle:** Even when the electorate shows no preference for a cycle ( $a = 0.5$ ),

- i) a political budget cycle is found in the pre-election period, given by  $g_A^2 > 0.5$ , and
- ii) there is no cycle in the post-election period,  $g_A^1 = 0.5$ .

**Proof:**

See appendix 1.

Interpreting the result, it can be said that the incumbent has a total opportunistic behaviour, which means that she has no ideological bias for  $g_A$  or  $g_B$ . Any eventual composition cycle follows only from the differences in political visibility of  $g_A$  and  $g_B$  during her legislature period. Moreover, this visibility differential matters in period 2 only, since she is uncertain about being re-elected and thus cannot guarantee a satisfaction from her investment expenditures choices in this period. In other words, one unit of consumption expenditure in period 2 generates higher utility than one unit attached to investment expenditure in the same period, because the latter is probabilistically discounted to the ensuing period 3.

The voters, in contrast, have an ideology in the model represented by parameter  $a$ , as already stated, which reveals a definite preference between consumption expenditure and investment expenditure. The higher is  $a$ , the more biased are voters' preferences towards consumption expenditures.

Contrary to signalling models in which the incumbent has an incentive to sign her competence, as referred in Chapter 1, in the model voters foresee perfectly the incumbent's performance. In this perspective, the incumbent, given her ideological neutrality, does not have an idiosyncratic incentive to increase investment expenditures in period 1. However, given the investment expenditure delay on utility, the incumbent cannot retrieve satisfaction from investment expenditure decided in period 2 (pre-election period), unless she gets re-elected. This induces the incumbent to spend more of her last period budget on consumption expenditures, thus leading to a budget cycle— $g_A^2 > g_B^2$ .

In this framework a cycle is only observed in the second half of legislature, since voters prefer no cycle, which gives the incumbent no reason to distort budget composition at the first period in office. In fact, any deviation away from a half budgetary partition, in period 1, reduces voters' satisfaction, thus decreasing the incumbent's re-election probability as well as her outside income.

### 3. Preference differences between the electorate and society at large

Now the following question is introduced: Is it reasonable that the entrepreneurs' willingness to pay for the (ex-) incumbent still reflects the electorate's assessment of her performance when non-voters show a significant weight in population? Probably not, because voters are not representative of society's preferences, under these circumstances.

This analysis becomes more interesting if it were taken in consideration that the preferences of voters and non-voters are usually misaligned in the sense that they do not evidence the same priorities.

Following this perspective, the polar cases will be in contrast where:

- i) society at large prefer no cycle at all and voters prefer a cycle and
- ii) society prefer a cycle and voters prefer no cycle at all.

It is plausible to ask what circumstances may lead the electorate to prefer one type of expenditure and society to prefer an equal partition between the two types of expenditures or vice-versa.

In fact some kind of expenditure satisfies more directly voters and other types of expenditure give more direct satisfaction to non-voters. For the first type of expenditures it can be referred the defence expenditures or economic services like transportation and communication expenditures. Examples of the second type contain expenditures on health, education and social housing construction, where beneficiary groups include much larger fractions of youth and migrant population who typically do not vote.

In this sense,  $g_B$  and  $g_A$  are re-interpreted respectively, as the first and second type of these expenditures.

Under the existence of preference misalignment between voters and non-voters, an incumbent wishing to please the former exclusively will bring a negative spillover effect on non-voters, since the last ones will find a budget composition different from their most desired partition.

O'Toole and Strobl (1994-pp.11) argued that *“government expenditure, both in size and composition, will more accurately reflect the tastes of the entire eligible-to-vote population under compulsory voting rules. In contrast, under voluntary voting rules the composition of government spending is biased towards the preferences of the voting population”*.

Gaviria and al. (2000) created an index of particularism for a large cross-section of countries using data on electoral rules, through which they attempted to capture the extent to which politicians and policymakers have incentives to follow specific interests rather than pursue broader national goals. In this sense they explored the effects of the degree of particularism on the size and composition of public spending. They found that easily targeted expenditures such as subsidies or capital expenditures are likely to play a larger role in the government budget since it favours special constituencies.

Kwon (2001-pp.6) using spending in South Korea, during the 1987-97 period, also found that *“incumbents favour their core electoral support groups and it implies that politicians are risk-averse. Instead of targeting transfers to voters whose affinity is less likely to be close to the incumbent, office-seeking politicians always choose to strengthen the electoral basis they have cultivated over time. This type of policy choices reflects the ‘machine politics’.”*

This gives some insights that those countries where a great number of voters do not actually exercise their right to vote, it is expected that incumbents distort budget

composition in order to favour effective electors. As O'Toole and Strobl (1994) referred, it is the voters with lower income as well as reduced instruction level who, usually, having less information about politics, do not vote.

In this sense, it is introduced in the model, at this point, a contra-incentive reproduced by an outside income related to society's assessment of the incumbent's performance.

The outside income will appear here as a recognition measure of the incumbent's merit or reputation by society. The prospective employers' evaluation of the incumbent's performance is now more enlarged.<sup>3</sup> Instead of focusing exclusively on strict economic results, the entrepreneurial community will correlate outside income to the incumbent's social goals achievement.

In this perspective, the two following propositions discuss how the political expenditure cycle evolves when society and voters exhibit different preferences. It is shown in Proposition 2 and in Corollary 1 that when either voters or society evidence a marginal preference for consumption expenditures, the incumbent distorts the budget composition, increasing the later share in both post-election and pre-election periods.

An alternative case is also discussed here where either voters or society prefer a budget mix biased towards investment expenditure. Proposition 3 and Corollary 2 show that in this particular case, investment expenditure exceeds current expenditure in the post-election period.

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<sup>3</sup> Wolfers (2000-pp.1) evidenced that if voters are not rational they will reward incumbents that achieve good economic results unrelated to gubernatorial actions. He says that: "*Voters in pro-cyclical states are consistently fooled into re-electing incumbents during national booms, only to dump them during national recessions*". This is not the considered understanding of voters' behaviour here.

### 3.1. The model redefinition

The society's assessment of the incumbent's policy is evaluated by the following expression:  $W = c[w(g_A^1) + w(g_A^2)] + (1-c)[w(g_B^1) + w(g_B^2)]$ , with  $w' > 0, w'' < 0$ .

Parameter  $c$  ( $c \in [0,1]$ ) indicates the budget composition between  $g_A$  and  $g_B$  expenditures as desired by society. When  $c > 0.5$  ( $c < 0.5$ ) it represents a bias in favour of the first type (second type) expenditures.

As referred, outside income is a measure of the incumbent's social reputation. In this sense,  $y(W)$  is a result of the assessment  $W$  and not a strictly outcome of voters' satisfaction. By now it is assumed that the entrepreneurial community is willing to pay the incumbent at least the same or an higher income than the one she would achieve if outside income was related to economic performance alone. If it is not the case, then the incumbent will have no incentive to care about society's preferences. In fact, if outside income is higher when it is just a function of voters' satisfaction, then there is a return to the basic model presented in (2.1).

In this framework, the incumbent's problem becomes:

$$\begin{aligned} \underset{g_A^1, g_A^2}{Max} \tilde{U} &= v(g_A^1) + v(1 - g_A^1) + v(g_A^2) + \pi(s)v(1 - g_A^2) + (1 - \pi(s))x(y(W)) \\ s.t. \quad s &= a[w(g_A^1) + w(g_A^2)] + (1-a)[w(1 - g_A^1) + w(1 - g_A^2)] \\ W &= c[w(g_A^1) + w(g_A^2)] + (1-c)[w(1 - g_A^1) + w(1 - g_A^2)] \end{aligned} \quad (3.1)$$

As a first case, assume voters and society have different preferences, such that the former prefer no cycle ( $a = 0.5$ ) and the latter have a bias towards consumption expenditures ( $c > 0.5$ ).

**Proposition 2—the inter-temporal political expenditure cycle when society prefers a cycle in favour of consumption expenditure and voters prefer the absence of a cycle:** When outside income is an outcome of total population satisfaction, voters prefer no cycle ( $a = 0.5$ ) and society favours consumption expenditure ( $c > 0.5$ ), then a political budget cycle emerges in both periods, such that current expenditure exceeds capital expenditure in the optimum

$$\left[ \overset{\sim}{g}_A^t > 0.5, t = 1,2 \right].$$

**Proof:**

See appendix 2.

A similar result to Proposition 2 is found if voters rather than society evidence a preference bias towards  $g_A$  expenditure type ( $a > 0.5$ ) and society prefer an absence of a cycle ( $c = 0.5$ ).

**Corollary 1—the inter-temporal political expenditure cycle when voters prefer a cycle in favour of consumption expenditure and society prefers the absence of a cycle:** When outside income is an outcome of total population satisfaction, society prefers no cycle ( $c = 0.5$ ) and voters favour consumption expenditure ( $a > 0.5$ ), then a political budget cycle emerges in both periods, such that current expenditure exceeds capital expenditure in the optimum

$$\left[ \overset{\sim}{g}_A^t > 0.5, t = 1,2 \right].$$

**Proof:**

*Mutatis mutandis*, the same kind of cycle emerges. ■

The other case in which voters prefer a concentration on  $g_B$  expenditures ( $a < 0.5$ ) and society prefer no cycle ( $c = 0.5$ ) is presented now.

**Proposition 3—the inter-temporal political expenditure cycle when voters prefer a cycle in favour of investment expenditure and society prefers the absence of a cycle:** When outside income is an outcome of total population satisfaction, society prefers no cycle ( $c = 0.5$ ) and voters favour investment expenditure ( $a < 0.5$ ), then

- i) the political budget cycle emerges in period 1 and,
- ii) the cycle type in period 2 is ambiguous.

**Proof:**

See appendix 3.

The cycle type in period 2, under the conditions described in Proposition 3, remains an empirical question. Putting it another way, it will be possible to evaluate empirically if in a country with a representative weight of non-voters, the cycle type has the same nature as common preferences ( $g_A^2 > 0.5$ ) or, in opposition, if it occurs either an absence of a cycle or a bias to  $g_B$  expenditures.

The nature of the cycle described in Proposition 3 stands if society rather than voters prefer  $g_B$  expenditures ( $c < 0.5$ ) and voters prefer no cycle ( $a = 0.5$ ).

**Corollary 2—the inter-temporal political expenditure cycle when society prefers a cycle in favour of investment expenditure and voters prefer the absence of a cycle:** When outside income is an outcome of total population satisfaction, voters prefer no cycle ( $a = 0.5$ ) and society favours investment expenditure ( $c < 0.5$ ), then

- i) the political budget cycle emerges in period 1 and,
- ii) the cycle type in period 2 is ambiguous.

**Proof:**

*Mutatis mutandis*, the same kind of cycle emerges. ■

### 3.2. Interpretation of the results

The intuition of the two last results can be explained as follows. If society's preferences differ from voters' ones, the incumbent will face a trade-off effect: pleasing voters improves her re-election chances but decreases her outside income, since incumbent has made options that are far away from the ones most preferred by society. It is useful to recall here that, in this case, incumbent's reputation is evaluated according to the society's assessment of the incumbent's performance.

This means that when incumbent pegs social preferences to her utility function (Proposition 2 and 3), the political expenditure cycles are no longer as predicted when she looks only into the voters' interest and her own (Proposition 1).

Under the case in Proposition 2 ( $c > a = 0.5$ ), given the incumbent's ideology absence, in period 1 she will follow society's preferences. In this case, the budget composition is distorted in favour of  $g_A$  expenditures, thus improving the

incumbent's outside reward. In period 2, both society and the incumbent's self-interest on  $g_A$  expenditures push for a  $g_A > 0.5$  cycle. In this case, the incumbent supports some cost on votes but increases its outside income in case of defeat. Besides, a bias is expected to  $g_A$  expenditures in period 1 and period 2.

The previous argument is also valid for the case in which voters' preferences are biased to  $g_B$  expenditures ( $a < c = 0.5$ ), presented in Proposition 3. Given the incumbent's preference absence for any type of expenditure, in period 1 a PBC is found, which increases  $g_B$  expenditures, thus favouring voters and improving the incumbent's re-election probability. Given the incumbent's re-appointment concern, she has an incentive to spend more on  $g_B$  expenditures also in period 2, compared to common preferences. However, the incumbent's self-interest is opposite to voters'. Thus, these two effects can lead to an absence of a cycle (the two-effect balance) or a bias in favour of any type of expenditure. A budget composition option where  $g_B$  expenditures are privileged seems also very plausible to the incumbent. Although imposing some dissatisfaction on all society, it pleases voters, first constituencies that give an immediate reward to the incumbent: the vote.

This analysis converges to other authors' results mentioned above in which the incumbents tend to satisfy particular constituencies, specifically those who vote.

The conclusion is that, in both cases, when outside income depends on society's preferences, which are not aligned with voters ones, a cycle will emerge in period 1.

The larger the number of non-voters in total population, the higher the impact of a given preference differential between society and voters. The society's behaviour is more differentiated from the voters' one as the weight of non-voters in society increases. Only in this case, different preferences are expected since non-voters influence society's assessment of the incumbent's policy. If non-voters are not a

significant fraction of population, an incumbent who chooses a budget composition that satisfies voters' preferences guarantees re-election and outside income is not penalised, since voters reflect society's preferences. However, when voters and non-voters are not aligned in preferences, and simultaneously non-voters have weight in the total population, this is an incentive for the incumbent to change budget composition in order to accommodate the preferences of both types of population.

The Propositions 2 and 3 presented two results that can be tested empirically.

#### 4. Concluding remarks

Is it necessary to have asymmetric information to find a government's expenditures manipulation?

The theoretical model has proven that even when

- 1) voters know the budget availability after the pre-electoral decision for investment expenditures as well as
- 2) the incumbent previously know her re-election chances – full information model,

an intertemporal political budget expenditure cycle emerges with implications on expenditure mix. In this case, an expenditure cycle prone to consumption expenditures is expected in the pre-election period.

When the incumbent's performance as perceived by the other players is brought into question, the incumbent faces two opposing incentives in the pre-election period. In fact, under this scenario, the incumbent finds herself into a dilemma, if voters or society preferences are in favour of investment expenditures. If she favours consumption expenditures she displeases either voters or society, thus decreasing her re-election chances, in the first case, or her outside income if she is defeated in the next election contest, in the second case. Given this opposing incentives faced by the incumbent in the pre-election period, it is not possible to know *a priori* the budget mix in that period.

If either voters or society preferences are biased towards consumption expenditures, then the political budget cycle above emerges in both post-election periods and in pre-election periods.

In contrast with some usual findings that a political budget cycle is more easily expected in developing countries, where the asymmetry information phenomenon is common, an empirical test of the main results on European Community countries, where voters have large access to information, will be performed. The second part of this dissertation shows the empirical application.

## Appendix 1:

The incumbent's problem is given by expression (2.1):

$$\begin{aligned} \underset{g_A^1, g_A^2}{\text{Max}} U &= v(g_A^1) + v(1 - g_A^1) + v(g_A^2) + \pi(s)v(1 - g_A^2) + (1 - \pi(s))x(y(s)) \\ \text{s.t.} \quad s &= a[w(g_A^1) + w(g_A^2)] + (1 - a)[w(1 - g_A^1) + w(1 - g_A^2)] \end{aligned}$$

The objective function is twice differentiable and assumed to be strictly concave in order to ensure the existence of a unique and global maximum. Under this condition the first-order conditions are necessary and sufficient to characterise the global extreme value, thus obviating the need for checking the second-order condition.

The first order-conditions are:

$$\begin{aligned} \frac{\partial U}{\partial g_A^1} &= v'(g_A^1) + \pi'(s)(aw'(g_A^1) - (1 - a)w'(1 - g_A^1))v(1 - g_A^2) - \\ &\quad - v'(1 - g_A^1) + \\ &\quad + x'y'(s)(aw'(g_A^1) - (1 - a)w'(1 - g_A^1)) - \pi'(s)(aw'(g_A^1) - (1 - a)w'(1 - g_A^1))x(y(s)) - \\ &\quad - \pi(s)x'y'(s)(aw'(g_A^1) - (1 - a)w'(1 - g_A^1)) = 0 \end{aligned}$$

$$\begin{aligned} \frac{\partial U}{\partial g_A^2} &= v'(g_A^2) + \pi'(s)(aw'(g_A^2) - (1 - a)w'(1 - g_A^2))v(1 - g_A^2) - \\ &\quad - \pi(s)v'(1 - g_A^2) + \\ &\quad + x'y'(s)(aw'(g_A^2) - (1 - a)w'(1 - g_A^2)) - \pi'(s)(aw'(g_A^2) - (1 - a)w'(1 - g_A^2))x(y(s)) - \\ &\quad - \pi(s)x'y'(s)(aw'(g_A^2) - (1 - a)w'(1 - g_A^2)) = 0 \end{aligned}$$

The two equations can be simplified to expressions (A.1.1) and (A.1.2) below, respectively:

$$\begin{aligned} v'(g_A^1) - v'(1 - g_A^1) &= \\ &= \left\{ \pi'(s)[x(y(s)) - v(1 - g_A^2)] - (1 - \pi(s))x'y'(s) \right\} (aw'(g_A^1) - (1 - a)w'(1 - g_A^1)) \end{aligned} \quad (\text{A.1.1})$$

$$\begin{aligned} v'(g_A^2) - \pi(s)v'(1 - g_A^2) &= \\ &= \left\{ \pi'(s)[x(y(s)) - v(1 - g_A^2)] - (1 - \pi(s))x'y'(s) \right\} (aw'(g_A^2) - (1 - a)w'(1 - g_A^2)) \end{aligned} \quad (\text{A.1.2})$$

Let  $g_A^{1*}$  and  $g_A^{2*}$  denote the optimal solution to problem (2.1).

*Step i*— Firstly, the focus is on period 1 expenditure composition, given by (A.1.1) above.

As previously referred, it is expected that  $g_A^1 - g_B^1 = 0$ . The following proof is made by contradiction. In this sense, suppose not. Under this scenario it could be found that  $g_A^1 - g_B^1 > 0$  or  $g_A^1 - g_B^1 < 0$ .

Define  $\Omega \equiv \pi'(s)(x(y(s)) - v(1 - g_A^2))$  as well as  $\hat{\Omega} \equiv (1 - \pi(s))x'y'(s)$ . Given the assumption  $x(y) - v(g_B^2) < 0$  and the signs of the primitive functions, then it implies  $\Omega < 0$  and  $\hat{\Omega} > 0$ .

This allows to rewrite expression (A.1.1) as:

$$v'(g_A^1) - v'(1 - g_A^1) = \left( \Omega - \hat{\Omega} \right) \left( aw'(g_A^1) - (1 - a)w'(1 - g_A^1) \right).$$

Assuming that  $g_A^1 - g_B^1 > 0$  could be observed, this means that  $g_A^1 > 0.5$ , given budget constraint.

Thus, under this scenario a strictly negative left-hand side will be found or equivalently  $v'(g_A^1) < v'(1 - g_A^1)$ . By the same token,  $w'(g_A^1) < w'(1 - g_A^1)$ , which leads to  $(aw'(g_A^1) - (1 - a)w'(1 - g_A^1)) < 0$ , given the basic assumption that  $a = 0.5$ .

Jointly with  $\left( \Omega - \hat{\Omega} \right) < 0$ , this gives a strictly positive right-hand side, which is a contradiction.

Thus, the conclusion is that  $g_A^1$  cannot be strictly larger than  $g_B^1$ .

The other scenario is  $g_A^1 - g_B^1 < 0$  or, equivalently,  $g_A^1 < 0.5$ . In this situation it will be found  $v'(g_A^1) > v'(1 - g_A^1)$  as well as  $w'(g_A^1) > w'(1 - g_A^1)$ . Here the left-hand side is strictly positive. Knowing that  $(\hat{\Omega} - \Omega) < 0$  as well that  $(aw'(g_A^1) - (1-a)w'(1 - g_A^1)) > 0$ , in this case a strictly negative right-hand side is found. Thus, a contradiction is found again, which means that  $g_A^1$  cannot also be strictly smaller than  $g_B^1$ .

Summarizing, if  $g_A^1$  is neither strictly bigger nor strictly smaller than  $g_B^1$ , well then this means that the equilibrium solution in period 1 can only be  $g_A^1 = g_B^1$ .

*Step ii*— At this point there is a turn into the period 2 expenditure shares, given by expression (A.1.2):

$$\begin{aligned} v'(g_A^2) - \pi(s)v'(1 - g_A^2) &= \\ &= \left\{ \pi'(s) \left[ x(y(s)) - v(1 - g_A^2) \right] - (1 - \pi(s))x'y'(s) \right\} \left( aw'(g_A^2) - (1-a)w'(1 - g_A^2) \right) \end{aligned}$$

The rest of this proof replicates Baleiras and Vasco (2000). The following exposition proceeds by contradiction. Suppose, therefore, that the inequality  $g_A^2 - g_B^2 > 0$  is not fulfilled. Then,  $g_A^2 - g_B^2 \leq 0$  or  $g_A^2 \leq 0.5$ , given the budget constraint in period 2.

The left-hand side of the expression is strictly positive, because  $g_A^2 \leq 0.5$ , which implies that  $v'(g_A^2) \geq v'(1 - g_A^2) > \pi(s)v'(1 - g_A^2)$ .

Let us return to the definition of  $\Omega \equiv \pi'(s)(x(y(s)) - v(1 - g_A^2))$  as well as  $\hat{\Omega} \equiv (1 - \pi(s))x'y'(s)$ , which are common in the two period first-order conditions.

Given also the assumption  $x(y) - v(g_B^2) < 0$  and the signs of the primitive functions,

then it is found  $\Omega < 0$  and  $\hat{\Omega} > 0$ , as previously stated.

In this case, the right-hand side can now be written as

$$\left(\Omega - \hat{\Omega}\right) \left(aw'(g_A^2) - (1-a)w'(1-g_A^2)\right)$$

From  $g_A^2 \leq 0.5$ ,  $w'(g_A^2) \geq w'(1-g_A^2)$ , implying for  $a = 0.5$  that

$\left(aw'(g_A^2) - (1-a)w'(1-g_A^2)\right) \geq 0$ . Therefore, the right-hand side of the expression

becomes non-positive, which establishes a contradiction.

Concluding, it can be said that  $g_A^2$  is strictly larger than  $g_B^2$  in the optimum. ■

## Appendix 2:

Step i—First-order conditions of problem (3.1)

$$\begin{aligned} \frac{\partial \tilde{U}}{\partial g_A^1} = & v'(g_A^1) + \pi'(s) \left( aw'(g_A^1) - (1-a)w'(1-g_A^1) \right) v(1-g_A^2) - \\ & - v'(1-g_A^1) + \\ & + x'y'(W) \left( cw'(g_A^1) - (1-c)w'(1-g_A^1) \right) - \pi'(s) \left( aw'(g_A^1) - (1-a)w'(1-g_A^1) \right) x(y(W)) - \\ & - \pi(s)x'y'(W) \left( cw'(g_A^1) - (1-c)w'(1-g_A^1) \right) = 0 \end{aligned}$$

$$\begin{aligned} \frac{\partial \tilde{U}}{\partial g_A^2} = & v'(g_A^2) + \pi'(s) \left( aw'(g_A^2) - (1-a)w'(1-g_A^2) \right) v(1-g_A^2) - \\ & - \pi(s)v'(1-g_A^2) + \\ & + x'y'(W) \left( cw'(g_A^2) - (1-c)w'(1-g_A^2) \right) - \pi'(s) \left( aw'(g_A^2) - (1-a)w'(1-g_A^2) \right) x(y(W)) - \\ & - \pi(s)x'y'(W) \left( cw'(g_A^2) - (1-c)w'(1-g_A^2) \right) = 0 \end{aligned}$$

Rearranging, it becomes:

$$\begin{aligned} v'(g_A^1) - v'(1-g_A^1) = & \left[ \pi'(s) \left( x(y(W)) - v(1-g_A^2) \right) \right] \left( aw'(g_A^1) - (1-a)w'(1-g_A^1) \right) - \\ & - (1-\pi(s))x'y'(W) \left( cw'(g_A^1) - (1-c)w'(1-g_A^1) \right) \end{aligned} \quad (\text{A.2.1})$$

$$\begin{aligned} v'(g_A^2) - \pi(s)v'(1-g_A^2) = & \left[ \pi'(s) \left( x(y(W)) - v(1-g_A^2) \right) \right] \left( aw'(g_A^2) - (1-a)w'(1-g_A^2) \right) - \\ & - (1-\pi(s))x'y'(W) \left( cw'(g_A^2) - (1-c)w'(1-g_A^2) \right) \end{aligned} \quad (\text{A.2.2})$$

Denote the optimal quantities of the first-order conditions (A.2.1) and (A.2.2) as

$\tilde{g}_A^1$  and  $\tilde{g}_A^2$ , respectively.

Step ii—Cycle in period 1

At first it is paid attention to period 1's budget composition or equivalently to equation (A.2.1).

Evaluating the  $\tilde{g}_A^1$  solution, it could be  $\tilde{g}_A^1 = \tilde{g}_B^1$ , or  $\tilde{g}_A^1 < \tilde{g}_B^1$  as well as  $\tilde{g}_A^1 > \tilde{g}_B^1$ .

If the solution were  $\tilde{g}_A^1 \leq 0.5$ , given the signs of the primitive functions,  $v'(\tilde{g}_A^1) \geq v'(1 - \tilde{g}_A^1)$ , then the left-hand side is non-negative. Knowing that with  $a = 0.5$  and  $\tilde{g}_A^1 \leq 0.5$ , the following inequality holds  $\left(aw'(\tilde{g}_A^1) - (1-a)w'(1 - \tilde{g}_A^1)\right) \geq 0$ , this leads to a non-positive right-hand first term, given  $\pi' > 0$  as well as  $\left(x(y(W)) - v(1 - \tilde{g}_A^2)\right) < 0$ , by assumption. With  $c > 0.5$  and  $\tilde{g}_A^1 \leq 0.5$ , the inequality is given as  $\left(cw'(\tilde{g}_A^1) - (1-c)w'(1 - \tilde{g}_A^1)\right) > 0$ , jointly with  $w' > 0$ ,  $x' > 0$  and  $y' > 0$ , a negative right-hand second term will be found.

Consequently, a negative right-hand side is found when  $\tilde{g}_A^1 \leq 0.5$ , which establishes a contradiction.

Therefore, if  $\tilde{g}_A^1$  is neither equal nor strictly smaller than  $\tilde{g}_B^1$ , this means that, in this case, it will be found  $\tilde{g}_A^{1*} > 0.5$ , thus leading to a *political expenditure cycle* in period 1.

*Step iii—Cycle in period 2:  $\tilde{g}_A^2 > 0.5$*

Analysing now period 2, with  $y = y(W)$  and returning to expression (A.2.2), here recalled for convenience:

$$v'(g_A^2) - \pi(s)v'(1 - g_A^2) = \left[\pi'(s)\left(x(y(W)) - v(1 - g_A^2)\right)\right]\left(aw'(g_A^2) - (1-a)w'(1 - g_A^2)\right) - (1 - \pi(s))x'y'(W)\left(cw'(g_A^2) - (1-c)w'(1 - g_A^2)\right)$$

The subsequent exposition follows by contradiction once again. Suppose now that  $\tilde{g}_A^2 - \tilde{g}_B^2 \leq 0$ , then  $\tilde{g}_A^2 \leq 0.5$ . More precisely, under  $\tilde{g}_A^2 \leq 0.5$ , expression (A.2.2) has a strictly positive left-hand side, given  $\nu' > 0$  and  $\pi < 1$ . When  $\tilde{g}_A^2 \leq 0.5$  as well as  $a = 0.5$ , then  $\left(aw'\left(\tilde{g}_A^2\right) - (1-a)w'\left(1 - \tilde{g}_A^2\right)\right) \geq 0$ . Thus, a non-positive first term of the right-hand side of expression (A.2.2) is found. Given  $c > 0.5$  and  $\tilde{g}_A^2 \leq 0.5$ , a strictly negative right-hand side second term is found, since  $\left(cw'\left(\tilde{g}_A^2\right) - (1-c)w'\left(1 - \tilde{g}_A^2\right)\right) > 0$ .

This leads to a contradiction. Thus,  $\tilde{g}_A^2 \leq 0.5$  is not a solution for problem (3.1). ■

### Appendix 3:

#### Step i—Cycle nature in period 1

For period 1 the expression is again given by (A.2.1):

$$v'(g_A^1) - v'(1 - g_A^1) = \left[ \pi'(s) \left( x(y(W)) - v(1 - g_A^2) \right) \right] \left( aw'(g_A^1) - (1 - a)w'(1 - g_A^1) \right) - (1 - \pi(s))x'y'(W) \left( cw'(g_A^1) - (1 - c)w'(1 - g_A^1) \right)$$

As previously, it is followed an exposition by contradiction. It is denoted

$$\Phi = (1 - \pi(s))x'y'(W) \left( cw'(\tilde{g}_A^1) - (1 - c)w'(1 - \tilde{g}_A^1) \right)$$

Seeing now the hypothesis that  $\tilde{g}_A^1 \geq 0.5$ , then, given the signs of the primitive

functions,  $v'(\tilde{g}_A^1) \leq v'(1 - \tilde{g}_A^1)$  and  $\Phi \leq 0$ . Given  $\pi' > 0$

and  $(x(y(W)) - v(1 - g_A^2)) < 0$ , by assumption, as well as

$\left( aw'(\tilde{g}_A^1) - (1 - a)w'(1 - \tilde{g}_A^1) \right) < 0$ , this leads to a positive first term. Thus a right-

hand side with a positive sign is found, which establishes a contradiction.

Therefore, if  $\tilde{g}_A^1$  is neither equal nor larger than  $\tilde{g}_B^1$ , this means that in this case it will be found  $\tilde{g}_A^{1*} < 0.5$ , thus leading to a political expenditure cycle in period 1 as in Proposition 2.

#### Step ii—Cycle nature in period 2

The first-order conditions (A.2.1) and (A.2.2) still apply.

Returning to expression (A.2.2) in order to evaluate if there is a political budget cycle in period 2 when there are voters' bias in preferences towards  $g_B$  expenditures.

At this point it is tested if when  $a < 0.5$  as well as  $c = 0.5$ , the equilibrium solution continues to be  $\tilde{g}_A^{2*} > 0.5$ , or equivalently, if it must be inquired whether  $\tilde{g}_A^{2*} > 0.5$  can solve problem (3.1).

When  $\tilde{g}_A^2 > 0.5$  as well as  $a < 0.5$ , then  $\left(aw'\left(\tilde{g}_A^2\right) - (1-a)w'\left(1 - \tilde{g}_A^2\right)\right) < 0$ . Thus a first term of right-hand side of expression (A.2.2) strictly positive is found. Given  $c = 0.5$  and  $\tilde{g}_A^2 > 0.5$ , a second term also strictly positive is found, since  $\left(cw'\left(\tilde{g}_A^2\right) - (1-c)w'\left(1 - \tilde{g}_A^2\right)\right) < 0$ . This implies a right-hand side strictly positive.

For  $\tilde{g}_A^2 > 0.5$  to be a solution to problem (3.1), it must also have a left-hand side strictly positive, i.e.,  $v'\left(\tilde{g}_A^2\right) - \pi(s)v'\left(1 - \tilde{g}_A^2\right) > 0$ . However, it cannot be ensured, given  $v' > 0$ ,  $v'' < 0$  and  $\pi < 1$ . Thus, the left-hand side has an ambiguous sign. Hence,  $\tilde{g}_A^2 > \tilde{g}_B^2$  is (is not) a possible solution in case  $\pi$  is enough low (high) to make the left-hand side strictly positive (non-negative).

Using  $\tilde{g}_A^2 < 0.5$ , a strictly positive left-hand side of expression (A.2.2) is found. The first term on the right-hand side has an ambiguous sign, which depends on  $\left(aw'\left(\tilde{g}_A^2\right) - (1-a)w'\left(1 - \tilde{g}_A^2\right)\right)$  being positive or negative, given  $a < 0.5$ ,  $w' > 0$ ,  $w'' < 0$ ,  $\pi' > 0$  and  $x(y(W)) - v\left(1 - \tilde{g}_A^2\right) < 0$ . Given  $c = 0.5$  and  $\tilde{g}_A^2 < 0.5$ , a right-hand second term strictly negative is found, since  $\left(cw'\left(\tilde{g}_A^2\right) - (1-c)w'\left(1 - \tilde{g}_A^2\right)\right) > 0$ . This

leads to a right-hand side taking any value, which leads to an ambiguous result. Once again it cannot be ensured that  $\tilde{g}_A^2$  is strictly smaller than  $\tilde{g}_B^2$ .

If it is considered  $\tilde{g}_A^2 = 0.5$ , then the left-hand side of expression (A.2.2) is strictly positive. On the right-hand side there is a first term strictly positive, given  $a < 0.5$ ,  $w' > 0$ ,  $\pi' > 0$  and  $x(y(W)) - v(1 - \tilde{g}_A^2) < 0$ . The second term is null given  $c = 0.5$  and  $\tilde{g}_A^2 = 0.5$ . Thus, it can be said that  $\tilde{g}_A^2 = 0.5$  is definitively a solution to problem (A.2.2) when voters have a preference bias to  $g_B$  expenditures. However, it cannot be guaranteed that this will be the only solution.

Given the results it can be said that  $\tilde{g}_A^2$  can take any value, i.e.  $\tilde{g}_A^2$  can be equal, strictly bigger or strictly smaller than  $\tilde{g}_B^2$ . ■

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## **PART II**

# **Cycles and Public Expenditure Composition within the European Union**

The main purpose of the current part is to investigate empirically the existence of politically induced cycles on public expenditure composition. The results provide support to the theoretical predictions that are elaborated in Part One of this dissertation.

Two feasible expenditure compositions are considered. First, total expenditure is broken down into current and capital outlays and, second, total expenditure is broken down into expenditure items specifically favourable to voters and expenditure items benefiting the society at large.

Using information regarding European Union member states, the empirical research focus primarily on the public expenditure cycle related with election terms and secondly on the influence that the weight of effective voters in society has on budget manipulation prone to a specific type of public expenditures.

A large empirical literature has developed on public finance in industrialised countries in recent years with a special attention to fiscal policy in Europe. The orientation of diverse strands of literature has been at the level of public spending or to deficit. Surprisingly little relevance has been given to the expenditure composition, namely to the budget partition between current and capital expenditures, which is the aim of this part.

In this sense, the empirical application intends to be a contribution to the growing political economy literature on the field.

Although the nuclear concern of the empirical estimations is to evaluate how elections and poll participation determine the manipulation of public expenditures by governments, the models specified in the estimation procedure invoke also other variables referred to in the literature. That reference is to the variables related to the partisan explanation for the budget cycles. In the empirical application the existence

of partisan budget cycles is evaluated through the introduction of a variable that measures party ideology and through a variable that measures differences in institutional arrangements, captured by the weight that the major party has in parliament.

The study is based on central government expenditure data collected for 15 European Union member states from 1970 to 2001, on annual base. Some studies in the same field use data regarding general government expenditures. Data addressed by those studies are inappropriate in this framework. More precisely, as general government data includes information on sub-national governments, whose election dates differ from the central governments, a mistaken empirical result is potentially found.

The estimation procedure uses panel data which relates a time dimension  $T$  with a cross-section dimension  $N$ . The use of a country panel of the type used in this part raises some important econometric methodological issues that are not always fully appreciated. There is an increasing use of panel data samples in macroeconomics, inspired in the micro areas in which panels have traditionally been used. Dynamic models are commonly adequate for typical time series rather than static models. When the cross-section dimension is added and the lagged dependent variable is introduced, some significant problems emerge, resulting from heterogeneity in the model parameters. Some earlier studies employing panel data techniques did not allow for the possibility of panel heterogeneity beyond fixed effects. Pesaran and Smith (1995) observe that while it is implausible for the dynamic specification to be common to all countries, it is at least conceivable that the long-run parameters of the model may be common.

In this sense, the pooled mean group estimation method (PMG) recently proposed by Pesaran *et al.* (1999) is applied to estimate dynamic specifications that impose homogeneity restrictions on long-run coefficients when such restrictions are not statistically rejected. However, the empirical application goes one step further by introducing a PMG correction proposed by Calderón *et al.* (1999), which is necessary under the existence of contemporaneous correlation across variables.

The plan of this second part is as follows. Chapter 1 describes the motivation for this empirical application and makes the bridge with the theoretical model. The econometric methodology that includes the performance of unit root tests on panel data and the estimation procedure followed in the empirical application is systematised in Chapters 2 and 3. The dataset sources and the description of the variables to test Propositions 1 and 2, respectively, are introduced in Chapters 4 and 5. Chapter 6 presents the unit root tests results performed on the data. Chapter 7 shows the electoral budget cycle nature and validates the theoretical Proposition 1. The empirical relevance of Proposition 2 is evaluated in Chapter 8. Chapter 9 concludes.

## **1. Relation between the theoretical and the empirical models**

### **1.1. Empirical motivations introduced by the theoretical model**

The theoretical framework has shown why a political budget manipulation is expected to occur across election dates. In the pre-election period, the model evidences a bias towards current expenditures in detriment of capital expenditures, evidencing a government's privilege of the former type of public expenditures. This government's behaviour is the outcome of two factors: capital expenditures give utility to government with a one period lag and re-election is an uncertain event.

The conjunction of these two factors leads to an inter-temporal public expenditure cycle, even when voters do not have a preference bias for any of the two types of public expenditure.

The absence of the two factors in the post-election years brings no public expenditure manipulation interest to those in power since government is modelled as being ideologically neutral. In fact, decisions regarding public expenditure made in the post-election periods gives the government a certain utility, even with capital expenditures still retrieving utility with a one period lag. As there is no election in the following budgetary period, the utility achieved with both types of public expenditure is a certain event for the government.

In this perspective, any budget cycle that may emerge in the post-election period occurs to please voters' preference for any one of the two types of public expenditure. If simultaneously government and voters have no preference bias, then no public expenditure cycle is found in the post-election periods.

These results are stated in Proposition 1 of the theoretical model and translate into a higher weight of current expenditures relative to capital expenditures in the pre-election years and an absence of any of these expenditures type preponderance in the post-election periods.

The main purpose of Chapters 7 and 8 of this Part is to test empirically the legitimacy of this statement. It is useful to remind here that the theoretical propositions for a political budget cycle depart from a symmetric information model, rather than from an asymmetric information model, as typically literature fundamentals the appearance of an electoral budget cycle. Under symmetric information, the government does not have an informational advantage through voters since government and voters have full information regarding public expenditure composition in the pre-election and in the post-election periods. Given voters' complete information, the common incentive that justifies, under asymmetric information models, the incumbent's manipulation of public expenditures with the intent of mistaken her electorate base, is suppressed. Although, even without this incentive, a political budget cycle still emerges as stated in the theoretical framework.

The theoretical model introduces in the second Proposition and in the first Corollary an enlargement of the political expenditure cycle comparatively with statements of Proposition 1. While Proposition 1 states that the political budget manipulation is an ultimate outcome of the proximity of an election time, Proposition 2 and subsequent theoretical developments show that a political budget manipulation occurs despite of electoral period be post or pre-election. At that point the possibility that governments care about society's preferences and not only about voters' preferences is introduced.

Proposition 2 and Corollary 1 states that if voters (society) evidence a bias towards a certain type of public expenditures when society (voters) have no public expenditure preference, then a cycle prone to that type of expenditures will be found during government's tenure.

The empirical application intend to evaluate if a less participating society in elections gives an incentive to the government's bias of the budget mix prone to expenditures that favours more voters than society in general.

## **1.2. Empirical testing of theoretical predictions**

The choice of a European framework for the empirical application elapses from the theoretical model assumptions regarding voters' information.<sup>1</sup> Knowing that voters' degree of information is a direct function of the democratic regimes consolidation, appears as being a reasonable choice to test empirically the theoretical model on a set of stabilised democracies.<sup>2</sup> An application on EU countries seems to be a set of countries with such characteristics.

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<sup>1</sup> A contra argument can be stated since who provides information has a strong influence on what information is transmitted. Given that in many circumstances governments are the main sources of information it would not be obvious that in European countries voters have more reliable information than in other countries in the world. If this statement were correct it is not expected a less asymmetric information in Europe than in the rest of the world.

The argument is based in Islam (2003) findings that the European countries is the set of countries that present a better position regarding information transparency. The author constructs a "transparency" index that measures the frequency with which economic data are published in countries around the world. Nine of the fifteen European Union countries present the highest position in that transparency indicator, in parallel with countries like United States, Canada and Australia. Apart from some oil producers, the author finds that countries with high-income levels are more than twice as "transparent".

<sup>2</sup> OECD countries for example include countries with much differentiated democracy maturation, contemplating European consolidated democracies and relatively recent democracies like Slovak

This test assumes even more interest, since there are some studies which report that political budget cycles have a reduced meaning in European countries. In that set of studies are included Schuknecht (1998) and Shi and Svensson (2000). Controversially, more recently, Hallerberg and Strauch (2002), Mulas-Granados (2002) and Buti and Noord (2003) found evidence of electoral budget manipulation in the pre-election years in Europe<sup>3</sup>, leading to high deficits.

The theoretical model focuses in Proposition 1 on the weight governments attach to current and capital expenditures and how it relates to election periods. The aim of the theoretical model is to identify an opportunistic behaviour by those that rule a country, which lead to a political budget cycle. The difference between current and capital expenditures weights is the dependent variable in the estimated functions. Thus, the composition of the public expenditures links the theoretical model with the empirical application.

Another literature branch explains the budget manipulation through partisan motivations since parties compose the governments and parties are embodied of different ideologies. The theoretical model describes the government as being ideological neutral, thus excluding the partisan budget cycle explanation for the arrival of the electoral budget cycle. Empirically the introduction of variables that measure ideology should not be statistically significant showing that is the opportunistic behaviour of governments rather than the partisan affiliation that explains the budget manipulation in the pre-election periods.

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Republic, Poland or Hungary. In this sense, it is expected a much more heterogeneous voters' degree of political information access on OECE countries rather than on EU countries.

<sup>3</sup> Franzese (2001) confirmed an electoral budget cycle on public debt accumulation, in OECD countries. Huber *et al.* (2002) also found to OECD countries higher budget deficits accumulation in election years.

The theoretical model explains in Proposition 2 the governments' concern with society's preferences through an incumbent's view as a way to get reputation near society. That concern will bring her into a better position, in case of defeat in elections, to get a job outside politics.

In the empirical model governments' behaviour that might be composed by several parties with different motivations are tested. Cumulatively, parties are a collective of persons and do not evaluate the defeat scenario as an incumbent, as being an individual person, does. Thus, in this case why parties when in government should care about society's preferences, specially when society and voters have no aligned preferences for public expenditures?

This implies a re-interpretation of the theoretical model to accomplish this difference. Rather than be outside politics as in the incumbent case, commonly parties remain politically active when are defeated electorally, namely with parliamentary representation, although in an opposition position.

The ruling party although trying to remain in power knows that re-election is an uncertain event and, as expected, also cares about the second stage of nature: the defeat.

In this sense, and given that the theoretical model contemplates the two states of nature, party re-election and party defeat, even when in power, a ruling party tries to ensure some future dividends by pleasing total society. Even displeasing some voters today, party will be rewarded later by society, bringing more typical non-voters to vote thus improving the party re-election chances.

This party's concern with society's preferences when in government is higher the lower the probability the party has to be re-elected, thus increasing expenditures more prone to non-voters.

In case of defeat, the utility of the ruling party increases with the degree of satisfaction of total society. That satisfaction is more important if the number of non-voters in society is high and if voters and non-voters present different preferences regarding public expenditures.

As the incumbent, the ruling party also tries to improve reputation near society, in the case of defeat. This is the main reason why those in power do care about society's preferences.

In fact, when in the opposition position the party will compare social expenditures made during the previous tenure (when the party was in power) with the level of social expenditures made by the ruling government. The goal of this behaviour is to bring some common non-voters that favour more social expenditures to voter and invert the actual position, returning to power in subsequent periods.<sup>4</sup> When in opposition, parties want to appeal to population participation, especially to those individuals less active politically. This population fringe is commonly referred to as being composed by individuals with both a lower income and education level, who commonly need more public welfare expenditures, translated in more transfers to their own and to their families.<sup>5</sup>

The opposing parties in parliaments currently observe this behaviour. Opposition parties constitute a refraining force to natural pro-voters government's expenditures. This is what is expected to be the opposition role. When in opposition it is easier for a party to claim more social expenditures, namely those oriented to less privileged

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<sup>4</sup> Reinforcing this idea, Carlson (1999-pp.4) can be quote:

*"People dissatisfied with government are more likely to vote."*

<sup>5</sup> Carlson (1999) shows that turnout increases with education, family income, interest in politics and party contact and decreases with the number of poor, unemployed and black registered people.

population stratum, then when the same party belongs to a government that has to sustain its electorate base.

## 2. Survey of unit root tests for panel data

The Chapter presents a survey of the panel unit root tests, evidencing the most recent developments. Those tests are performed on the panel data which results are presented in Chapter 6. The importance of a priori check of the existence of unit roots in the panel data comes from the already known effect that the presence of unit roots in time series causes a misinterpretation of the estimated results.

Testing for unit roots in time series is now common practice among empirical studies.<sup>6</sup> However, testing for unit roots in panels is quite recent, having the major developments in nonstationary panel models occurred since the middle of the 1990s. The recent attention given to the problem in the econometrics of panel data emerges from numerous applications of time series procedures to panels, for which issues such as nonstationarity, spurious regressions<sup>7</sup> and cointegration have becoming important.

Panel data applications have shifted from micro panels with large  $N$  (number of cross sections) and small  $T$  (length of the time series) to macro panels with large  $N$  and large  $T$ .<sup>8</sup>

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<sup>6</sup> For a literature review of unit root tests in the time series framework see Stock (1994), Maddala and Kim (1998) and Phillips and Xiao (1998).

<sup>7</sup> Considering two independent random vectors  $Y_{it}$  and  $X_{it}$  that are  $I(1)$ , or equivalently, nonstationary, and without cointegration between them, then if a time series regression for a certain  $i$  is performed, the regression coefficient will have a nondegenerative limit distribution and the regression is characterized as spurious. The problem is only attenuated when the panel has large cross sectional and time series dimensions.

<sup>8</sup> Hall and Urga (2001) propose an introduction to the traditional and most recent developments of econometrics of panel data.

Adding the cross-section dimension to the time series dimension offers an advantage in testing for nonstationarity and cointegration since cross-section increases the data used in those tests, thus improving their power.

In what follows, some commonly used unit root panel data tests which rely on cross-section independence are briefly reviewed and their recent developments, where the assumption of cross-section independence is relaxed, are also described.<sup>9</sup>

## **2.1. Panel data unit root tests with the assumption of cross-section independence**

The assumption of independence across  $i$  is rather strong and relies on the argument by Quah (1994)<sup>10</sup> that modelling cross-sectional dependence is involved given that there is no natural ordering of the individual observations in a cross-section.

Levin and Lin (1992, 1993)-henceforth referred to as LL, Im, Pesaran and Shin (2003)-hereafter referred as IPS and Maddala and Wu (1999)-identified by MW are the most important references of panel unit root tests that rely on cross sectional independence.

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<sup>9</sup> Baltagi and Kao (2000) and Cerrato (2002) provide some surveys on panel unit root tests. The former review panel unit root tests that assume cross section independence and the latter summarizes the main developments in panel unit root tests allowing cross section dependence.

<sup>10</sup> The test proposed by Quah (1994) is based on pooled OLS and considers the following simple dynamic panel  $y_{it} = \rho y_{i,t-1} + u_{it}$ , with  $i = 1, \dots, N$ ,  $t = 1, \dots, T$  and  $u_{it}$  are independently and identically distributed across  $i$  and  $t$ , with finite variance  $\sigma^2$ .

### 2.1.1. Panel data unit root test to homogeneous cross sections

The LL test treats panel data as being composed by homogeneous cross-sections, thus performing a test on a pooled data series. The LL test for unit roots in panel data is applied based on the following model:

$$y_{it} = \rho_i y_{i,t-1} + z_{it}' \gamma + u_{it}, \quad (2.1)$$

where  $i = 1, \dots, N$  and  $t = 1, \dots, T$ ,  $z_{it}$  is the deterministic component and  $u_{it}$  is a stationary process.  $z_{it}$  can be zero, one, fixed effects -  $\mu_i$ , and fixed effects and a time trend.

Under the homogeneity assumption, the LL test assumes that  $\rho_i = \rho$  for all  $i$  and that  $u_{it} \sim iid(0, \sigma_u^2)$ .

In this sense, the LL test is defined as  $H_0: \rho = 1$  against the alternative hypothesis that  $H_a: |\rho| < 1$ . The test procedure is then designed to evaluate the null hypothesis that each individual in the panel has unit root properties versus the alternative hypothesis that all cross section series in panel are stationary.

Levin, Lin and Chu's (2002), referred as LLC hereafter, suggest some adjustments to the unit root test described above.<sup>11</sup>

Using also a pooling approach, the unit root test is implemented by a three-step procedure. In step 1 Augmented Dickey-Fulley (ADF) regressions are estimated on each cross-section in the panel and residuals are computed.

Using an ADF type regression as

$$\Delta y_{it} = \rho_i y_{i,t-1} + \sum_{j=1}^{p_i} \varphi_{ij} \Delta y_{it-j} + z_{it}' \gamma + \varepsilon_{it}, \quad (2.2)$$

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<sup>11</sup> Bayoumi and MacDonald (1999) present some applications of the LLC unit root tests.

the residuals are obtained from the two following auxiliary regressions:

$$\hat{e}_{it} = \Delta y_{it} - \sum_{j=1}^{p_i} \hat{\pi}_{ij} \Delta y_{it-j} - \hat{z}_{it} \gamma \quad \text{and} \quad \hat{v}_{i,t-1} = y_{i,t-1} - \sum_{j=1}^{p_i} \tilde{\pi}_{ij} \Delta y_{it-j} - \tilde{z}_{it} \gamma.$$

The residuals are then weighted by the regression standard error of expression (2.2) to control for heterogeneity across cross sections, becoming  $\bar{e}_{it}$  and  $\bar{v}_{i,t-1}$ .

In step 2, the ratio of long-run to short-run standard deviations is estimated, for each cross section, which is then used to adjust the mean of the  $t$ -bar statistic found in step 3, when the model includes either fixed effects or both fixed and time effects. The LLC test is the outcome of pooling all cross sectional and time series to estimate  $\bar{e}_{it} = \delta \bar{v}_{i,t-1} + \bar{\varepsilon}_{it}$ . The null hypothesis is now described as  $H_0: \delta = 0$ , and the t-statistic defined as usual.

Given the small time dimension of most panels, the emphasis has been put on models with homogeneous dynamics. However, Pesaran and Shin (1995) and subsequent developments have shown the inconsistency of pooled estimators under dynamic heterogeneous panels. This argument, in some detail, is discussed in Chapter 3.

### 2.1.2. Panel data unit root test for heterogeneous cross sections

The homogeneity hypothesis can be considered too restrictive since panel data can be composed by several cross-sections with different autoregressive coefficients. The main argument is that under the alternative hypothesis the same convergence rate across countries can bias the panel data unit root tests. Imposing homogeneity when coefficient heterogeneity is present in cross-sections data can lead to misleading conclusions.

The IPS panel data unit root test presents an alternative to overcome this restriction.

An average of the ADF tests to contemplate the case when  $u_{it}$  is serially correlated and the correlation properties vary across cross sections is suggested by IPS.

Analogously, 
$$u_{it} = \sum_{j=1}^{p_i} \varphi_{ij} u_{it-j} + \varepsilon_{it}.$$

Under this case and substituting the above equality in expression (2.1), the following regression model is used to test for the existence of unit roots in panel data:

$$y_{it} = \rho_i y_{i,t-1} + \sum_{j=1}^{p_i} \varphi_{ij} \Delta y_{it-j} + z_{it}' \gamma + \varepsilon_{it}. \quad (2.3)$$

The null hypothesis is defined as  $H_0: \rho_i = 1$  for all  $i$ , whereas now the alternative hypothesis is given as  $H_a: |\rho_i| < 1$ , for at least one  $i$ .

This test relies on the autoregressive properties of each cross section, being the final result of the IPS test based on an average of the individual ADF statistics.

The IPS t-bar statistic is the average of the individual ADF statistics, *i.e.*

$$\bar{t} = \frac{1}{N} \sum_{i=1}^N t_{\rho_i}, \text{ where } t_{\rho_i} \text{ is the individual t-statistic for testing } H_0 \text{ in (2.3).}$$

The order of augmentation used for the ADF test in each cross-section can be chosen based on a information criteria such as the Akaike Information Criterion (AIC) or the Schwarz Information Criterion (BIC).<sup>12</sup>

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<sup>12</sup> Ng and Perron (2001-a) emphasize the importance of choosing a correct lag specification for the ADF regressions in finite samples and provide a guide to robust model selection. In Ng and Perron's (2001-b) article, the authors propose a Modified Information Criteria that seems to perform better than usual information criteria such as the AIC and the BIC, for samples with  $T > 100$ .

The IPS test as  $T \rightarrow \infty$  followed by  $N \rightarrow \infty$ ,<sup>13</sup> sequentially, is given as

$$t_{IPS} = \frac{\sqrt{N} \left( \bar{t} - E[t_{iT} | \rho_i = 1] \right)}{\sqrt{\text{Var}[t_{iT} | \rho_i = 1]}} \Rightarrow N(0,1).$$

IPS assume that  $t_{iT}$  are *iid* and have finite mean as well as finite heterogeneous variances,  $\sigma_i^2$ . The values of  $E[t_{iT} | \rho_i = 1]$  and  $\text{Var}[t_{iT} | \rho_i = 1]$  have been computed by IPS via simulations for different values of  $T$  and  $p_i$ 's.<sup>14</sup>

The MW test for unit roots in panel data is inspired on a Fisher type test that combines P-values from unit root tests for each cross-section  $i$ .

Being in contradiction with LLC's alternative hypothesis that imposes a homogeneous  $\rho_i$  across cross sections, this test also allows a different autoregressive coefficient across  $i$ .

The MW unit root test is defined as  $P = -2 \sum_{i=1}^N \ln p_i$ , with  $P$  being distributed as  $\chi^2$  with  $2N$  degrees of freedom as  $T_i \rightarrow \infty$  for all  $N$ .

This test presents an advantage over the IPS test since it does not require a balanced panel, however, the test presents also a significant disadvantage associated to the fact that the  $p$ -values must be derived through Monte Carlo simulation.

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<sup>13</sup> Phillips and Moon (1999) clearly defined the implications of the way the cross sectional and time series dimension approach infinity for the definition of asymptotic properties of the estimators and tests proposed for nonstationary panels, imposing cross-sectional independence.

<sup>14</sup> A 1997's version of the IPS article includes two tests, one corresponds to t-bar statistic already described and the other relies on the average of Lagrange Multiplier (LM) tests.

The LM-statistic allows for heterogeneity in the value of  $\rho_i$  and lets the errors  $\varepsilon_{it}$  be serially autocorrelated with different serial correlation properties across the units.

## 2.2. Comparison of the performance of the panel data unit root tests with the assumption of cross-section independence

Comparing the previous three unit root tests is not appropriate since those tests rely on different null hypothesis. Although, Breitung (2000) investigates the local power of the LL and IPS tests<sup>15</sup> and concludes that the LL test is very sensitive to the lag augmentation.<sup>16</sup> MW also point out that under the presence of cross correlation, situation that neither of the three tests described above contemplate, the LL test is the one with the worst results regarding power of the test.

Cumulatively, when the assumption of independent error terms is violated, the derived distributions of IPS and MW test statistics are no longer valid. In the former case the t-bar statistic does not have the stated variance and consequently the asymptotic normal distribution and in the second case the test does not have a  $\chi^2$  distribution.<sup>17</sup>

Banerjee *et al.* (2001-b) compared the LL test, with the IPS LM-bar test, the IPS t-bar and with the MW test and found that under the presence of cross-unit cointegration relations, which implies the existence of weak exogeneity, the MW test

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<sup>15</sup> Karlsson and Lothgren (1999) compare the small sample power properties of the LL and the IPS tests and found that panel unit root tests can have high power when a small fraction of the series are stationary and low power when a large fraction is stationary.

<sup>16</sup> The author also found that the power of the LL and IPS tests is very sensitive to the specification of the deterministic terms.

<sup>17</sup> MW propose a bootstrap method that permits a reduction of the size distortions of the test under cross sectional correlation, although it does not eliminate them.

is the worst in terms of size distortions and the IPS-t-bar test it is the one which performs better.

Hadri (2000) also proposes a residual based LM test for the null hypothesis that time series for each  $i$  are stationary around a deterministic level or around a deterministic trend against the alternative of a unit root in panel data. Hadri considers the following two models  $y_{it} = r_{it} + \varepsilon_{it}$  and  $y_{it} = r_{it} + \beta_i t + \varepsilon_{it}$ , with  $r_{it} = r_{i,t-1} + u_{it}$ . The null hypothesis is defined as  $H_0: \lambda = 0$  against  $H_a: \lambda > 0$ , where  $\lambda = \frac{\sigma_u^2}{\sigma_\varepsilon^2}$ . This test can be used as a complement to the tests that consider nonstationarity as the null hypothesis, since in this case, the null hypothesis corresponds to stationarity, specially when the researcher are unsure about the stationary or nonstationarity characteristics of the panel data.<sup>18</sup>

Choi (2000) has explored this approach called confirmatory analysis. The author argues that combining a test under the null hypothesis of stationarity with a test under the null of unit root in panel data can improve the reliability of test inferences over using either test alone, when the two tests corroborate each other. Further, if under different null hypothesis the two tests reject their respective nulls simultaneously, this disagreement is a sign that the panel data under study has a mixed structure, where unit root time series coexist with stationary time series.

Banerjee *et al.* (2001-a) argue that the assumption of a tie absence between time series of a panel data is very often violated when analysing macroeconomic time series across countries. Further, the authors prove that the presence of cross sectional correlation adds a problem, since when it is not adequately considered as in the

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<sup>18</sup> Following this argument, Bac and Pen (2002) study the unit root properties of the health care expenditures and per capita GDP panel data, using both the IPS and the Hadry approaches.

common cointegration analysis on panel data, it can lead to the finding of “spurious” cointegration in cross-section regressions.<sup>19</sup> In this sense, the common used unit root tests and cointegration methods only can be employed successfully in a restricted number of cases.

### 2.3. Testing for cross-section independence

In order to evaluate if the time series that compose a panel are in fact correlated or not, a Granger (1969) causality analysis is used. This test allows approaching the question of how much time series  $y$  Granger cause  $x$  and vice-versa. However, one does not imply the other.

After the selection of a reasonable lag length, the Granger causality analysis is based on two regressions, generally defined as

$$\begin{aligned} y_t &= \alpha_0 + \alpha_1 y_{t-1} + \dots + \alpha_l y_{t-l} + \beta_1 x_{t-1} + \dots + \beta_l x_{t-l} + \varepsilon_t \\ x_t &= \alpha_0 + \alpha_1 x_{t-1} + \dots + \alpha_l x_{t-l} + \beta_1 y_{t-1} + \dots + \beta_l y_{t-l} + e_t \end{aligned}$$

for all possible pair of  $(x, y)$  time series in the panel and where  $l$  is the selected lag length.

The Granger causality is reported through a  $F$ -statistic that corresponds to a Wald-statistic for the joint null hypothesis that  $\beta_1 = \dots = \beta_l = 0$ . The null hypothesis is

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<sup>19</sup> Larsson and Lyhagen (1999 and 2000) and Larsson, Lyhagen and Lothgren (2001) develop a likelihood-based panel test of cointegrating rank in heterogeneous panel models based on the average of the individual rank trace statistics as presented by Johansen. However, the authors found that the test requires a large time series dimension to be implemented. Further, the model proposed allows cointegration within units but rules out cointegration relationships across the units and simultaneously assumes that the cointegration rank is the same for each unit, conditions which are often violated as shown by Banerjee *et al.* (2001-a).

therefore that  $x$  does not Granger-cause  $y$  in the first regression and that  $y$  does not Granger-cause  $x$  in the second regression.

Through the analysis of the relations that are established across cross sectional series, it is possible to evaluate the existence of cross section correlation and, consequently, the adequacy of panel unit root tests that rely on the assumption of cross sectional regressions independence.<sup>20</sup>

In what follows panel unit root tests that allow the existence of dependencies across units are described, which configures a second branch of the literature in this research area.

#### **2.4. Panel data unit root tests without the assumption of cross-section independence**

Unit root tests in panel data that take into account the existence of cross sectional correlation have recently being developed and follow two orientations. One that solves the problem using a non-linear regression approach and the other that relies on a Seemingly Unrelated Regression (SUR) procedure.

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<sup>20</sup> The cross sectional dependence can appear from cross-sectional correlation or from cross-sectional cointegration or from both, as pointed out by Bornhorst (2002). However, given the inability to deal with the cointegration across cross-sections through a Johansen (1995) cointegration test given our  $N$  length, our panel unit root tests will be mainly concerned with the former form of cross-sectional dependence.

### 2.4.1. The use of instrumental variables in panel data unit root tests

To deal with the presence of cross-sectional dependency, the first model described is the panel unit root test proposed by Chang (2002), based on non-linear IV estimation of the usual ADF type regression for each cross-sectional unit, using as instruments non-linear transformations of the lagged levels. The test statistic is defined as an average of individual IV t-ratios, which is asymptotically normal, and does not require the tabulation of critical values.<sup>21</sup>

The IV test is performed on the following autoregressive regression:

$$y_{it} = \rho_i y_{i,t-1} + \sum_{j=1}^{p_i} \varphi_{ij} \Delta y_{it-j} + \varepsilon_{it} \quad (2.4)$$

and the null hypothesis is given as  $H_0: \rho_i = 1$ , against the alternative  $H_a: |\rho_i| < 1$  for some  $i$ . The rejection of the null does not imply that the entire panel is stationary, while the unit root non-rejection means that all  $y_{it}$ 's have unit roots.<sup>22</sup>

The cross-sectional dependency is present in the innovations  $\varepsilon_{it}$ .<sup>23</sup>

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<sup>21</sup> In previous work, Chang (forthcoming) deals with the presence of cross-sectional dependency using a bootstrap procedure, which leads to limiting distributions of the unit root tests in panels that are nonstandard.

<sup>22</sup> Chang and Song (2002) using also as instruments non-linear transformations of the lagged levels, present a panel unit root test that accounts for the cross-sectional dependencies of innovations and for the presence of cointegration across cross-sections. The unit root tests are performed at individual

levels adding to expression (2.4) the component  $\sum_{j=1}^{Q_i} \beta'_{ik} w_{i,t-k}$ , where  $w_{it}$  are the covariates added to

the ADF regression for the  $i$ -th cross-sectional unit.

<sup>23</sup> Choi's (2002) work introduces cross sectional dependency through error-components (more precisely through the time effect variable) and not through innovation terms of autoregressive processes. The panel unit root test is performed by combining p-values from the ADF test applied to each cross-section, whose nonstochastic trend components and cross-sectional correlations are eliminated

Expression (2.4) is estimated using a non-linear function  $F(y_{i,t-1})$  for the lagged level  $y_{i,t-1}$ . For the lagged differences  $(\Delta y_{i,t-1}, \dots, \Delta y_{i,t-p_i})$ , the variables themselves are used as instruments. The autoregressive order for each cross-sectional unit is selected using the Schwartz Information Criterion (BIC).

The use of the instrument  $F(y_{i,t-1})$  requires that it be correlated with the regressor  $y_{i,t-1}$ . Chang (2002) presents some regularly integrable functions that might be used as instruments in the IV estimation. From them the following function:  $xe^{-|x|}$  is chosen as instrument for the IV panel unit root tests.

From the autoregressive coefficient of expression (2.4), estimated for each cross section, the IV t-ratio statistics are obtained by  $Z_i = \frac{\hat{\rho}_i - 1}{s(\hat{\rho}_i)}$ , where  $s(\hat{\rho}_i)$  is the standard error of the IV estimator  $\hat{\rho}_i$ . The IV t-ratio  $Z_i$  follows a standard normal distribution and the cross-sectional independence is ensured by the integrable function used as instrument in individual estimations, since, as is shown by Chang (2002), the non-linear instruments  $F(y_{i,t-1})$  and  $F(y_{j,t-1})$  are asymptotically uncorrelated, even when  $y_{i,t-1}$  and  $y_{j,t-1}$  are correlated.

Chang's panel unit root test is based on an average of the cross-sectional t-ratios statistics. The average IV t-ratio statistic is thus defined as  $S_N = \frac{1}{N} \sum_{i=1}^N Z_i$ .

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following an approach suggested by Elliot, Rothenberg and Stock's (1996) for conventional unit root tests. However, a t-statistic computed from quasi-differenced data also suffers from a Nickell (1981) type bias so that a bias correction is required to obtain a reasonable test procedure.

This panel unit root test limit theory is developed for models with no deterministic components, although it can easily be implemented to models with nonzero means and deterministic trends by replacing the lagged level  $y_{i,t-1}$  in expression (2.4) with the adaptive demeaned  $y_{i,t-1}^\mu$  or with the adaptive detrended  $y_{i,t-1}^\tau$ , respectively.

Chang's test for the presence of a unit root is now based on the test regression

$$y_{it}^\mu = \rho_i y_{i,t-1}^\mu + \sum_{j=1}^{p_i} \varphi_{ij} \Delta y_{i,t-j}^\mu + \varepsilon_{it} \quad \text{or} \quad y_{it}^\tau = \rho_i y_{i,t-1}^\tau + \sum_{j=1}^{p_i} \varphi_{ij} \Delta y_{i,t-j}^\tau + \varepsilon_{it}, \quad \text{respectively.}$$

Knowing that the stochastic component  $y_{it}$  comes from a time series  $z_{it}$ , with a nonzero mean, as in the former case, given as  $z_{it} = \mu_i + y_{it}$ , or with a more general deterministic time trends, as in the latter case, given as  $z_{it} = \mu_i + \delta_i t + y_{it}$ .

The transformations are called adaptive because data is used up to period  $t-1$  instead of using the full sample.

In this sense, the respective transformed time series are obtained as,

$$y_{it}^\mu = z_{it} - \frac{1}{t-1} \sum_{k=1}^{t-1} z_{ik}$$

$$y_{i,t-1}^\mu = z_{i,t-1} - \frac{1}{t-1} \sum_{k=1}^{t-1} z_{ik}$$

$$\Delta y_{i,t-k}^\mu = \Delta z_{i,t-k}, \quad k = 1, \dots, p_i, \quad \text{for the adaptive demeaning and}$$

$$y_{it}^\tau = z_{it} + \frac{2}{t-1} \sum_{k=1}^{t-1} z_{ik} - \frac{6}{t(t-1)} \sum_{k=1}^{t-1} k z_{ik} - \frac{1}{T_i} z_{iT_i}$$

$$y_{i,t-1}^\tau = z_{i,t-1} + \frac{2}{t-1} \sum_{k=1}^{t-1} z_{ik} - \frac{6}{t(t-1)} \sum_{k=1}^{t-1} k z_{ik}$$

$$\Delta y_{i,t-k}^\tau = \Delta z_{i,t-k} - \frac{1}{T_i} z_{iT_i}, \quad k = 1, \dots, p_i, \quad \text{where the term } z_{iT_i} / T_i \text{ is the total sample}$$

mean of  $\Delta z_{it}$ , for the adaptive detrending.

#### **2.4.2. The use of seemingly unrelated regression (SUR) in panel data unit root tests**

The second approach to panel unit root tests that allows for the presence of contemporaneous cross-correlation and heterogeneous serial correlation of the regression residuals was suggested by Breuer, McNown and Wallace (1999), hereafter BNW.<sup>24</sup>

Returning to the IPS and the MW panel unit root tests, it can be said that those tests are joint hypothesis tests in the sense that all units of a panel contain a unit root. When the joint null hypothesis is rejected it is possible that one or a few time series in the panel contribute to this finding. Cumulatively, given that these tests allow the autoregressive parameter to differ across cross sections under the alternative, then the rejection of the null hypothesis means that not all units of the panel contain a unit root. Effectively, a mixture of stationary and nonstationary time series can cohabit in the same panel data.<sup>25</sup>

In this sense and having in mind the limitations associated with the previous panel unit root tests, the BNW test main advantage is to permit to determine which cross sectional series rejects the null hypothesis of a unit root and which does not. Given that in the empirical application the major focus will be on the estimation of a panel

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<sup>24</sup> A recent empirical application of the BNW panel unit root test is presented by Wagner (2003), which uses the test on budget stabilization funds in order to separate pool estimates, considering, on the one hand, those American states that present stationary data and, on the other hand, those with nonstationary data.

<sup>25</sup> Kónya (2001) compares the LL, IPS, MW and BNW unit root tests performance on a panel composed by the logarithm of real GDP across OECD countries. The author emphasizes that the major advantage of BNW test is to permit the identification of those time series that are stationary and those that are nonstationary.

data model relying on regressions specified for cross sections, the study of the properties of the individual time series becomes important.

Taking into account this argument, the main incentive now is to test for each panel unit the null and the alternative hypothesis using a SUR framework, which exploits the information in the error covariances to produce efficient estimators and potentially more powerful test statistics. The structure of hypothesis follows the ADF specification used in the IPS test procedure.

The panel specification that is used in the SURADF estimation is described as

$$\begin{aligned} \Delta y_{1,t} &= \rho_1 y_{1,t-1} + \sum_{j=1}^{p_1} \varphi_{1,j} \Delta y_{1,t-j} + z'_{1,t} \gamma_1 + \varepsilon_{1,t} \\ &\cdot \\ &\cdot \\ &\cdot \\ \Delta y_{N,t} &= \rho_N y_{N,t-1} + \sum_{j=1}^{p_N} \varphi_{N,j} \Delta y_{N,t-j} + z'_{N,t} \gamma_N + \varepsilon_{N,t} \end{aligned}$$

The null hypothesis is  $H_0: \rho_i = 0$  for each time series of the panel.

In general the SURADF is a more powerful test than the ADF test. For the  $I(0)$  time series, BNW show, based on median rejection rates, that SURADF has twice the power or even more than a single equation ADF to reject the null hypothesis when the autoregressive coefficient on each  $I(0)$  time series is 0.90. However, these power gains vanish for an autoregressive coefficient between 0.95 and 0.99.

The BNW test has however a disadvantage that emerges from the fact that the tests statistics obtained through SURADF model have no standard distributions, implying the need for simulation of the necessary critical values. To compute these critical values it is necessary to consider the estimated covariance matrix for the system under analysis, the sample size and the number of panel units. This means that each study has its own critical values.

Bearing in mind that the interest, at this point, is not to study the cointegration properties but only to check the existence of a unit root in the time series that compose the panels the simulation procedure is discarded because that procedure will be too demanding. Instead, an approach that demands less work, but which is also less reliable, is used, since appeals to an estimated regression to generate the critical values. In this sense, the critical values presented in the study are slightly different from the ones obtained if a simulation process were used to compute them. This is so because the specified regression does not adjust perfectly to the simulated values. In fact, the regression estimated by BNW only explains around 0.8 of the critical values simulated.

Based on the BNW regression, the following expression is obtained, adapted to the  $T$  length:

$$CV(.05) = -\alpha - \beta * AverCorr - 0.161 * NumCountry,$$

being  $\alpha$  and  $\beta$  parameters that change with the number of countries included in the analysis, using as reference the information regarding those countries presented in BNW tables, which were adjusted to the data. The parameter  $\alpha$  takes the values 0.171 and 0.127 and the parameter  $\beta$  assumes the values 6.04 and 4.48, respectively, when either fifteen or ten countries are respectively in the panel unit root test.<sup>26</sup>

The *AverCorr* corresponds to the average correlation of the time series residuals with the residuals from all other time series in the panel, the *NumCountry* denominates the number of countries included in the panel unit root tests and  $CV(.05)$  is the critical value attributed, considering a 5% significance level.

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<sup>26</sup> The performance of the panel unit root tests on a subset of countries is a consequence of the number of countries that are considered in the estimated regressions. The reason for an empirical application on a subset of European countries is described in detail in Chapters 7 and 8.

In order to complement the overview of the more recent developments on panel unit root tests, the main routes followed to evaluate cointegration relations between variables and the inherent cointegration tests are briefly summarised. The intention here is to highlight the main restriction that underlies this strand of the literature, which induces the choice of a second strand for the empirical application.

## **2.5. Cointegration tests in panel data**

Parallel to the panel unit root test developments, great attention has been given to cointegration tests and estimation within regression models in panel data.

The most widely referred cointegration tests are the ones introduced by McCoskey and Kao (1998)<sup>27</sup>, Kao (1999)<sup>28</sup> and Pedroni (1999)<sup>29</sup>.

McKoskey and Kao (1999) compare the three panel data tests for cointegration, under the null of no cointegration in the latter two articles and under the null of cointegration in the former one. The authors found that in those cases where economic

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<sup>27</sup> McCoskey and Kao (1998) derive a residual-based LM test for the null of cointegration in panel data, allowing for varying slopes and intercepts. The test evidences good power performance for panels where  $T > 50$ , being indicated for panels with also an approximate number of cross-sections.

<sup>28</sup> Kao (1999) develops a framework for understanding the behavior of spurious panel regression using fixed-effects model to estimate panel regression when the dependent variable and independent variable are  $I(1)$  processes. Kao also presents two types of cointegration tests for panel data; the Dickey-Fulley (DF) and the ADF types tests and derives the asymptotic distributions for each test.

<sup>29</sup> Pedroni (1999) derives asymptotic distributions and critical values for several residual-based tests of the null of no cointegration in panels where there are multiple regressors. The model includes regressions with fixed and time effects and allows heterogeneity across units resulting from the presence of cointegrating vectors and from the dynamics of the error process.

theory predicts a long run steady state relationship, the null of cointegration rather than the null of no cointegration seemed to be more appropriate.

In what concerns the estimation of cointegrating relations between variables, the principal references are the dynamic OLS (DOLS) proposed by Kao and Chiang (2000) and the fully modified OLS (FMOLS) developed by Pedroni (2000).<sup>30</sup>

The DOLS estimation method describes a system of cointegrating regressions between  $y_{it}$  and  $x_{it}$ , where the disturbances are stationary. However the estimation procedure assumes too restrictive assumptions like the independence across  $i$  of the error terms and no cointegration of the  $I(1)$  regressors.

The FMOLS also assumes the same restrictions as DOLS but allows the associated serial correlation properties of the error processes to vary across individual units of the panel. Pedroni proposes, in this sense, a group mean t-statistic to test the null hypothesis that the cointegrating vector  $\beta$  between  $y_{it}$  and  $x_{it}$  is equal across sections:  $H_0: \beta_i = \beta_0$  versus the alternative hypothesis that  $H_a: \beta_i \neq \beta_0$  for all  $i$ , so that the values of  $\beta$  are not necessarily constrained to be homogeneous across units.

The described strand of literature is mainly concerned with nonstationarity, spurious regressions and cointegration. Another strand is worried with the rejection of homogeneous regression parameters implicit in the use of a pooled regression, favouring the idea of heterogeneous parameters.

When some of the individual time series that compose a panel show evidence of the existence of unit roots (see Chapter 6), then an estimation procedure like mean group estimation or pooled mean group estimation, described in Chapter 3, seems to be appropriate. This argument is reinforced when simultaneously there is a suspicion

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<sup>30</sup> Kao, Chiang and Chen (1999) present an application of these two estimation methods under panel cointegration.

of the existence of heterogeneous autoregressive coefficients on the dependent variable across cross-sections. The mean group estimation or pooled mean group estimation can be used despite of the stationarity or nonstationarity characteristics of the regressors, which constitutes a main advantage.

Further, under heterogeneous slopes and under small sample properties of panel time series estimators, Coakley, Fuertes and Smith (2001) prove that allowing for  $I(1)$  errors, which implies a spurious time series regressions, the pooled and mean group estimators appears unbiased. The authors also argue that if individual units in a panel cointegrate with different coefficients, then the penalties associated with pooling increases with  $T$ .

This is the principal argument for the subsequent empirical approach and for the use of the estimation technique proposed by Pesaran, Shin and Smith (1999). The respective framework and the theoretical details of the estimation procedure are described in the next Chapter.

### 3. Survey of panel estimation procedures

The transition from economic theory to a testable formulation necessarily involves the use of certain “simplifying assumptions”. However, if these are not valid, a misspecified model results. In what follows the empirical route that the quantitative studies have accomplished throughout the last decades is put into evidence.<sup>31</sup> Specifically, the main focus is on the contribution that estimation techniques have been giving to the field of comparative political economy, in order to fundament the options taken in the empirical application.

The present Chapter systematises the econometric approach followed in the empirical application, which relies on panel data estimation. The goal of this Chapter is to survey the most recent developments made in the field. Given that those recent developments on the literature on panel data inference and estimation are dispersed elsewhere, a systematisation of those disperse literature imposes as an auxiliary tool. The intend is to contribute for an easier understanding of the econometric techniques used in the empirical application.

Simultaneously, a survey on the panel data estimation techniques more widely used is also presented, evidencing their main applications and limitations. The reasoning for the use in the empirical application of a certain estimation technique is as well presented. The empirical results using the selected panel data estimation technique,

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<sup>31</sup> Quantitative techniques to more adequately estimate empirical models have developed very rapidly, with new results emerging in recent years which minimize some of the underlying problems detected in previous estimation methods. Some authors like Smith (2000) and Hall and Urga (2001) present interesting surveys for applied researchers of the main problems that have been identified and how the econometric theory for panel data regressions proposes to solve them.

which combine time series for several cross-sections<sup>32</sup>, are reported in Chapters 7 and 8.

### **3.1. Estimation techniques that assume homogeneous slopes and estimation techniques that allow heterogeneity only in the error components**

Pooled Ordinary Least Squares estimates (POLS) are commonly used, although the standard assumptions about the error processes are often violated, namely because errors tend to be serially correlated across time and countries and tend to be groupwise heteroscedastic. If errors observe some of those effects, then the POLS estimates of the parameters will be consistent but inefficient. To overcome this problem, Beck and Katz (1995) propose to retain the POLS parameters but replacing POLS standard errors by panel-corrected standard errors (PCSE).<sup>33</sup>

The violation of the assumptions about error processes can also be caused by model specification imposing the level of the dependent variable to be homogeneous across time periods and countries.<sup>34</sup> To deal with this problem, the error component

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<sup>32</sup> Hsiao (1986, 2003) presents the first systematic textbook work on panel data estimation.

<sup>33</sup> This research field is usually defined as time-series-cross-section (TSCS) models.

<sup>34</sup> This problem is well evidenced, in a dynamic model framework, by Wawro (2000) who argues that if individual specific effects are not adequately accounted for, this induces an inappropriate POLS estimates. Under these conditions, the fundamental requirement for consistency of parameter estimates is violated –the explanatory variables in a regression equation have to be uncorrelated with the disturbance term.

model was used, referred to as fixed effect model, which allows the intercept term to vary, thus capturing the differences in behaviour over time and countries.<sup>35</sup>

To understand the consequences of erroneously abstracting from slope heterogeneity, consider the following static fixed-effects panel data model:<sup>36</sup>

$$y_{it} = \mu_i + \beta' x_{it} + u_{it}, \text{ with } i = 1, 2, \dots, N \text{ and } t = 1, 2, \dots, T,$$

where  $\beta$  is the vector of unknown slope coefficients, assumed to be the same across countries and  $\mu_i$  the fixed-effects, when the true model is

$$y_{it} = \mu_i + \beta_i x_{it} + u_{it}, \tag{3.1}$$

with  $\beta_i = \beta + \eta_i$  being described as having a homogeneous and a heterogeneous component like random coefficient models (see Swamy, 1971).

If a researcher ignores this slope heterogeneity and instead considers the model

$$y_{it} = \mu_i + \delta_x x_{it} + \delta_z z_{it} + v_{it},$$

where  $z_{it}$  is an additional regressor spuriously thought to be important, then the fixed-effects estimator of the slope coefficient  $\delta = (\delta_x, \delta_z)$  is generally inconsistent.

The above problem is substantially improved in dynamic models as shown by Pesaran and Smith (1995).

The authors state that, under heterogeneous slopes, both the fixed-effects and the random-effects model are not consistent in a dynamic panel data model.

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<sup>35</sup> Baltagi (1995, 1999) presents the details of the fixed effect model. Marques (2000) reviews the main estimators that assume homogeneous slopes and systematizes specification tests.

<sup>36</sup> For panels with very small time dimension  $T$  and a dynamic specification, Cermeño (1999) shows that OLS median-bias correction is more appropriate than the fixed-effects estimation given that the former has much smaller upward bias. Judson and Owen (1997) have already found that the fixed effects model bias can be significant, even with a time dimension as large as 30. Bun and Kiviet (2001) propose a bias adjustment for the fixed effect model under dynamic specification when both the time-series and cross-section dimensions of the data set are small.

To see this through an example, consider a simple dynamic panel data model (Autoregressive Distributed Lag Model-ARDL (1,0))<sup>37</sup>.

$$y_{it} = \alpha_i + \lambda_i y_{i,t-1} + \beta_i x_{it} + \varepsilon_{it}, \quad (3.2)$$

with  $i = 1, 2, \dots, N$  and  $t = 1, 2, \dots, T$ , where the slopes,  $\lambda_i$  and  $\beta_i$ , as well as the intercepts,  $\alpha_i$  are allowed to vary across countries. In this way, heterogeneity is introduced into the model through the short-run coefficients  $\lambda_i$  and  $\beta_i$ .

In this sense, the long-run coefficient of  $x_{it}$  for country  $i$  is defined by  $\theta_i = \beta_i / (1 - \lambda_i)$ .

Then expression (3.2) can be re-written as an error-correction model (ECM):

$$\begin{aligned} \Delta y_{it} &= \alpha_i - (1 - \lambda_i)(y_{i,t-1} - \theta_i x_{it}) + \varepsilon_{it}, \text{ or equivalently as,} \\ \Delta y_{it} &= \alpha_i - \phi_i (y_{i,t-1} - \theta_i x_{it}) + \varepsilon_{it}, \text{ where } \phi_i = 1 - \lambda_i. \end{aligned} \quad (3.3)$$

The exogenous regressor is described as following a first-order autoregressive process:

$$x_{it} = \mu_i (1 - \rho) + \rho x_{i,t-1} + u_{it},$$

where  $\mu_i$  is the (unconditional) mean of  $x_{it}$ ,  $|\rho| < 1$  and homogeneous across countries, and for each  $i$ ,  $u_{it} \sim iid(0, \tau_i^2)$ .

Considering now that the random coefficients model is given as  $\phi_i = \phi + \eta_{i1}$  and  $\theta_i = \theta + \eta_{i2}$ , then  $\beta_i = \theta_i \phi_i = \theta \phi + \eta_{i3}$ , with  $\eta_{i3} = \phi \eta_{i2} + \theta \eta_{i1} + \eta_{i1} \eta_{i2}$ .

If, alternatively,  $\lambda = 1 - \phi$  and  $\beta = \theta \phi$ , then returning to expression (3.2) it becomes:

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<sup>37</sup> The advantage of the use of ARDL models is presented in Pesaran and Shin's (1999) article. The authors point out that these models are robust to integration and cointegration properties of the regressors, and for sufficiently high lag orders they are immune to the endogeneity problem, at least as far as the long-run properties of the model are concerned.

$$y_{it} = \alpha_i + \lambda y_{i,t-1} + \beta x_{it} + v_{it},$$

where  $v_{it} = \varepsilon_{it} - \eta_{i1}y_{i,t-1} + \eta_{i3}x_{it}$ .<sup>38</sup>

It is now clear that  $v_{it}$  and  $y_{i,t-1}$  are correlated, thus implying the inconsistency of fixed-effects and random-effects models. In fact, neglecting slope heterogeneity causes the disturbances to be serially correlated as well as contemporaneously correlated with the included regressor(s).

Further, in Pesaran and Smith's work it is stated that even when having  $T \rightarrow \infty$  and  $N \rightarrow \infty$ , the inconsistency of those models remains, if the slopes  $\lambda_i$  and  $\beta_i$  are heterogeneous across countries. Thus, the larger the degree of parameter heterogeneity, the greater the bias of those models.

More precisely, the fixed-effects model evidences a tendency to underestimate the short-run effects and overestimate the average long-run effects under the presence of parameter heterogeneity.<sup>39</sup> In this case, none of the usual remedies such as instrumental variables estimation technique or differencing the variables solves the problem.

Traditional studies on electoral budget cycles using panel data techniques have relied on the fixed effects model. In spite of that, a new branch of studies have questioned the adequacy of this model which only allows heterogeneity across countries through the intercept, arguing that slope homogeneity seems unlikely to

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<sup>38</sup> For a detailed proof see Pesaran and Smith (1995).

<sup>39</sup> This statement is true independently of the stationary or integrated nature of the variables. In fact, Pesaran, Smith and Im (1996) argue that with integrated variables under slope heterogeneity a differentiating cointegrating relation across countries is found. Thus, incorrectly imposing common slope parameter for all countries introduces an  $I(1)$  component in the disturbances, leading to inconsistent parameter estimators, even in the static form.

hold when countries are at different stages of their economic development and have diverse institutions, customs and social norms.

### **3.2. Estimation techniques that allow for heterogeneity beyond fixed effects**

Pesaran (1995,1999) has been developing different approaches, which allow either slope heterogeneity across panel estimations or a differentiation between long-run effects and short-run effects. In the latter approach the long-run effects are fixed to be homogeneous across countries but heterogeneity is allowed in the short-run effects. The reference is to Mean Group Estimator (hereafter MG) in the former case and to Pooled Mean Group Estimator (hereafter PMG) in the latter case.

#### **3.2.1. The Mean Group (MG) Estimator**

When heterogeneity is erroneously neglected, an inconsistency problem occurs. Pesaran (1995) proposes the MG estimator to overcome this problem. The estimation procedure is briefly described below. This estimator is shown to be consistent and having asymptotic normal distribution for  $N$  and  $T$  large.

The expression (3.3) defined as:

$$\Delta y_{it} = \alpha_i - \phi_i (y_{i,t-1} - \theta_i x_{it}) + \varepsilon_{it},$$

where  $\varepsilon_{it} \sim iid(0, \sigma_i^2)$  (the disturbances  $\varepsilon_{it}$  have zero means and are heteroscedastic across different countries), is used here again for expositional purpose.

To estimate expression (3.3), the first step is to run an individual OLS regression for each country, in order to estimate for each one  $\alpha_i$ ,  $\phi_i$  and  $\theta_i$ , using temporal observations from  $t = 1, 2, \dots, T$ , assuming that the time span is equal across  $i$ .

Denoting the estimates by  $\hat{\alpha}_{iT}$ ,  $\hat{\varphi}_{iT}$  and  $\hat{\theta}_{iT}$ , respectively, then the second step consists of an arithmetic average of the individual estimated coefficients<sup>40</sup>. The estimators depend on T, but for expositional simplicity from now on the subscript  $T$  is dropped.

The MG estimator is found through this two step procedure and the estimators are given as

$$\hat{\alpha} = \frac{1}{N} \sum_{i=1}^N \hat{\alpha}_i, \quad \hat{\varphi} = \frac{1}{N} \sum_{i=1}^N \hat{\varphi}_i \quad \text{and} \quad \hat{\theta} = \frac{1}{N} \sum_{i=1}^N \hat{\theta}_i, \quad \text{respectively.}$$

The variance-covariance matrix of the MG estimator is given as

$$V \begin{pmatrix} \hat{\alpha} \\ \hat{\varphi} \\ \hat{\theta} \end{pmatrix} = \frac{\sum_{i=1}^N \begin{pmatrix} \hat{\psi}_i - \bar{\psi} \\ \hat{\psi}_i - \bar{\psi} \end{pmatrix} \begin{pmatrix} \hat{\psi}_i - \bar{\psi} \\ \hat{\psi}_i - \bar{\psi} \end{pmatrix}'}{N(N-1)}, \quad \text{where } \psi_i = \begin{pmatrix} \alpha_i \\ \beta_i \\ \varphi_i \\ \theta_i \end{pmatrix}.$$

The MG estimator<sup>41</sup> relies on a set of assumptions that are not reproduced here extensively, reporting to Pesaran and Smith's (1995) article for more details. In spite of that, some assumptions are needed to ensure the validity of MG estimation that are emphasised here. Specifically,  $x_{it}$  and  $\varepsilon_{is}$  are independently distributed for all  $t$  and  $s$ , *i.e.*  $x_{it}$ 's are strictly exogenous and both set of variables are independently distributed from  $\eta_{i1}$  and  $\eta_{i2}$ . Recently, Pesaran, Smith and Im (1996) include also as

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<sup>40</sup> The MG estimator provides an estimate of the averages of the long-run and the short-run parameters while the fixed-effects and pooled OLS provide estimates of the long-run and the short-run averages, as distinguished by Phillips and Moon (1999).

<sup>41</sup> For expositional purpose  $ARDL(1,0)$  specification is considered, but the statements are valid for any other  $ARDL$  specification. In fact, the  $ARDL$  specification is a crucial matter as discussed later.

an assumption that the disturbances are uncorrelated across different countries, *i.e.*,  $E(\varepsilon_{it}\varepsilon_{js}) = 0$ , for all  $t$  and  $s$ , if  $i \neq j$ .

When  $T$  is small, the MG estimator of the dynamic panel data model is biased, even when  $N \rightarrow \infty$ . This means that for that bias to disappear it is necessary to have a large enough  $T$ .

The empirical application includes 32 observations across countries, which is considered a large enough  $T$  length<sup>42</sup>, since the lower limit is commonly established at  $T = 25$ .

To evaluate the estimation adequacy of the fixed-effects model versus the MG model, Pesaran, Smith and Im (1996) propose a Hausman (1978) type test for heterogeneity of both the short-run and the long-run coefficients.

Taking fixed-effects estimators and MG estimators, the Hausman type test for the homogeneity of the long-run coefficients, *i.e.*, the test for the null hypothesis  $\theta_i = \theta$  for all  $i$ , is given as

$$h_{\theta} = \left( \hat{\theta}_{MG} - \hat{\theta}_{FE} \right) \left[ \hat{V} \left( \hat{\theta}_{MG} \right) - \hat{V} \left( \hat{\theta}_{FE} \right) \right]^{-1} \left( \hat{\theta}_{MG} - \hat{\theta}_{FE} \right).$$

Under the null hypotheses, for large  $T$ ,  $h_{\theta} \sim \chi_k^2$ , where  $k$  is the number of parameter estimates.

For expositional convenience expression (3.2) is re-introduced, written more compactly as

$$y_{it} = \alpha_i + \gamma_i' w_{it} + \varepsilon_{it},$$

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<sup>42</sup> To deal with the MG estimator small sample bias, Hsiao, Pesaran and Tahmiscioglu (1999) and Pesaran and Zhao (1999) propose alternative methods, respectively, for the short-run coefficients and for the long-run coefficients.

where  $\hat{\gamma}_i = \left( \hat{\lambda}_i, \hat{\beta}_i \right)$  is the vector of estimators for each country.

For testing the homogeneity hypothesis, now on short-run coefficients (*i.e.*,  $\lambda_i = \lambda$ ,  $\beta_i = \beta$  and  $V(\varepsilon_{it}) = \sigma^2$ , for all  $i$ ), the following Hausman statistic<sup>43</sup> is presented:

$$h = \hat{\sigma}_{MG}^2 \left( \hat{\gamma}_{MG} - \hat{\gamma}_{FE} \right)' \hat{V}^{-1} \left( \hat{\gamma}_{MG} - \hat{\gamma}_{FE} \right),$$

where  $\hat{\sigma}_{MG}^2 = \frac{1}{N} \sum_{i=1}^N \hat{\sigma}_i^2$  and  $\hat{V} = \frac{1}{N^2} \sum_{i=1}^N (W_i' H_T W_i)^{-1} - \left( \sum_{i=1}^N (W_i' H_T W_i) \right)^{-1}$ , with

$H_T = I_T - l_T (l_T' l_T)^{-1} l_T'$ , where  $I_T$  is an  $T \times T$  identity matrix, and  $l_T$  is a  $T \times 1$  unit vector.

Now, under the null hypothesis,  $h \sim \chi_{k+1}^2$ .

Using a static model like expression (3.1), Coakley, Fuertes and Spagnolo (2001)

present the standard error for the MG estimator as  $se\left(\hat{\beta}_{MG}\right) = \frac{\sigma\left(\hat{\beta}_i\right)}{\sqrt{N}}$ , where

$$\sigma\left(\hat{\beta}_i\right) = \sqrt{\sum_{i=1}^N \left(\hat{\beta}_i - \hat{\beta}_{MG}\right)^2 / (N-1)}.$$

Consequently, the standard  $t$ -statistic is then calculated as  $\frac{\hat{\beta}_{MG}}{se\left(\hat{\beta}_{MG}\right)}$ .<sup>44</sup>

<sup>43</sup> If the Hausman's test reveals that the pooling estimate is adequate, the existence of contemporaneous errors across countries should also be tested and, if this is not rejected, the Seemingly Unrelated Regression Equation (hereafter, SURE) procedure is the one recommended. Following Zellner (1962), the advantage of the SURE procedure lies in the fact that it allows the contemporaneous error covariances to be freely estimated.

<sup>44</sup> The explanatory power of the MG model is an outcome of the average of the country-specific adjusted  $R^2$ . Under an error correction model specification, a reasonable good fit is considered when a

Somewhere between total slope heterogeneity as is assumed by the MG estimator and total homogeneity beyond the one that is considered in the fixed-effects estimator, there is a wide range of intermediate estimators<sup>45</sup> that allow for some degree of heterogeneity across countries (cross-sections).

### **3.2.2. The Pooled Mean Group (PMG) Estimator**

The PMG estimation procedure is an intermediate estimator between the total slope heterogeneity as assumed by the MG estimator and the heterogeneity that is considered in the fixed-effects estimator. In fact, the PMG estimator proposed by Pesaran, Shin and Smith (1999) is more interesting and reliable than the other two estimators since it involves both pooling and averaging.

The PMG estimator allows the intercepts, short-run coefficients and error variances to differ across countries, but imposes equality of one or more of the long-run coefficients. In this sense, the PMG estimator imposes some homogeneity across

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model explains over 35 percent of the total variance. A model using only variables in levels typically leads to a much higher  $R^2$ , but this is only because the lagged dependent variables artificially inflate the total explained variance.

<sup>45</sup> Other intermediate estimators between the fixed effects estimators and the MG estimator are the shrinkage estimator and the Pooled MG estimator (PMGE). Maddala, Li and Srivastava (2001) introduce the former estimator and Haque, Pesaran and Sharma (1999) introduce the later.

The short-run effects of the former estimator are calculated by shrinking the simple average of each separate country's OLS estimator to a weighted-average inversely proportional to the respective variances. The long run effects are allowed to vary across countries, being adjusted by a weighting process defined as the Stein-rule estimator.

The second estimator is a kind of fixed-effects estimator, since the computation of the estimator consists on pooling a model that includes a regressor that weights differences across countries observed on an explanatory variable.

countries compared with the MG estimator, which imposes quite strong assumptions, as mentioned above, like the independence of parameters and regressors, as well as strictly exogenous regressors. Cumulatively, the PMG estimator reveals to be quite robust to outliers <sup>46</sup> as well as to the choice of the lag order of the model, more than the MG estimator, whose estimates can be highly influenced by those factors.

The PMG estimation has been applied in several areas, for instance in panel data studies on economic growth (Asteriou and Price, 2000; Bassanini and Scarpetta 2001, Bassanini, Scarpetta and Hemmings, 2001), on labour markets changes (Fedderke, Shin and Vaze, 2001; Serres, Scarpeta and Maisonneuve, 2002), on private saving rates growth (Serres and Pelgrin, 2002) and on public budget balance growth (Hallerberg and Strauch, 2002).

The general model is an ARDL(p,q,q,...,q) such as:

$$y_{it} = \sum_{j=1}^p \lambda_{ij} y_{i,t-j} + \sum_{j=0}^q \delta'_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (3.4)$$

with  $i = 1, 2, \dots, N$  and  $t = 1, 2, \dots, T$ .

Expression (3.4) can be re-parameterised into an Error Correction Model (ECM) as

$$\Delta y_{it} = \phi_i y_{i,t-1} + \beta'_i x_{i,t-1} + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta^{**}_{ij} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (3.5)$$

where  $\phi_i = -\left(1 - \sum_{j=1}^p \lambda_{ij}\right)$ ,  $\beta_i = \sum_{j=0}^q \delta_{ij}$ ,  $\lambda^*_{ij} = -\sum_{m=j+1}^p \lambda_{im}$ , with  $j = 1, 2, \dots, p-1$ , and

$$\delta^{**}_{ij} = -\sum_{m=j+1}^q \delta_{im}, \text{ with } j = 1, 2, \dots, q-1.$$

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<sup>46</sup> In small samples, the MG estimator, being an unweighted average, is excessively sensitive to the inclusion of outlying country estimates. The PMG estimator performs better in this regard because it produces estimates that are similar to weighted-averages of the respective country-specific estimates, where the weights are given according to their precision (i.e., the inverse of their corresponding variance-covariance matrix).

The lag order used into ARDL specification is obtained from each country's unrestricted regression model, where the selection is done according to the best Schwarz Bayesian Criterion (SBC) associated with each lag specification. The homogeneous lag order used in the ARDL model is determined by the highest most common lag specification that is chosen in the individual regressions.

Below some of the underlying assumptions of PMG estimator are reported.<sup>47</sup>

The PMG estimator assumes that the disturbances  $\varepsilon_{it}$  are independently distributed across  $i$  and  $t$ , with zero means, variances  $\sigma_i^2 > 0$  and also distributed independently from the regressors  $x_{it}$ .

The assumption that the disturbances  $\varepsilon_{it}$  are independent across time is not very restrictive and usually is satisfied by increasing the distributed lag orders on  $y_{it}$  and  $x_{it}$ . The independence of the disturbances and of the regressors is needed for the consistent estimation of the short-run coefficients, but can be relaxed when estimating the long-run coefficients, allowing for these coefficients the possible dependence between  $x_{it}$  and  $\varepsilon_{it}$ .

Another assumption is the existence of a long-run relationship between  $y_{it}$  and  $x_{it}$ , which is ensured by  $\phi_i < 0$ . The long-run relationship is defined by

$$y_{it} = -(\beta_i' / \phi_i) x_{it} + \eta_{it}$$

for each  $i = 1, 2, \dots, N$ , where  $\eta_{it}$  is a stationary process.<sup>48</sup>

As mentioned before the PMG estimator assumes also long-run homogeneity, meaning that  $\theta_i = \theta$ , for  $i = 1, 2, \dots, N$ , where  $\theta_i = -\beta_i' / \phi_i$ . To test this assumption a

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<sup>47</sup> For more details see Pesaran, Shin and Smith (1999).

<sup>48</sup> Pesaran, Shin and Smith (2001) test this assumption in a time series framework, irrespective of the underlying variables considered in the estimation being  $I(0)$  or  $I(1)$ .

Hausman test must be performed between PMG estimates and MG estimates, through a procedure analogous to the one described above to test long-run coefficients homogeneity between MG estimates and fixed-effects estimates.

The Hausman statistic test for the long-run coefficients is now defined as

$$h_{\theta} = \left( \hat{\theta}_{MG} - \hat{\theta}_{PMG} \right)' \left[ \hat{V} \left( \hat{\theta}_{MG} \right) - \hat{V} \left( \hat{\theta}_{PMG} \right) \right]^{-1} \left( \hat{\theta}_{MG} - \hat{\theta}_{PMG} \right).$$

Under the slope homogeneity hypothesis the Hausman statistic is asymptotically distributed as  $\chi^2$  with  $\theta$  degrees of freedom.

If the homogeneity assumption is invalid then the PMG estimates are no longer consistent, which implies the prevailing of the MG estimates. If the long-run coefficients are in fact equal across countries, then the PMG estimates will be consistent and efficient, whereas the MG estimates will only be consistent.

Under the assumption of long-run homogeneity some complications are expected in estimation of equation (3.5), namely the regression equation for each country is non-linear in  $\phi_i$  and  $\theta$ , there are cross-equation parameter restrictions since  $\theta$  is common across countries and the error variances differ across countries.

In this framework the standard pooled estimators relying on the Ordinary Least Squares (OLS) are not applicable, thus the long-run coefficients  $\theta$  of the PMG estimation is obtained based on Maximum Likelihood (ML) estimation. The long-run coefficients are subsequently used to estimate country-specific error-correction coefficients  $\phi_i$  and short-run coefficients  $\lambda_{ij}$  and  $\delta_{ij}$ , which, after averaging, gives the estimates of the respective aggregate coefficients.

It can be said now that the PMG estimator is a two-step procedure: one is the joint estimation of the homogeneous long-run coefficients across countries through the ML

procedure and the other is the estimation of the error-correction coefficients and the short-run parameters of the model, on a country-by-country basis.

To simplify the exposition and using an ARDL (1,1) as a particular case, the first step to PMG estimation is defined by the following equation

$$y_{it} = \lambda_i y_{i,t-1} + \delta_{10i} x_{it} + \delta_{11i} x_{i,t-1} + \mu_i + \varepsilon_{it}, \quad (3.6)$$

being the second step implemented through the error correction model

$$\Delta y_{it} = \phi_i (y_{i,t-1} - \theta_{0i} - \theta_{1i} x_{i,t-1}) + \delta_{11i} \Delta x_{it} + \varepsilon_{it}, \quad (3.7)$$

where  $\theta_{0i} = \frac{\mu_i}{1 - \lambda_i}$ ,  $\theta_{1i} = \frac{\delta_{10i} + \delta_{11i}}{1 - \lambda_i}$  and  $\phi_i = -(1 - \lambda_i)$ .

In expression (3.7),  $\phi_i$  is the error correction coefficient measuring the speed of adjustment <sup>49</sup> towards the long-run equilibrium.

The consistency and efficiency of the PMG estimates depend on several conditions regarding the specification. In order to assess the robustness of the empirical model some previous diagnostic statistics are applied on individual country ARDL equation. The usual battery of statistical tests include the Breusch-Godfrey test for residual serial correlation, the Ramsey RESET test for functional form misspecification, the Jarque-Bera test for errors normality, and the White test for homoscedasticity, which are computed for each individual country regression. The former two statistics and the latter one have a qui-square distribution with  $p$ -degrees of freedom, where  $p$  represents the number of lags included in regressions, having the third statistic a qui-square distribution with two degrees of freedom.

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<sup>49</sup> The magnitude of the adjustment speed is smaller in the PMG than in the MG specification (or, equivalently, the autoregressive coefficient is higher) according to Robertson and Symons (1992) predictions that pooling in the presence of heterogeneity tends to increase inertia.

Only individual country regressions that pass the above four diagnostic tests can be included either into the PMG estimation or into the MG estimation.

Returning to expression (3.6), the set of explanatory variables is restricted to follow an AR process, which does not depend on contemporaneous values of  $y$ . This restriction arises from the assumption that there is only one long-run relationship between  $x$  and  $y$ . However, as Calderón, Loayza and Servén (1999) point out, there is a possibility for  $x$  to be endogenous in the sense that the factors that affect  $x$  may be correlated with contemporaneous effects in  $y$ . In this case, the endogeneity of  $x$  must be taken into account when the long-run relationship is derived from the dynamic ARDL specification, as it was in the PMG estimation procedure.

The simultaneous causation possibility, *i.e.*, the existence of a feedback between  $y$  and  $x$ , is captured in what follows by a non-zero  $\sigma_{\varepsilon u}$ .

Using a single equation framework, Calderón *et al.* derive the parameterisation that should be introduced to account for the endogeneity of  $x$ .

The  $ARDL(1,1)$  model in expression (3.6) is now given as  $y_t = \lambda y_{t-1} + \delta_{10} x_t + \delta_{11} x_{t-1} + a + \varepsilon_t$ , for each country, where  $x_t = \rho x_{t-1} + u_t$ ,<sup>50</sup> and

$$\begin{pmatrix} \varepsilon_t \\ u_t \end{pmatrix} \sim iid(0, \Sigma), \quad \Sigma = \begin{pmatrix} \sigma_{\varepsilon\varepsilon} & \sigma_{\varepsilon u} \\ \sigma_{\varepsilon u} & \sigma_{uu} \end{pmatrix}.$$

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<sup>50</sup> Loayza and Ranciere (2002) introduce a slightly different specification of the regressor variable, which takes the form  $x_t = \gamma + \rho x_{t-1} + u_t$ , thus leading to an error correction model with a component

$$\left( a - \gamma \frac{\sigma_{\varepsilon u}}{\sigma_{uu}} \right) / (1 - \lambda).$$

The contemporaneous correlation between  $\varepsilon_t$  and  $u_t$  is then represented by a linear regression of  $\varepsilon_t$  on  $u_t$  as follows,  $\varepsilon_t = \left( \frac{\sigma_{\varepsilon u}}{\sigma_{uu}} \right) u_t + \eta_t$ , where  $\eta_t$  is distributed independently from  $u_t$  (and, thus, from  $x_t$ ).

In this way, the new residual in the  $ARDL(1,1)$  model is uncorrelated with all explanatory variables and is given as

$$y_t = \lambda y_{t-1} + \left( \delta_{10} + \frac{\sigma_{\varepsilon u}}{\sigma_{uu}} \right) x_t + \left( \delta_{11} - \rho \frac{\sigma_{\varepsilon u}}{\sigma_{uu}} \right) x_{t-1} + a + \eta_t.$$

The error correction model implied by the  $ARDL(1,1)$  given above can be expressed, analogously as in expression (3.7), by

$$\Delta y_t = \phi \left( y_{t-1} - \frac{a}{1-\lambda} - \left( \frac{\delta_{10} + \delta_{11} + \frac{\sigma_{\varepsilon u}}{\sigma_{uu}} (1-\rho)}{1-\lambda} \right) x_{t-1} \right) + \left( \delta_{10} + \frac{\sigma_{\varepsilon u}}{\sigma_{uu}} \right) \Delta x_t + \eta_t.$$

Therefore, the long-run relationship is given as

$$y^* = \left( \frac{a}{1-\lambda} \right) + \left( \frac{\delta_{10} + \delta_{11} + \frac{\sigma_{\varepsilon u}}{\sigma_{uu}} (1-\rho)}{1-\lambda} \right) x^* + \eta^*.$$

Pesaran *et al.* (1999) use a Gauss Program to implement the PMG estimator, where the long-run relationship between  $y$  and  $x$  assumed no contemporaneous feedback effect. In order to eliminate the presence of such effect from model specification, each equation is modelled analogously to Calderón *et al.* (1999) and Loayza and Ranciere (2002). The PMG estimates corrected from the contemporaneous correlation problem are obtained through a dynamic equation specification, using the Eviews 3.0 Program.

## **4. Empirical variables of Proposition 1**

The present Chapter describes the variables included in the empirical application to test Proposition 1 and its statistical sources: the dependent variable denominated EXP and 8 independent variables.

The sample covers 15 countries and 32 years. The countries comprise the current European Union in full: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom. Data are available on an annual basis from 1970 to 2001.

### **4.1. The dependent variable**

The explanation begins with a description of the variable which behaviour the present part intends to explain in order to sustain Proposition 1's statements of the theoretical model, *i.e.*, the dependent variables EXP.

The dependent variable EXP corresponds to the difference between central government's current expenditure weight in every year budgetary values of public expenditures and its capital counterpart weight.

The dependent variable defined by such difference is in accordance with the theoretical model that defines  $g_A - g_B$  as being the comparison between the weight that current expenditures have on government's budget and the weight attached to capital expenditures. The theoretical model evaluates the bias towards some of the two types of expenditures, meaning that the difference takes the values zero when the

respective weights are balanced.<sup>51</sup> In this sense, the variable captures the bias to a certain type of expenditure, *i.e.*, positive values mean a bias towards current expenditures and a negative value indicate a bias towards capital expenditures. A variable defined in this way permits to evaluate the influence of the explanatory variables, described in next Sections, to the bias evolution.

The main data source for the absolute values of central government's current expenditures as well as capital expenditures is the IMF's *Government Finance Statistics Yearbook*, with information published until 1999. However, for some countries the series were incomplete, implying the use of others complementary statistical sources, namely: National Accounts (OECD), National Bank of Belgium, Eurostat, INSEE National Accounts, National Accounts - Dutch Department of Finance, European Commission (2001), and Bank of Portugal.<sup>52</sup>

With the purpose of having all the variables included in the empirical specification with a similar time lag, all EXP series are expanded until 2001 through a simulation program of Honaker *et al.* (2000), named *Amelia*, which runs in Gauss, and permits to

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<sup>51</sup> An argument for the definition of the variable in such a way relies on the goal of the empirical application. The goal is to evaluate the budget bias towards some of the two types of public expenditure. Since  $g_A + g_B = 1$  the reader can state that defining only the weight of the current expenditures in the budget will do the same, since when current expenditure weight increases, the capital expenditure weight decreases necessarily. However, the model does not intend to explain the evolution of one of the expenditure's component but how the deviation between the two components evolves.

An example illustrates the argument. Let's consider that the current expenditure takes in three years the following values: 40, 50 and 80%. Considering only the current expenditure, the current expenditure weight increases 10% and 30% respectively, between years. Considering the variable defined as a difference, the bias towards capital expenditures decreases 20% (being the two weights balanced) and the bias towards current expenditures increases 60%.

<sup>52</sup> Having different data sources in the compilation of the data is considered that fact, being the published data adjusted in order to prevent structural breaks into the dataset.

complete each country data. The program produces five simulated results for each country missing values. The authors suggest the use of each simulation in the empirical estimation, giving origin to an upper and a lower limit to each coefficient estimated. Although, taking into account that the missing values are only approximately 6% of the central government's expenditure data compiled, the option was to use solely the simulated series which panel evidences the lower standard deviation and variance.

Having explained how the dependent variable was compiled, a description of the independent variables proceeds.

The empirical model considers, as referred, eight explanatory variables. More precisely, two dummies variables based on legislative election date, the unemployment rate, the consumer price index, a measure of the government's ideological position, a measure of the government's power in the assembly, a turnout variable as well as a variable that measures the weight of population older than 65 years.

Each one of these variables is described in the next Section.

#### **4.2. The regressors**

The empirical application must accomplish another set of variables in order to check the relevance of other influences on the nature of the electoral expenditure cycle preconized in the theoretical Propositions.

In this sense, the empirical model includes variables to evaluate either the presence of an electoral expenditure cycle, *i.e.*, electoral variables, as well as other control

variables to capture institutional and economic differences across countries. In that set of variables, political variables like parliamentary strength measures, turnout and party ideological positions as well as economic variables like unemployment rate, consumer price index and population over 65 are considered.

#### **4.2.1. The electoral periods**

The first regressor that comes naturally from the theoretical model is a variable that translates the elections into post-election and pre-election periods. In this sense, two dummies were considered, denominated by ELEC0 and ELEC1, following Schucknecht (1998)'s approach.<sup>53</sup>

The former dummy variable assumes value 1 in the pre-election year when elections take place until the fourth month of the year and in the election year when elections take place during or after the fifth month. In this periods the difference between current expenditure and capital expenditure is expected to be wider. Otherwise, the variable takes the value zero.

The later dummy variable takes value 1 in the election year when elections occur during the first two months of the year and in the after election year when elections occur in or after the third month of the year. In this period it is anticipated that the difference between current expenditure and capital expenditure becomes smaller. Otherwise, the variable takes the value zero.

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<sup>53</sup> There are several approaches proposed in the literature for the definition of the electoral dummies. After analyzing the alternative specifications, namely those proposed by Blais and Nadeau (1992), by Dalen and Swank (1996), by Franzese (1999), by Carmignami (2000), by Shi and Svensson (2000), by Chang (2001), by Huber, Kocher and Sutter (2002) and by Mulas-Granados (2002), the Schucknecht's approach was considered the most reasonable to capture the phenomena nature that the present work intend to explain.

During the dictatorial regimes, both variables take the value zero given the absence of any electoral cycle in the correspondent periods.

The two dummy variables are based on legislative election date, whose information is mainly taken from the following net-address: [www.electionworld.org/](http://www.electionworld.org/). Early election dates are collected from Wolderdorp *et al.* (1993, 1998) and it were held, for Belgium on 1971, 1974, 1981 and 1985, for Denmark on 1977, 1979, 1981, 1984 and 1987, for Greece on 1977 and 1990, for Ireland on 1982, 1987 and 1992, for Netherlands on 1977 and 1989 and for Austria on 1970. Greek legislative election date is retrieved from the site: [www.janda.org](http://www.janda.org). Some election data information is also available in the Lijphart Election Archive at the net-address: <http://dodgson.ucsd.edu/lij>.

In order to test empirically Proposition 1, the relation between the electoral cycle (pre-election periods versus post-election periods) and the budget composition bias towards current expenditures is investigated. In this sense, in a regression including both ELEC0 (pre-election period) and ELEC1 (post-election period), the parameter associated with the former is expected to be significantly positive and with the second is anticipated as being smaller than ELEC0 and probably not significant statistically. The parameter of the ELEC1 variable is an empirical question, thus a positive or a negative sign can be considered.

This result would confirm the prior expectations regarding the effect of the electoral cycle on the governments' manipulation of the composition of the public expenditures. In the former case, a positive sign to the parameter of the ELEC0 variable indicates that pre-elections periods induce governments to bias the budget composition towards current expenditures. In the second case, having a parameter to

the ELEC1 variable not statistically significant means that governments do not bias the budget composition in the post-election periods.

#### **4.2.2. The economic and social variables**

The incorporation of economic variables permits to contemplate empirically the existence of economic cycles that might restrain government's incentives to manipulate public expenditures. The economic variables are the unemployment rate and the consumer price index.

The unemployment rate variable, named UER, is collected from OECD (1996, 2000) until 1999, and OECD (2001-a) afterwards.

The consumer price index (CPI variable) values are taken from Eurostat (2001) until 1997, from OECD (2001-b) between 1998 and 2000, and from Institute Flores de Lemus (2000), which report to Eurostat, to the last year.

Both economic variables the unemployment rate and the consumer price index are expected to reflect the economic cycle impact on public expenditure cycle. Thus, in the regression, the parameter of the unemployment rate variable must be positive; meaning that higher unemployment induces the increasing of current expenditures through public funds. Contrarily, a negative sign is expected on the parameter of the consumer price index variable in the regression, especially if the variable enters in estimation with a period lag. In this case, the budget plays a stabilisation role, controlling for the inflationary stress on economy, through a contraction on the amount attained to current expenditures on the next budgetary exercise.

The last variable corresponds to a social variable identified as POP65, which represents the weight of population older than 65. Data sources are Eurostat (2001) until 1999 and CIA-World Factbook afterwards.

Analogously as to unemployment rate, the weight of the population over 65 bias budget's composition towards current expenditures through social transfers and health care expenditures and, in this sense, is anticipated a positive sign to the coefficient of this variable. This is reasonable given the rivalry in consumption this kind of welfare expenditures evidence, being a direct function of the number of unemployed and the number of older citizens in population.

#### **4.2.3. The ideology**

The inclusion of an ideological variable in the empirical application intends to evaluate the extent of partisan bias on the public expenditures' mix. However the theoretical model defines the government as being ideological neutral. In this sense, the investigation of the sign and significance of the ideology variable coefficient assumes relevance because in fact governments have ideological positioning since parties that are not ideologically neutral compose them. Having in mind the statements regarding government's preferences of the theoretical model, the prior expectation is that government's ideological position does not significantly determine budget manipulation.

The ideological variable allows the position of governmental preferences regarding public expenditures since the common knowledge is that left-wing parties are more prone to spend on current expenditures than right-wing parties. This argument is confirmed by Cusack (1995), who shows, using industrialised democracies data

during 1955 to 1989, the importance of ideological preferences of the ruling parties to the levels of governing spending determination. Parties on the left, favour redistribution, thus providing greater public expenditures while parties on the right, favour the untrammelled workings of the market system, which reduces government's spending. Dalen and Swank (1996) using Netherlands data for 1953-1993 also reported that left-wing cabinets attach greater importance to social security and health care and right wing cabinets value expenditure on infrastructure and defence.

The Tsebelis and Chang (forthcoming)'s database is used to define the government's ideological position, identified as IDEOL variable. The database is available at <http://www.polisci.ucla.edu/tsebelis/>.

The authors compiled earlier versions of ideological party positioning studies under democratic regimes driven by Castles and Mair (1984), Laver and Hunt (1992) and Huber and Inglehart (1995) and extended it. Since neither of the studies aggregates results for all countries considered in the empirical application, a different ideological scale between countries according to data availability is used.

The positioning of each party, with assembly representation, are taken from Huber and Inglehart (1995) for Germany, Ireland, Italy, Austria, Portugal, Finland, Sweden and United Kingdom, from Castles and Mair (1984) for Belgium, Denmark, Netherlands, Spain and France, and from Laver and Hunt (1992) for Luxembourg. The government's ideological position is completed with Greece, with by Beck *et al.* (2000) on the net-address <http://econ.worldbank.org/staff/tbeck/>.

Information regarding more recent legislative election results and respective assembly composition is obtained through CIA – The World Factbook (2001), at the internet site: <http://www.cia.gov/cia/publications/factbook/geos>.

In order to harmonise the different party ideological scales the approach of Carmignani (1999) is followed, which orders each parliamentary party in a scale from 0 to 10, corresponding to a sequence from the left to the right. A party positioned below (above) 5.5 is considered a left (right) one. Following this approach the democratic governments' ideology in Europe vary between a lowest value of 2.3 in the United Kingdom and a highest value of 8.453 in Italy.

During the 70s, Greece, Portugal and Spain faced a transition from a dictatorial to a democratic regime. Dictatorial regimes are not quoted in a scale as a party with democratic legislative representation commonly are, which leaves a problem of unbalanced panel data for those countries.

In order to minimise this situation the ideological data emptiness was filled. In that filling the goal is twofold. Firstly to overcome the problem of working with unbalanced panel data which will leave information regarding other variables outside the estimation procedure, and secondly not distort the explanatory effect of this variable, since the motivation is to evaluate party's behaviour under democratic regimes.

The lower the value of the IDEOL variable as defined, the higher will be the expected budget bias prone current expenditures, given the leftist party preferences in what concerns public expenditure pattern, under a democratic regime.

In the theoretical model the incumbent's opportunistic behaviour is refrained by elections, since if she displeases too much voters the next election context can not be gained and she does not get re-appointed. Under a dictatorship the government does not face those constraint that are impose by the electoral cycles. Given the certain re-appointment under a dictatorial regime, the incumbent will prefer to spend on current expenditures rather than on capital expenditures since the latter type of expenditures

gives her an utility with a period delay. So why expect to have pleasure tomorrow if she can get it now. In this sense, the incentive of a dictatorial regime to manipulate budget composition is at the higher position compared with any democratic regime, which is independent of the ideological position of the dictatorship, according with the theoretical model. In accordance with this argument, the value zero is allocated to the period of democracy absence in those three countries.

This filling is in line with the theoretical model, which considers the government as being ideologically neutral and ideology importance comes up through electorate, whose preferences for the two types of public expenditures are ideologically positioned. In this sense, a government only cares about voters' preferences if re-election is uncertain, which is not the case under a dictatorship. This argument is in line with Block, Singh and Ferree (2001), who confirmed, under an African context, that if elections do not entail multiparty competition, an incumbent's utility function does not produce incentives to engage in electoral economic manipulation to satisfy the electorate.

The European governments evidence, during the three decades in analyse, different ideological positions. In mean terms, left-wing parties predominantly governed Europe between 1970 and 2001; however three countries present a rightist tendency, namely Italy, Ireland and United Kingdom.

The parameter of the political variable IDEOL is anticipated to have a negative sign in the regression. The sign is in accordance with the literature that describes right-wing parties as being less prone to welfare transfers, thus less prone to current expenditures.

#### **4.2.4. The legislative share of the largest party**

The theoretical model focuses on the incumbent's opportunistic behaviour prior elections. The incumbent is modelled as being the head leader of a government.

In real world, government can be of a single party or a coalition. In this sense assumes relevance the evaluation of what of the two configurations of government produces a more evident political budget cycle with a nature of the one presented in the theoretical model.

The political variables evidence different realities across countries. Some European countries have a very divided parliament, with many parties having a reduced share of total parliamentary seats. As expected, in those countries, coalitions are the natural government outcome. The European countries evidence a differentiated pattern on the formation of governments, which gives an incentive to test government's behaviour under the alternative configurations. On some countries like Belgium, Denmark, Italy, Luxembourg, Netherlands and Finland, for example, to mention just a few, coalition governments are dominant. In contrast Portugal, Spain, Greece and United Kingdom present a tradition of a single party governments.

The empirical application will show that single party governments do not perform equally to coalition governments, determining differences on the manipulation of public expenditures across European countries.

The importance of government's polarisation to the electorally manipulation of public expenditures is well documented.<sup>54</sup> From a government composed by a set of

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<sup>54</sup> Carmignami (2000) argues that different electoral institutions will produce different forms of bias in fiscal policy formation. Scartascini and Crain (2001) examine the structure of party competition across democratic nations and its impact on the size and composition of government's expenditures and find, empirically, that increases in the number of effective political parties has a significant effects on

parties is expected to feel less responsible for budget options since the probability of being in government again is substantially smaller than when one party represents a significant parcel of the electorate. To reinforce this argument Economides, Miaouli and Philippopoulos (2001-pp.16) can be quoted:

*“As the re-election probability gets smaller, the party in power cares less about the future and spends more now.”*

Another explanation is that the war of attrition is higher if there is not a leading party of considerable size in a ruling coalition, thus leading to more systematic manipulations on the composition of public expenditures by coalition rather than by single party governments.

In order to capture those differences on government’s behaviour in the empirical application is introduced a variable that measures the weight of the larger party in a parliamentary assembly. The LPS abbreviation becomes the name of the legislative share of the largest party variable. The correspondent values are found by dividing the number of seats of the most representative party in the assembly by the assembly’s total number of seats. This variable intends to capture different budgetary behaviours across countries distinguishing between countries where coalition governments are the rule from countries where single party dominates the legislatures.

In the definition of the LPS variable, the Beck *et al.* (2001) jointly with the Tsebelis *et al.* (forthcoming) databases are used as data sources.

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expenditure composition. The authors affirm (pp.3) that *“for each effective political party that gains parliamentary representation, central government expenditure as a share of GDP increases by roughly two percentage points in OECD countries and by half a percentage point in the large sample of countries.”* Also Huber, Kocher and Sutter (2002-pp.1) found that *“coalition governments with about equally strong parties have higher deficits than governments where there is one dominating party and one or more relatively weaker parties.”*

When budgetary options are taken under dictatorial governments, the variable is coded to one, since it is assumed that government's opposition had no role in the government's budget decisions.

In the regression, for the parameter associated with the political variable LPS is anticipated a negative sign.

If the major parliamentary party has a significant fraction of the parliamentary seats, the party has a smaller incentive to manipulate budget composition in the pre-election years, since the re-election comes more likely. However, if the largest parliamentary party only shares a small proportion of the seats an inverse incentive is expected. Any party in such a minority position will have a higher present ego-rent when bias budget to current expenditures compared with a party with a more enlarged electorate.

In this sense, the parameter can be interpreted as how party re-election chances determine the bias on the expenditure mix.

#### **4.2.5. The turnout rate**

The last political variable considered is a measure of participation in elections by the electorate. The turnout rate might be a constraining force on government's freedom to manipulate expenditure. Governments know that manipulating excessively public expenditures, far from voters' preferences will be translated into a price to be paid in election terms. In fact, the model distinguishes from common electoral cycle literature where electors are mistaken by fiscal illusion.

The theoretical model shows that if voters have no public expenditure bias, even so the incumbent increases current expenditures in the pre-election years.

Under the circumstances in which voters do not have preferences regarding current expenditures, the incumbent knows that the higher the turnout rate the more heavy any electoral punishment will be. The main idea is that if there are countries with a greater number of effective voters, this means more participant societies.

And a society is more participant as more informed is. In fact, as Coupé and Noury (2002-pp.1) argued *“information is a major determinant of abstention. Uninformed agents use abstention to delegate their “vote” to their more informed fellows.”* Matsusaka (1995) also developed a decision theoretic model of abstention showing that more informed voters get a higher expected return for voting than do their less informed counterparts. Ghirardato and Katz (1999) demonstrated that as voters acquire more information about an election, they are more likely to vote on it, since the informational costs needed to avoid the vote on the wrong candidate are lower. Indirect evidence on the importance of voters’ information can be also found in Matsunaka and Palda (1999), which show that more educated people are more likely to vote. The relevance of information to explain voters’ participation in elections is more directly evaluated, in Larcinese (2000), who shows that people that are more informed (measured, for example, by how many of the candidates can be named) are more likely to turnout in the UK.

More voters expressing their dissatisfaction to government’s expenditure options imply a more responsible government to their constituents, thus lowering budget manipulation. If voters’ displeasure is too prominent, government’s political account can be too high, loosing any re-election chance that might have.<sup>55</sup>

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<sup>55</sup> A government evidencing a bias to current expenditures, in a persistent manner, is generally punished in elections. For this statement, we can present, as an example, the Portuguese case and the parliamentary 2002’s election results, which lead to a change from a PS government to a coalition government between PSD and PP-CDS.

So, in the empirical application, the expectation is that the greater the number of voters' bailouts, the smaller the incentives for governments to engage in excessive current expenditures compared to capital expenditures. This result is expected if voters preferences are prone to capital expenditures or if voters have no preference regarding the expenditure mix, in accordance with the theoretical model.<sup>56</sup> However, if voters prefer current expenditures the budget will have this bias given the government's manipulation incentive in the pre-election periods, as stated in the theoretical model.

Ultimately, given that voters' preferences are unknown, the turnout variable effect on the public expenditure mix remains an empirical question.

In order to test the above effect, a measure of the turnout rate is introduced in the empirical application. The turnout variable (VPR) is defined by the ratio between the number of votes cast and the number of people entitled to vote, The information used to define the variable can be found at [http://idea.int/voter\\_turnout/westeurope/](http://idea.int/voter_turnout/westeurope/).

Belgium turnout rate is a particular case since an upper 90% of voter's participation is found across the three decades of the present study, which is an outcome of the compulsive election law.

Since elections are not an every year's phenomena, middle year data is completed according to Franzese (2000)'s suggested methodology. The number of votes cast and the number of people entitled to vote are obtained by holding fixed the information related to each variable, in each election, until next election and, then smoothing the

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<sup>56</sup> Franzese (2000) presents a different argument, that leads to a contrary expectations from the ones we have relating to turnout variable signal, showing, in an OECD countries framework, that higher voter turnout produces more transfers, since there are a greater electoral representation of the relatively poor. Our empirical work does not come up with the same conclusion. The main reason can reside on the set of countries included in the study, since OECD is a more heterogeneous set regarding poverty levels than the one composed by the EU countries.

resulting series by a moving average that contemplates the previous and the last variable results.

The population data is retrieved from Eurostat (2001) between 1970 and 2000 and the information for 2001 is collected from CIA-World Factbook (2001).

If the parameter associated with the VPR variable takes a negative sign that would mean that the higher the turnout rate, the more voters' disciplinary force reduces government's manipulation prone to current expenditures. This case will indicate that voters do not prefer current expenditures, since the participation of voters constraint the government's incentive to spend more on current expenditures. A parameter with a positive sign would mean that voters have a preference bias towards current expenditures.

## **5. Empirical variables of Proposition 2**

This Chapter describes the variables included in the empirical application to test Proposition 2 and correspondent statistical sources: the dependent variable EXPF and 5 regressors.

The sample covers the 15 EU countries from 1970 to 2001.

### **5.1 The dependent variable**

Differences regarding the composition of public expenditures between society's preferences and voters' preferences cannot be directly evaluated.

The public expenditure partition between current and capital expenditures is quite general and does not allow for an effective differentiation between voters' preferences and non-voter's preferences. The non-voters group determines the differences between society's preferences and voters' preferences. In order to evaluate more appropriately the kind of public expenditure that is more prone to each of society's groups, a split by functions of the public expenditures becomes necessary<sup>57</sup>.

In this sense, for the definition of the other dependent variable considered in the study (EXPF), central government's expenditures are broken down by functions and clustered into two categories, in line with Kneller, Bleaney and Gemmell (1998)'s methodology. These authors proposed a dichotomy between productive and non-

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<sup>57</sup> Sanz and Velásquez (2002) present a comprehensive review of the literature that uses models with a public expenditure partition by functions and the respective forms of aggregating those functions.

productive functions for central government's expenditures<sup>58</sup>. The main argument for this partition is that the former category favours voters more and the last category is more prone to non-voters.

The productive central government's expenditure includes expenditure on general public services, defence, public order and safety, education, health, housing and community amenities, economic affairs and services as well as other undifferentiated expenditures. The remaining functions categories, namely social security and welfare expenditures as well as recreational, cultural and religious affairs expenditures correspond to a second category of expenditures, referred to as non-productive.

An analogous approach taken for the EXP variable is now followed in the EXPF variable definition where this variable represents the difference between weights that each of the public expenditure category mentioned above have on central government's total expenditure.

The IMF's - *Government Finance Statistics Yearbook* is once again the main source for the compilation of this variable. However, central government's expenditure data by function are only available until 1997 and even so with many incomplete series. In fact, only Belgium, Denmark and Spain have a full-range of information. There is also a group of countries for which the first two years are missing (Finland, Sweden and United Kingdom), and another group with the two or three last years missing (Germany and Luxembourg). For the remaining countries, missing values are dispersed through the series and are a more frequent event.

Given the information holes regarding central government's expenditure by function, a solution already followed is adopted and the missing data were simulated

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<sup>58</sup> Previously, Barro (1990) and Devarajan *et al.* (1996) already distinguished between productive functions, which stimulate growth, and non-productive functions, that increase social welfare.

using the *Amelia* package. As previously mentioned, to each missing value, five possible values are attached.

Having in attention that the missing values in the EXPF variable are in higher number than in the EXP variable (27.5% of central government's expenditure data, by function), some additional caution must be taken and in the estimation should not be considered only one of the simulated value series. The most appropriate simulated values for each regression specification is in this sense evaluated.

With this purpose, a country by country regression with each five values simulated is run and the robustness of the regressions is checked through four tests: residual serial correlation, functional form specification, homocedasticity and normality of the residuals. The simulated values used in regression estimations are not always the same, being adjusted according to the robustness tests performed on each regression specification (*i.e.*, the number of regressors' lags included in the regression specifications).

The country's simulated values used in panel estimation identified on Table A in the Appendix as EXPF1 and EXPF2 were, in this sense, the ones with better robustness tests results.

To test the adequacy of Proposition 2 and Corollary 1, a function in which EXPF is the dependent variable is estimated. In this sense, EXPF is regressed on economic variables, namely on UER and on CPI and, on political variables as IDEOL, LPS and VSP.

This means that the goal is to investigate the evolution of public expenditures by function and its relation to both economic and political phenomena.

## **5.2. The regressors**

### **5.2.1. Common regressors**

To test the adequacy of Proposition 2, the unemployment rate (UER) and the consumer price index (CPI) are maintained as regressors in the empirical application in order to evaluate the influence of the economic cycle on the composition of public expenditures. The included political variables in the regression are again the government's ideological position (IDEOL) and the government's power to decide alone the composition of public expenditures (LPS).

As explained in detail in Section 3.2, in the estimation procedure is allowed the finding of two parameters to each variable: one for the long run and other for the short run effects.

In this framework, the parameters of some explanatory variables can evidence an ambiguous effect in the long-run but a very precise effect in short-run.

More precisely, in the long-run, do not exist prior expectations regarding the coefficient signs of the unemployment rate as well as the consumer price index, but in the short-run a negative sign for UER and an ambiguous sign for CPI are expected.

The reasons for the expected sign are in conformity with the already stated effects those two variables have on budget mix. On the one hand, an increase on the number of unemployed implies more public transfers to those citizens, which implies an increase of welfare expenditures included into non-productive expenditures. On the other hand, given budget stabilisation role, an increase on the consumer price index leads to government's refraining to expand both types of public expenditures, given the multiplier effect expenditures have on inflation.

In what concerns political variables, the short-run and the long-run effects of IDEOL and LPS<sup>59</sup> on budget composition between pro-voters and non-pro-voters expenditure remains an empirical question. Although it is reasonable to expect that as larger a parliamentary party is, the more flexible a government composed by that party will be to satisfy non-voters' preferences without facing a too high reduction on the electorate base.

### **5.2.2. The voters share of population**

In a society with a more pronounced participation of voters, governments are too tight to voters' preferences thus leading to a significant bias towards public expenditure functions that favour voters, since in that case it also favours society. The expectation is that the more participant in elections a society is the less likely will be to find a great difference between society's preferences and those expressed by voters.<sup>60</sup> Thus, if effective voters represent a significant weight in total population then the expectation is that governments will follow voters' preferences given that would not be too much differentiated from society's preferences. If voters prefer a specific type of public expenditures, then budget composition must be directly and

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<sup>59</sup> Using panel estimation with 21 OECD countries in the period 1982-1997, Kittel and Obinger (2002) find that party fractionalization and coalition governments only explain a small percentage of the variance in social spending in times of austerity. Although, the authors consider that consolidation is much more difficult if parties need to find a compromise between different ideological orientations, as is the case on coalition governments.

<sup>60</sup> The possibility of differentiated preferences pattern between effective voters and the reminding society's citizens was already referred by Sanders (1996) when refers that registered electors evaluate candidates differently than the unregistered.

positively correlated with the degree of representation that effective voters have in society.

Contrarily, a smaller weight of voters in society will imply a larger scope for governments to please non-voters' preferences.

After the public expenditure partition into two subgroups according to either expenditure more prone to voters or expenditure more oriented to non-voters, then the greater the number of effective voters in society, the higher a bias towards the former type of public expenditure is expected.<sup>61</sup> The major motivation at this point is to test empirically if in fact a more participant society leads to that kind of bias on public expenditures.

The variable that measures the weight of the effective votes cast into population is denominated by VSP variable. The information used to define the variable is available at [http://idea.int/voter\\_turnout/westeurope/](http://idea.int/voter_turnout/westeurope/).

The sign of the parameter associated with the VSP variable is expected to be positive and statistically significant, meaning that the higher the weight of effective voters in society the more likely governments engage into a budget manipulation prone to pro-voters expenditures.

To the insight of the above explanation, Table A on the Appendix presents a summary of the descriptive statistics, by country, of both dependent and explanatory variables.

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<sup>61</sup> Cusack (1995) argues that the preferences of voters are based on objective differences across groups within the electorate, differences that reflect the economic well being of the individuals within these groups. Thus electorate evidences different public expenditures preferences. While poorer groups, less politically active, tend to favor greater government intervention in the economy, which increases transfers and consequently the weight of unproductive expenditures, more influent groups are

### 5.3. Goals of the empirical application

Summarising, the empirical application intends to test empirically the following results:

- a positive relationship between a bias on public expenditures towards current expenditures and the pre-election periods;
- a relationship between a bias on public expenditures towards current expenditures and turnout rate and,
- a positive relationship between a bias on public expenditures towards pro-voters expenditures and the weight of effective voters in society.

Generally, the empirical model presented is:

$$\begin{aligned} \text{Current expenditure weight} - \text{Capital expenditure weight} &= \\ &= f(\text{electoral cycle}) + f(\text{economic variables}) + f(\text{political variables}) \end{aligned}$$

to test Proposition 1.

In order to accomplish the goals relative to Proposition 2, the empirical model used the following expressions:

$$\begin{aligned} \text{Current expenditure weight} - \text{Capital expenditure weight} &= \\ &= f(\text{economic variables}) + f(\text{political variables}) \end{aligned}$$

$$\begin{aligned} \text{Pro - voters expenditure weight} - \text{Pro - non - voters expenditure weight} &= \\ &= f(\text{economic variables}) + f(\text{political variables}) \end{aligned}$$

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interested in restricting government intervention, holding a lower preference for that expenditure's type.

## **6. Unit root tests on the EU panel data**

In this Chapter a preliminary analysis of the data set is presented. In a first step the panel series are analysed in order to determine their unit root characteristics. Then the stationary properties of these time series are investigated, for each country, through a SURADF procedure. The panel unit root tests performed on the entire country set and on the set of countries included in the estimated regressions of the empirical application are reported in tables B1 to B10 in the appendix. The panel referred to as 10-I considers the set of countries included in the estimation of Proposition 1, whose estimated results are presented in Chapter 7. Analogously, the panel indicated by 10-II refers to the set of countries included in the estimation of Proposition 2. Chapter 8 reports the results achieved for this Proposition.

The first step consists of checking for the presence of a unit root in the dependent variables and in the regressors. In this sense, both the IPS and the Chang panel data unit root tests are applied.

### **6.1. The implementation of the panel data unit root tests that assume cross-section independence**

Performing a standard ADF test on each individual time series with an intercept and with both an intercept and a time trend, the IPS test is implemented, exploiting the panel dimension of the data set. The number of lags  $p_i$  included in individual regressions to eliminate residual auto correlation is chosen according to the BIC Criterion with a maximum length of 8 periods. To confirm absence of residual serial

correlation as required for the implementation of IPS' t-bar test, a LM test is performed on the residuals with a lag span of three.

## **6.2. Results for the panel data unit root tests that assume cross-section independence**

Results from the IPS panel data unit root test show that the null hypothesis of a unit root can be rejected for the dependent variables EXP, EXPF1 and EXPF2, and for the regressors UER, IDEOL, LPS and VSP. However, this hypothesis cannot be rejected for the regressor CPI when the test is performed with an intercept and a time trend and, for the regressors VPR and POP65 when the test only includes an intercept.

As already referred to, the IPS test assumes cross-country independence. Nevertheless being the panel unit root test, which performs better comparatively with other tests with the same assumption, as already pointed out in sub-section 2.1.2, when cross-section dependence is in fact present in the panel, other panel unit root test techniques are more adequate.

## **6.3. The implementation of the panel data unit root tests that allow cross-section dependence**

The existence of cross-section dependencies is shown using a Granger Causality Test with 2 lags, the results of which are presented in Table C of the appendix. This Table reports the results of the F-statistic that are statistically significant, meaning that time series expressed in line Granger cause the time series expressed in column. As can be observed, all variables present a causality relation across some of the countries

that compose the panel, thus violating the independence assumption required by the IPS panel unit root test.

In this sense, Chang's non-linear IV unit root tests are performed, in each cross-section. The number of lags  $p_i$  included in individual regressions is once again chosen according to the BIC Criterion with a maximum length of 8 periods. An analysis of the residual serial correlation LM test is also performed with a lag span of three.

Finally the SURADF unit root test is performed. This procedure makes use of the panel data setting and uses seemingly unrelated regressions, but performs separate unit root tests in each panel unit, as previously described. This procedure has the advantage of identifying which cross-sections are stationary and which cross-sections have unit roots. This analysis is interesting in the sense that in a panel the rejection of a unit root does not mean that all units are stationary.

#### **6.4. Results for the panel data unit root tests that allow cross-section dependence**

As can be observed in tables B1 to B10, the unit root null of Chang's test cannot be rejected for the CPI regressor, when considering the panel as a whole. Apart from this regressor, all the other regressors and the dependent variables reject the null hypothesis of a unit root in the panel, either considering all the set of countries or subsets.

After performing the SURADF unit root test it can be observed that the panel data are composed of a mix between stationary and nonstationary time series. The CPI

panel unit root test is the only one that presents systematic evidence of a unit root in all cross section units.

The present results indicate the presence of a unit root puzzle in the cross sections that compose a panel. As indicated, the rejection of the null of a panel unit root does not imply that all time series are stationary. More, the rule appears to be a mix between stationary and non-stationary time series when the presence of cross sectional dependence is taken into account. Further, cointegration tests are derived under the assumption of cross sectional independence across individual units, which seems not to be appropriate here.

The panel unit root tests presented and the mixed characteristics of the panels considered in the empirical application provide the main argument for the subsequent analysis and to use the estimation procedure described in Section 3.2, with empirical results shown in Chapters 7 and 8.

## **7. Empirical results for Proposition 1**

### **7.1. Model selection and sensitivity analysis**

The estimation procedure begins with the selection of the appropriate specification form to empirically test Proposition 1 of the theoretical model.

To begin with, five alternative specifications are considered and, according to each specification, different countries were included for the MG and PMG estimations, depending on the results obtained for the four diagnostic tests, performed on cross-section regressions. As already referred in Section 3.2.2 the tests are the Breusch-Godfrey test for residual serial correlation, the Ramsey RESET test for functional form misspecification, the Jarque-Bera test for errors normality, and the White test for homoscedasticity.

For the performance of the four diagnostic tests the following statistical distributions are considered. In the performance of the former two statistics a qui-square distribution is used with a one-degree of freedom, and for the third statistic a qui-square distribution with two degrees of freedom performance is considered. White test statistic has a  $\chi^2$  distribution with degrees of freedom equal to the number of slope coefficients (excluding the constant) considered in the tested regression.

Table D in the appendix shows the countries included in the analysis under each initial model specification.

Since each specification includes different countries, the results are not immediately comparable. To more accurately select the specification for the empirical model, PMG estimates on each specification are run. The option was to use the model specification

whose estimation retrieves the highest log-likelihood, with acceptable Hausman-test results.

The selected specification is:<sup>62</sup>

$$\begin{aligned} \exp_{it} = & \mu_i + \lambda_i \exp_{i,t-1} + \delta_{10,i} \text{elec}0_{it} + \delta_{20,i} \text{elec}1_{it} + \delta_{30,i} \text{uer}_{it} + \delta_{41,i} \text{cpi}_{i,t-1} + \\ & + \delta_{50,i} \text{ideol}_{it} + \delta_{51,i} \text{ideol}_{i,t-1} + \delta_{60,i} \text{lps}_{it} + \delta_{70,i} \text{vpr}_{it} + \delta_{80,i} \text{pop}65_{it} + \varepsilon_{it} \end{aligned}$$

Conditional on the long-run homogeneity hypothesis, the above model can be re-written as:

$$\Delta \exp_{it} = -\phi_i \left( \begin{array}{l} \exp_{i,t-1} - \theta_0 - \theta_1 \text{elec}0_{it} - \theta_2 \text{elec}1_{it} - \theta_3 \text{uer}_{it} - \\ \theta_4 \text{cpi}_{i,t-1} - \theta_5 \text{ideol}_{i,t-1} - \theta_6 \text{lps}_{it} - \theta_7 \text{vpr}_{it} - \theta_8 \text{pop}65_{it} \end{array} \right) + \Delta \delta_{51,i} \text{ideol}_{it} + \varepsilon_{it}$$

where  $\phi_i = (1 - \lambda_i)$ ,  $\theta_z = \frac{\delta_{z0} + \delta_{z1}}{1 - \lambda_i}$ , with  $z = 1, 2, \dots, 8$  and  $\theta_0 = \frac{\mu_i}{1 - \lambda_i}$ .

The empirical application initially includes fifteen countries in the analysis. However, after performing the four robustness tests on cross-section regressions, that number is reduced to ten, since the other five do not accomplish the necessary conditions to be included in the PMG estimation. Those results are reported in Table I.

In particular, at a conventional statistical level, there is evidence of serial correlation in the residuals of one country, functional form misspecification in another country and evidence of non-normality of residuals in four countries.

Excluding from the analysis those countries that do not accomplish the necessary conditions to be included in the regression estimation, the empirical application

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<sup>62</sup> The other model specifications tested are reported in Table D of the appendix.

comprehends the following ten countries: Belgium, Denmark, Germany, Greece, Spain, France, Italy, Luxembourg, Portugal and Finland.

**TABLE I - Tests of model specification: Mean Group Estimators**

	Breusch-Godfrey's Test	Jarque-Bera Test	Ramsey's RESET Test	White Test	$R^2$
BEL	0,052116	1,275839	3,385411	21,2806	0,909606
DNK	0,184541	4,941352	0,093022	17,07866	0,590126
GER	0,000112	0,214095	1,476925	17,13051	0,889244
GRE	2,304666	0,845987	0,36098	24,0798	0,782926
SPA	0,002729	0,064018	0,05646	19,75415	0,906398
FRA	0,393959	0,073142	1,045848	17,94314	0,373421
IRE	0,481154	<b>94,27131</b>	0,161818	20,9128	0,693
ITA	1,329297	0,694517	0,001692	16,83381	0,410702
LUX	0,605456	0,885231	0,251367	18,13184	0,687865
NLD	2,62076	<b>6,392635</b>	1,306113	21,88212	0,856796
AUS	0,08278	0,775733	<b>14,75666</b>	26,87497	0,859621
POR	0,42349	0,055713	3,834293	18,88052	0,354273
FIN	1,076634	0,090927	2,251494	11,48089	0,965561
SWE	<b>4,444167</b>	<b>46,34976</b>	0,000123	27,49989	0,783061
UK	2,835337	<b>17,47262</b>	1,554527	19,71031	0,635846

Critical Value

$$\chi^2_{(1)} = 3,841$$

$$\chi^2_{(2)} = 5,991$$

$$\chi^2_{(1)} = 3,841$$

$$\chi^2_{(18)} = 28,869$$

In addition, as required for a long-run relationship to exist, the estimated convergence coefficient ( $\phi_i$ ) is negative in the ten countries and statistically significant in 8 of them.

## 7.2. The estimation approach

As discussed above, results are also likely to vary significantly with respect to the estimation method, *i.e.*, from the least restrictive, but potentially not efficient (MG), to PMG and to Dynamic Fixed Effects (DFE) that only allow intercepts to vary across countries.

Table II reports results using these three approaches.

**TABLE II - Selection of the estimation method and estimation results**

			Long-Run Coefficients		Hausman-Test	PMG_Corrected
	DFE	MG	Hausman-Test	PMG		
elec0	0,012251 <i>4,9338 *</i>	0,005881 <i>0,9544</i>	1,251044	0,013488 <i>4,4655 *</i>	1,956527	0,009660 <i>3,5002 *</i>
elec1	0,014010 <i>4,9554 *</i>	0,007260 <i>1,3756 ***</i>	2,200988	0,000728 <i>0,2837</i>	1,955502	0,000778 <i>0,2731</i>
uer	0,002381 <i>3,9721 *</i>	0,001568 <i>0,3248</i>	0,028759	0,004579 <i>9,1585 *</i>	0,393018	0,005607 <i>11,6082 *</i>
cpi(-1)	-0,019744 <i>(-3,5394 *)</i>	0,015483 <i>0,2617</i>	0,357493	-0,024136 <i>(-4,4149 *)</i>	0,452114	-0,028822 <i>(-6,6638 *)</i>
ideol(l)	-0,003785 <i>(-2,9374 *)</i>	-0,001462 <i>-0,261</i>	0,180541	-0,000635 <i>-0,5216</i>	0,022783	-0,000063 <i>-0,0584</i>
lps	-0,135458 <i>(-7,9936 *)</i>	-0,217804 <i>(-2,3269 **)</i>	0,797345	-0,019461 <i>-1,2329</i>	4,610467	-0,024932 <i>-1,1604</i>
vpr	0,202980 <i>3,8873 *</i>	-0,260536 <i>-0,6503</i>	1,359327	0,009390 <i>0,1758</i>	0,461486	0,090868 <i>1,9136 **</i>
pop65	2,670162 <i>11,0019 *</i>	0,920212 <i>0,9932</i>	3,801388	2,084878 <i>9,0194 *</i>	1,676180	2,003935 <i>9,5333 *</i>
<b>Hausman Test</b>			<b>9,976885</b>		<b>11,528077</b>	
			Adjustment speed			
exp(-1)	0,678239 <i>-0,321761</i>	0,459121 <i>-0,540879</i>		0,670796 <i>-0,329204</i>		0,662753 <i>-0,337247</i>
			Short-Run Coefficients			
d(ideol)	-0,002538 <i>-1,2723</i>	-0,000280 <i>-0,0752</i>	0,000115	0,000912 <i>0,2904</i>		0,001008 <i>0,3130</i>
<b>Hausman Test</b>			<b>0,000115</b>			
<b>N° of countries</b>	10	10		10		10
<b>N° of obs.</b>	310	310		310		310
<b>Log likelihood</b>	932,0809	838,13521		791,1516		803,0828
$R^2$	0,76	0,69		0,53		0,52

Included countries: BEL, DNK, GER, GRE, SPA, FRA, ITA, LUX, POR and FIN. t-student statistics are in italic.

\*\*\*:significant at 10 % level; \*\* at 5% level; \* at 1% level

Equation specification includes a constant term for each country not reported here.

The validity of DFE depends critically on the assumption of a common economic development stage, on homogenous political behaviour and participation of the electorate as well as a common adjustment speed of convergence to a long-run equilibrium on budget composition across countries.

However, if it is reasonable to expect that economic effects can have a similar impact on the composition of public expenditures, the same is more difficult to accept when the political impacts are considered, given the different realities across countries.

In fact, if the DFE estimation is compared with an estimation where political variables are introduced, one at a time, namely IDEOL, LPS and VPR with cross section specific effects, the DFE estimation evidences an increase of the adjusted R-squared to 0.777, 0.775 and 0.777, respectively. The Log Likelihood becomes 951 when a cross section of the former variable is contemplated in the DFE estimation and is equal to 949 when cross section is considered in the other variables.

The improvements achieved with the DFE estimation constitute evidence that it cannot be assumed that all the estimated slopes are homogeneous, being plausible to think that at least political variables are in fact heterogeneous across countries.

Besides, as Pesaran and Smith (1995) suggest, if there is slope heterogeneity that is not adequately modelled the DFE estimates of the adjustment speed are affected by a heterogeneity bias. To this problem the usual small-sample downward lagged dependent variable bias can be added.<sup>63</sup> (see Nickell, 1981).

Moving from MG to PMG (*i.e.*, imposing long-run homogeneity) reduces the standard errors and reduces significantly the measured speed of convergence, with some impacts on the size, sign and the statistical significance of the estimated long-run coefficients. The homogeneity assumption is not rejected by the Hausman test.<sup>64</sup>

Comparing PMG to DFE, the latter yields a lower speed of convergence due to a downward bias in dynamic heterogeneous panel data. Moreover, restricting the short-term dynamics<sup>65</sup> to be homogeneous affects the significance of the long-run

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<sup>63</sup> Instrumental variables (e.g. Arellano and Bond, 1991 and Arrelano and Bover, 1995) are applied in the case of existence of lagged dependent variable bias, but are generally used in dynamic panel data when N is large and T relatively small. However, this does not solve the heterogeneity problem.

<sup>64</sup> The critical values for the Hausman test are 5.991 and 16.919 respectively for each long-run coefficient and for the joint long-run coefficients, at a 5% significance level.

<sup>65</sup> The Hausman test critical value for the short-run coefficient is 3.841, at a 5% significance level.

coefficients. The DFE estimation of the parameters related to political variables becomes extremely relevant to explain budget composition, with an importance similar to the economic factors, importance which disappears under PMG estimates. The PMG outcome is more in line with the results expected given MG estimates.

### **7.3. Statistical results**

Returning to Table II it can be easily observed that the evaluation that the electoral cycle has on public expenditures is very sensitive to the estimation method used in the analysis.

In fact, at one extreme, MG estimates indicate that the electoral cycle is not statistically significant and, on the other extreme, DFE estimates show that the budget bias towards current expenditures is significant and almost of the same magnitude in the two periods (pre-election and post-election periods). Given the small sample, MG estimates are very sensitive to outliers, which gives a reasoning for the use of PMG estimates, when the long-run coefficients homogeneity assumption is not violated, as already described.

The DFE estimates indicate rigidity of the composition of public expenditures and consequently no government's manipulation with electoral purposes, as described in some studies referred in Chapter 1.

However, comparing the speed of convergence estimates under MG and DFE, cross country homogeneity cannot be assumed, given the difference of values found when total heterogeneity is accepted and total homogeneity is imposed, *i.e.*, between  $-0.54$  and  $-0.32$ , respectively. In fact, under MG estimates, the adjustment speed varies between  $-0.21$  in the regression for France to  $-0.81$  in the regression for Denmark.

There seems to be a wide gap for a homogenous adjustment speed to be established. This implies that although Hausman tests do not reject the homogeneity assumption of the long-run coefficients, DFE cannot be the most appropriate estimation technique used in the present estimation case.

The Hausman test does not reject the null hypothesis of the long-run coefficients homogeneity as required for the PMG estimation, meaning that the difference in the estimated coefficients between MG and PMG are not significantly different and PMG is more efficient.

#### **7.4. Economic results**

As predicted by the theoretical model, governments do manipulate budget composition towards current expenditures in the pre-election years, as the PMG estimate for ELEC0 demonstrates. Simultaneously, the long-run coefficient for the post-election period, referred to as ELEC1, is not statistically significant, meaning that there is no evidence that governments change the composition of public expenditures in those periods.

Putting it differently, a political budget cycle is found in the pre-election years and no cycle is determined in the post-election periods. This statement confirms the prior expectations described in Proposition 1 of the theoretical model.

Simultaneously, it can be affirmed that, contrarily to the DFE estimation, only the economic variables estimated by PMG procedure are statistical significant in determining the composition of public expenditures. More precisely, the UER and POP65 regressors influence positively a budget bias towards current expenditures, which are a natural outcome, and the CPI regressor with a year delay refrains

government's incentive to increase that type of public expenditures to avoid an inflationary effect on the economy.

In what concerns political variables, it seems that they are not relevant in explaining the composition of public expenditures. However, some caution must be put in those conclusions given the small sample analysis. As it is shown in the next Section, the political variables are very sensitive to the subset of countries included in the analysis, meaning that it cannot be definitely ensured if those variables determine or not changes in the composition of public expenditures across periods. The long-run coefficient associated to the VPR variable is also sensitive to the countries covered by the estimation, as it is demonstrated in Section 7.5.

The PMG estimate of the short-run coefficient to IDEOL, although not being statistically significant, its sign changes comparatively to the DFE estimate. This change can be explained by the fact that on average (equal to 5.077) those ten countries have leftist governments,<sup>66</sup> implying that ideology variations presented by the successive governments are slight and turn around parties politically positioned on the left.<sup>67</sup>

After controlling for contemporaneous correlation, the adjustment speed estimated through the PMG procedure, which allows differentiation across countries<sup>68</sup>, translates an intermediate value between DFE and MG estimates, as expected.

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<sup>66</sup> The only exceptions are the Italian and the Finland governments.

<sup>67</sup> Allowing different short-run coefficients, changes to the right in Italian governments are found to reduce budget bias to current expenditures. Although politically positioned on the left, Greek governments change to the right also decreases the difference on the weight attributed to current expenditures and to capital expenditures.

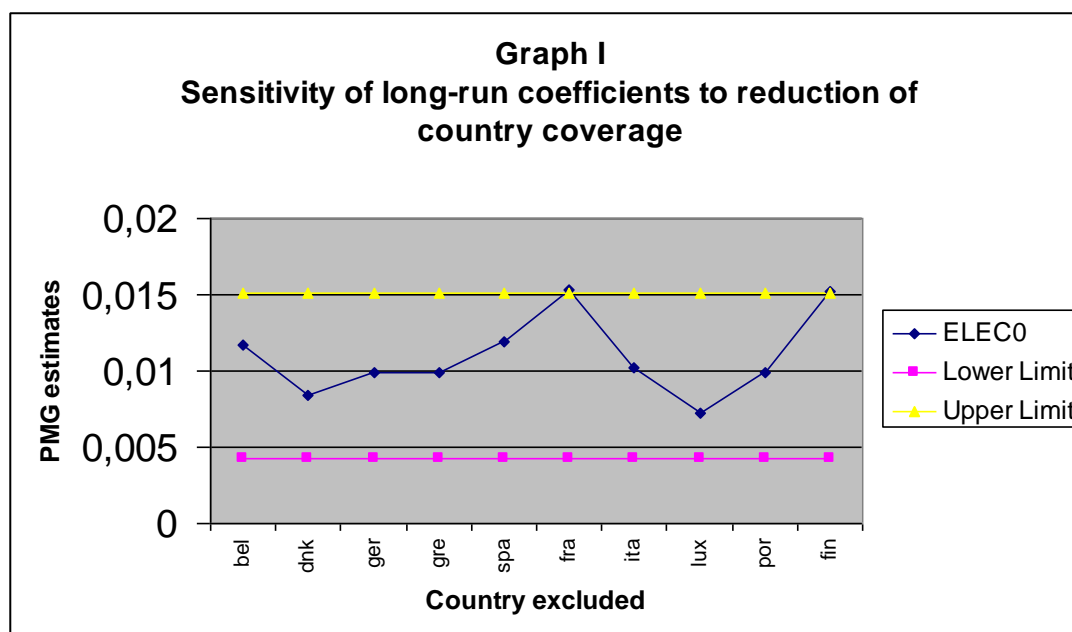
<sup>68</sup> The adjustment speed varies between -0.169 in Belgium and -0.476 in Portugal.

## 7.5. Stability analysis

In small samples, as in the present case, one individual country can significantly affect the estimated parameters, even when the Hausman tests do not reject the hypothesis of common long-run coefficients. A sensitivity analysis is thus performed in order to assess the robustness of results to variation of country coverage, by eliminating one country at a time and re-running the PMG estimation procedure.

Taking into account the width of confidence intervals ( $coef + 1.96stdD$ ), the ELEC0 and ELEC1 estimates seem to be sufficiently stable, thus implying that it can be stated that a political budget cycle of the above described kind can be defended, despite of the countries included in the analysis.

The stability of the ELEC0 and ELEC1 long-run coefficients is presented in the subsequent Graphs I and II.



The nature of the election cycle, the major goal of the empirical analysis, can be considered stable in the sense that in pre-election periods governments manipulate

current expenditures in order to get re-appointed, irrespective of the set of countries included in the analysis. The same cannot be argued for other variables. In fact, the sensitivity analysis carried out for the other regressors of the model show that some of them are not stable. The change in some of the long-run coefficients is very significant when a different set of countries are considered in the analysis.

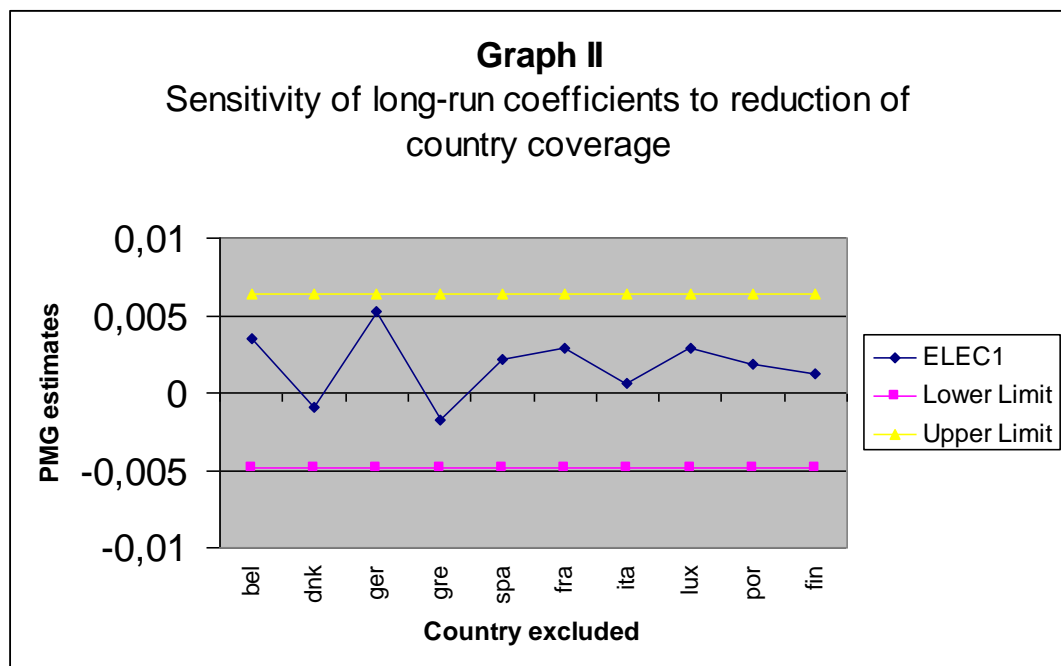


Table III describes the maximum and the minimum values each long-run coefficient can take when the country coverage is reduced to nine countries. Table E of the appendix presents more detailed information regarding each PMG re-estimation.

As can be observed it cannot be argued that the long-run estimates of IDEOL and VPR are stable since their sign and significance level can vary substantially, allowing either a significant negative value or a significant positive value, depending on the countries that have been covered by the analysis.

These results have two implications for the analysis and for the link with the theoretical model.

**Table III - Stability Analysis**

<b>Variable</b>	<b>Maximum</b>	<b>Excluded country</b>	<b>Minimum</b>	<b>Excluded country</b>	<b>PMG-Corrected Estimative</b>
elec0	0,015309 <i>6.6572</i>	FRA	0,007248 <i>2.5003</i>	LUX	0,009660 <i>3.5003</i>
elec1	0,005244 <i>1.6853</i>	GER	-0,001736 <i>-0.5822</i>	GRE	0,000778 <i>0.2732</i>
uer	0,007246 <i>14.6544</i>	FRA	0,004731 <i>10.2647</i>	GER	0,005607 <i>11.6083</i>
cpi(-1)	-0,017987 <i>-3.4258</i>	FRA	-0,032456 <i>-7.2119</i>	GER	-0,028822 <i>-6.6639</i>
ideol(l)	0,003932 <i>2.0646</i>	SPA	-0,003819 <i>-2.6248</i>	BEL	-0,000063 <i>-0.0585</i>
lps	0,0020281 <i>0.1020</i>	GRE	-0,073165 <i>-1.8605</i>	FIN	-0,024932224 <i>-1.1604</i>
vpr	0,2070887 <i>3.5657</i>	GER	-0,109086 <i>-3.1080</i>	FRA	0,090867854 <i>1.9137</i>
pop65	2,7017424 <i>13.1698</i>	SPA	1,6184464 <i>4.7315</i>	FRA	2,003934724 <i>9.5334</i>

t-student statistics are in italic. Equation specification includes a constant term for each country not reported here,

The first is that the impact of IDEOL on the composition of public expenditure cannot truly be evaluated in the small sample that is considered in the present application. In this sense either of the following three scenarios for the impact of IDEOL on the composition of public expenditures is viable: no impact, as found in the estimation, increases in the gap between current expenditure and capital expenditure or decreases in that difference. However, since the theoretical model is related to the opportunistic political business cycle branch of literature, evaluating how political business cycles are influenced by the government's ideology is not of primer concern. In this sense and given that, the present estimation does not allow to conclude about the

partisan budget cycle ideology still can play a role in electoral budget manipulation, as predicted by the correspondent literature branch.

The relationship between the number of effective voters in an election (VPR variable) and the composition of public expenditure is also ambiguous. Contrarily to what it is expected, the number of voters can have no disciplinary force on the government's bias towards current expenditures, seeming that in many cases there is a contrary phenomena. However, some caution must be taken in the analysis of this variable, since if France is excluded from the PMG estimation, the sign of the regressor becomes significantly negative, which indicates a presence of an outlier in the calculus of this variable, determining its final coefficient. This leads to think that VPR can have a significant impact in restraining the opportunistic government's behaviour, as initially expected.

This outcome can be more accurately evaluated later when the empirical relevance of Proposition 2 is tested, given in this sense the present results regarding VPR variable a mobile for the study of the importance that voters participation in elections have in the governmental manipulation of public expenditures.

The sign of the LPS variable also evidences some sensibility to the countries included in the analysis. Although in the majority of the cases, not statistically significant, the effect of the largest party representation in parliament can be positive or negative. This result can be influenced by the structure of governments' power considered in the estimation procedure, since estimation included countries governed by a single party and by a coalition. As a consequence, an analysis where only countries with coalition governments are considered appears to have interest at this point. The main results are exposed in the next Section.

## **7.6. Economic results when only countries with coalition governments are considered in the estimation**

In this point the countries considered in the estimation procedure are the ones where coalition governments is dominant. The goal is to evaluate if the previous economic results sustain when the analysis is focused on such a subset of countries. The analyse contemplates only seven countries, being excluded from the empirical application, in comparison with the number of countries initially included the following countries: Greece, Spain and Portugal.<sup>69</sup>

Comparing the results under this subset of countries with the initial results, it is interesting to notice that after correcting for contemporaneous correlation, the PMG estimates of the electoral cycle are reinforced. In fact, there is evidence that countries with higher fractionated power resulting into coalition governments have an enlarged pre-election manipulation of public finances prone to current expenditures. This outcome is anticipated since ministers that compose coalition governments, expecting to lose their positions in the next election period, prefer to maximise their utility spending on current expenditures as much as possible in the pre-election periods. This incentive is only refrained by the impact that budget bias may have on ministers' self-interests in outside income.

Besides, it seems that those coalition government countries also increase the current expenditures in the post-election periods, although slightly. This might be interpreted as a reaction of parties in a minority position in government. Under these circumstances, parties want to satisfy some fringes of their electorate increasing specific types of public transfers in the post-election period.

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<sup>69</sup> Results not reported here, but that can be seen in Table F of the appendix.

However, it is interesting to notice that CPI variable has a positive effect on budget bias towards current expenditures. This coefficient sign means that the governments of these countries have less power to use budget composition as an instrument to stabilise inflation, contrarily to what is found when all the ten countries are considered. This result is in accordance with the usual belief that coalition governments are less able to deal with negative shocks in the economy since such governments usually face a prisoner's dilemma of whose ministry should reduce current expenditures.

This phenomenon leads to the conclusion that coalition governments having in their interior decision process more forces to be gathered conduce to a more pronounced manipulation on the composition of public expenditures. This result is in agreement with the theoretical model statement in the sense that lower parliamentary representation means reduced electorate representation and consequently lower probability of continuing to integrate government after elections.<sup>70</sup>

Accordingly, it can be said that single party governments, given their higher re-election chances are less prone to manipulate public expenditures. Single party governments know that if re-elected (very likely event), then they will also retrieve utility from decisions made in the pre-election periods regarding capital expenditures, although visible only in the next legislature. This expectation reduces the government incentive to excessively increase current expenditures in the pre-election periods.

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<sup>70</sup> In line with this argument, Hallenberg and Hagen (1997) show that in European Union states with multi-party governments are not willing to delegate to one actor the ability to monitor and punish who defects on budget agreements. The authors state that a strong finance minister is only feasible in countries where one-party governments are the norm. Although the ministers of a coalition government can cooperate in a prisoner's dilemma game, in a budget game that solution is unlikely since it involves the need for monitoring and punishing all ministers who have different budget goals and defeat from compromises.

Simultaneously, the LPS variable continues to be not statistically significant after re-running the PMG procedure excluding the countries where a single party government dominates.

### 7.7. Economic results when dictatorial regimes are excluded from the estimation

It can be argued that including in the estimation countries that have dictatorial regimes during part of the seventies can bias the result. In order to evaluate if the mix of governmental regimes influences the results, PMG estimates are re-run considering series beginning at 1978 data, when all the ten countries have already implemented democratic regimes.

Table IV shows the new PMG estimates, after controlling the contemporaneous correlation, for the period 1978-2001.

**Table IV - Sensitivity Analysis excluding dictatorial regimes**  
(1978-2001)

Variable	PMG estimates	t-Statistic
elec0	0,013604	4,0796
elec1	-0,004298	-1,0611
uer	0,005286	7,7416
cpi(-1)	-0,048476	-5,3893
ideol(l)	0,000073	0,0588
lps	-0,051911	-2,1696
vpr	0,050620	0,8897
pop65	2,005614	5,2684

Equation specification includes a constant term for each country not reported here.

As can be observed, when the dictatorial regimes are excluded from the analysis, the political business cycle in the pre-election years become more statistically significant, thus evidencing, as predicted by the theoretical model, that dictators do not have the same incentive to induce budget manipulation.

The variable LPS becomes now statistically significant indicating, as already explained, that governments with a larger parliamentary representation are less induced to manipulate budget prone current expenditures. Given governments' higher re-appointment chances, governments restring their incentive to engage excessively into an increase on this type of expenditures, irrespective of the electoral period considered.

## **8. Empirical results for Proposition 2**

### **8.1. Model selection and sensitivity analysis**

The Proposition 2 presented in the theoretical model proposes a budget partition according two types of public expenditures. One type is more aligned with voters' preferences and the other type, despite of being able to potentially benefit all society, is more directed to those individuals in society with lower income resources who typically participate less in elections, as previously stated.

To test the adequacy of the Proposition 2 it is necessary to evaluate empirically the significance and sign of the VSP variable, which captures the significance that the number of effective voters in society have in the budgetary process. The expectation is that a society with a higher number of effective voters presents a lower budget weight of the considered non-productive expenditures. When governments satisfy voters' preferences they also achieve higher re-election probability and get a higher reputation level given the representation of voters in society. Under a less participant society, the number of non-voters is more prominent which leads the government to a dilemma between how to please exclusively its electorate basis and get some reputation in society by increasing the expenditures, which favours more those who do not vote. Under these circumstances, the governments restring their natural interest to spend more on expenditures that please voters.

The dependent variable of the empirical model is now EXPF. As described in Section 5.1, five alternative data values for the missing values presented in EXPF series are simulated. In order to choose a better model specification, several specifications for each one of the five panel series are tested and it is found that for each simulated panel

the model specification that better fits the data is not always the same. In this sense the option was to use the panel series simulation, defined as EXPF1, whose model estimation allows the inclusion of a higher number of countries. The comparison with alternative missing value imputations and respective model specifications is left to a stability analysis.

After analysing the robustness test results achieved under each model specification associated with each one of the completed panel series, the following model specification is selected as being the one that allows the inclusion of a higher number of countries:

$$\begin{aligned} \exp f_{it} = & \mu_i + \lambda_i \exp f_{i,t-1} + \delta_{10,i} uer_{it} + \delta_{11,i} uer_{i,t-1} + \delta_{20,i} cpi_{it} + \delta_{21,i} cpi_{i,t-1} + \\ & + \delta_{30,i} ideol_{it} + \delta_{31,i} ideol_{i,t-1} + \delta_{40,i} lps_{it} + \delta_{50,i} vsp_{it} + \delta_{51,i} vsp_{i,t-1} + \varepsilon_{it} \end{aligned}$$

Re-writing the above model under a long-run homogeneity hypothesis leads to:

$$\begin{aligned} \Delta \exp f_{it} = & -\phi_i \left( \exp f_{i,t-1} - \theta_0 - \theta_1 uer_{i,t-1} - \theta_2 cpi_{i,t-1} - \theta_3 ideol_{i,t-1} - \theta_4 lps_{it} - \theta_5 vsp_{i,t-1} \right) + \\ & + \delta_{11,i} \Delta uer_{it} + \delta_{21,i} \Delta cpi_{it} + \delta_{31,i} \Delta ideol_{it} + \delta_{51,i} \Delta vsp_{it} + \varepsilon_{it} \end{aligned}$$

$$\text{where } \phi_i = (1 - \lambda_i), \theta_z = \frac{\delta_{z0} + \delta_{z1}}{1 - \lambda_i}, \text{ with } z = 1, 2, \dots, 5 \text{ and } \theta_0 = \frac{\mu_i}{1 - \lambda_i}.$$

Table V reports the robustness tests performed on the model specified above using cross-section regressions. This test determines which countries can be included in PMG estimation.

Despite of only Ireland being rejected by the individual regression robustness tests, the estimation procedure is reduced to ten countries, since four of them do not present reliable PMG estimation results. More specifically, three countries have a negative

adjusted R-squared: France, Portugal and Italy and the other country (UK) have a positive adjustment speed, meaning that the long-run equilibrium is not attainable.

**TABLE V - Tests of model specification: Mean Group Estimators**

	Breusch-Godfrey's Test	Jarque-Bera Test	Ramsey's RESET Test	White Test	$R^2$
BEL	3,041442	5,550108	1,89141	29,63872	0,317148
DNK	0,175453	2,497026	0,133948	11,57839	0,262856
GER	0,42804	0,93104	0,89533	24,67622	0,418345
GRE	0,032328	1,951524	0,764458	23,73609	0,369466
SPA	1,660399	0,850531	1,687671	26,26768	0,577153
FRA	0,08171	0,456799	1,739927	21,74401	0,690967
IRE	<b>10,02482</b>	0,102831	<b>24,02308</b>	23,09984	0,509586
ITA	0,011722	0,569741	2,195175	17,24017	0,390238
LUX	3,160999	0,829122	1,224971	23,27716	0,399535
NLD	1,439112	2,444747	0,231123	29,97626	0,062748
AUS	1,041863	2,182298	3,371989	21,04639	0,446009
POR	1,251217	0,55101	0,092571	19,15	0,281893
FIN	0,081368	0,742033	0,850076	26,05855	0,639822
SWE	2,472565	0,512527	0,187302	14,64336	0,236755
UK	0,357406	0,824723	0,173199	27,28258	0,542577

Critical Value

$$\chi^2_{(1)} = 3.841$$

$$\chi^2_{(2)} = 5.991$$

$$\chi^2_{(1)} = 3.841$$

$$\chi^2_{(20)} = 31.41$$

## 8.2. The estimation approach

Following an analogous procedure already adopted to test Proposition 1, the DFE, MG and PMG estimations are run for the above described model.

Table VI summarises the estimation results.

Contrarily to the case described in Table II, the Hausman test between DFE estimation and MG estimation do not accept the null hypothesis of a homogeneous short-run coefficient, implying that DFE estimation, imposing that homogeneity does not translate reliable results. As previously indicated this result points to the PMG estimation when long-run coefficients homogeneity hypothesis is accepted, as in the case, since this econometric technique translates an increase on estimation efficiency compared to MG estimation, given the small number of countries included in the analysis.

**TABLE VI - Selection of the estimation method and estimation results**

	Long-Run Coefficients					
	DFE	MG	Hausman-Test	PMG	Hausman-Test	PMG_Corrected
uer(l)	0,012995 <i>9,6847*</i>	0,006078 <i>0,4943</i>	0,319727	0,000354 <i>0,2754</i>	0,218934	-0,003718 <i>(-1,8948**)</i>
cpi(l)	-0,067700 <i>(-10,558*)</i>	-0,113215 <i>-0,6369</i>	0,065632	-0,038682 <i>(-6,6513*)</i>	0,175974	-0,006922 <i>-0,1885</i>
ideol(l)	-0,008573 <i>(-3,0749*)</i>	0,003979 <i>0,2786</i>	0,798574	-0,002400 <i>-0,8886</i>	0,206269	0,003682 <i>0,8241</i>
lps	0,232672 <i>7,2484*</i>	-0,355504 <i>-1,1532</i>	3,674768	0,089714 <i>2,2397*</i>	2,118904	0,238263 <i>8,08*</i>
vsp(l)	1,665085 <i>11,4544*</i>	0,841667 <i>1,5907***</i>	2,591402	1,408255 <i>13,8398*</i>	1,187333	1,413155 <i>7,5199*</i>
<b>Hausman Test</b>			<b>7,450104</b>		<b>3,907414</b>	
	Adjustment speed					
expf(-1)	0,764609 <i>-0,235391</i>	0,393078 <i>-0,606922</i>		0,662161 <i>-0,337839</i>		0,673073 <i>-0,326928</i>
	Short-Run Coefficients					
d(uer)	-0,000892 <i>-0,3052</i>	-0,000352 <i>-0,1204</i>	0,000007	-0,000518 <i>-0,1687</i>		-0,000349 <i>-0,1087</i>
d(cpi)	0,112553 <i>1,7284*</i>	0,275810 <i>1,3552***</i>	3,000911	-0,003997 <i>-0,0995</i>		0,007556 <i>0,1808</i>
d(ideol)	-0,000494 <i>-0,1785</i>	0,004331 <i>0,3409</i>	0,002243	0,001388 <i>0,1834</i>		0,002425 <i>0,303</i>
d(vsp)	0,162963 <i>0,8093</i>	1,178819 <i>0,9446</i>	128,043858	0,297155 <i>0,398</i>		0,331981 <i>0,463</i>
<b>Hausman Test</b>			<b>131,047020</b>			
<b>N° of countries</b>	10	10		10		10
<b>N° of obs.</b>	310	310		310		310
<b>Log likelihood</b>	748,9272	614,753085		600,9033		613,412
<b>R<sup>2</sup></b>	0,94	0,37		0,47		0,52

Included countries: BEL, DNK, GER, GRE, SPA, LUX, NLD, AUS, FIN and SWE.  
t-student statistics are in italic. \*\*\*:significant at 10 % level; \*\* at 5% level; \* at 1% level  
Equation specification includes a constant term for each country not reported here.

The short-run coefficient heterogeneity is essentially observed in VSP coefficient, meaning that an increase on the number of effective voters in society has a differentiated short-run impact across countries on the budget bias towards pro-voters expenditures.

Comparing the long-run coefficients estimated by DFE and MG procedures, it can be observed that imposing homogeneity on the short-run coefficients artificially increases the statistical significance of the long-run coefficients. In fact, under DFE estimation all

the regressors have a significant t-student test, when MG estimates only indicate that VSP variable has some explanatory power on the composition of public expenditures.

Looking at the speed of convergence estimates under MG and DFE, it cannot be assumed that their estimates are homogenous across countries, given the difference of values achieved by the two estimation procedures:  $-0.61$  and  $-0.24$ . In fact, under MG estimates, the adjustment speed varies between  $-0.14$  in Germany regression to  $-0.94$  in Denmark regression. Once again and with this gap, a homogenous adjustment speed cannot be established. This implies that although Hausman test does not reject the homogeneity assumption of the long-run coefficients, DFE cannot be the most appropriate estimation technique to be used in the case.

The Hausman test on PMG estimates does not reject the long-run coefficient homogeneity assumption.<sup>71</sup> Without contemporaneous correlation correction, PMG estimates indicate that CPI, LPS and VSP variables are important to determine the partition of public expenditures by functions between the two sub-sets considered. To the former variable PMG estimates retrieve an odd result, in the sense that a negative and significant impact of this variable on the dependent variable was not expected.

### **8.3. Economic results**

After controlling for the presence of contemporaneous correlation, the PMG estimates only indicate that UER, LPS and VSP variables are determinant in explaining the bias on public expenditures towards pro-voters type of expenditures.

The weight in society of effective voters is effectively a major force to explain this kind of public expenditure bias. In this sense, it can be stated that a society with more

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<sup>71</sup> The joint long-run coefficients critical value to Hausman test is 12.592, at 5% significance level.

participant citizens in elections constrains governments to engage into a purely redistributive policy by increasing non-productive expenditures.

In the light of the theoretical model the reason for this governments' behaviour is the government seeking for re-election which is achieved if governments please their electorate basis.

As expected, the unemployment rate induces a bias towards non-voters type of public expenditures. This result is in accordance with the previous results for Proposition 1 which indicates that the unemployment rate increases those types of expenditures included in the welfare transfers, considered here as being prone to non-voters, and account on current expenditures in Proposition 1. However, as shown in the following Section, this result is very sensitive to the set of countries included in the analysis. Although being always negative, it is not clear that this variable is statistically significant.

The budget bias towards pro-voters expenditures appears to be positively and significantly related to the party with the major share of legislature seats (LPS variable). The interpretation of this result can be that a bigger representation in a parliament of a certain party implies a more pronounced motivation to satisfy voters' preferences regarding public expenditures. This is so because governments' re-election chances are higher when a ruling party has a significant number of the parliamentary seats, thus reducing the governments' incentive to bias the budget mix prone to welfare expenditures.

The PMG estimate of the adjustment speed indicates, on average, an intermediate value between DFE and MG estimates, as expected, varying between -0.06 to Spain and -0.59 to Luxembourg, taken cross-sectional results.

The PMG estimates of the short-run coefficients, aggregately taken, are not statistically significant.<sup>72 73</sup>

#### **8.4. Stability analysis**

The above analysis can be significantly affected in small samples by an outlier country, thus a stability analysis assumes a major importance, principally on the VSP parameter stability.

To perform this analysis one country is eliminated at a time and the PMG estimation procedure is re-run.

Taking into account the width of confidence intervals ( $coef \pm 1.96stdD$ ), the VSP estimates can be considered stable, implying that despite of the countries included in the analysis, there is evidence supporting the Proposition 2. In this sense, the weight of voters in society that participate in elections do induce governments to spend more to pro-voters kind of public expenditures and reduces the percentage of those classified as being unproductive expenditures.

Graph III presents the long-run coefficient sensitivity to reduction of country coverage of the VSP variable.

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<sup>72</sup> Cross sectional results reveal that unemployment rate changes are important to Finland and that changes on governments' ideology position affect negatively the budget composition towards pro-voters expenditures in Finland and Sweden. Changes on the voters' participation in society are not statistically significant in most of the countries to explain changes on the composition of public expenditures. However, is highly significant to Finland and Sweden.

<sup>73</sup> The Hausman test critical value to the joint short-run coefficients is 9.488, at 5% significance level.

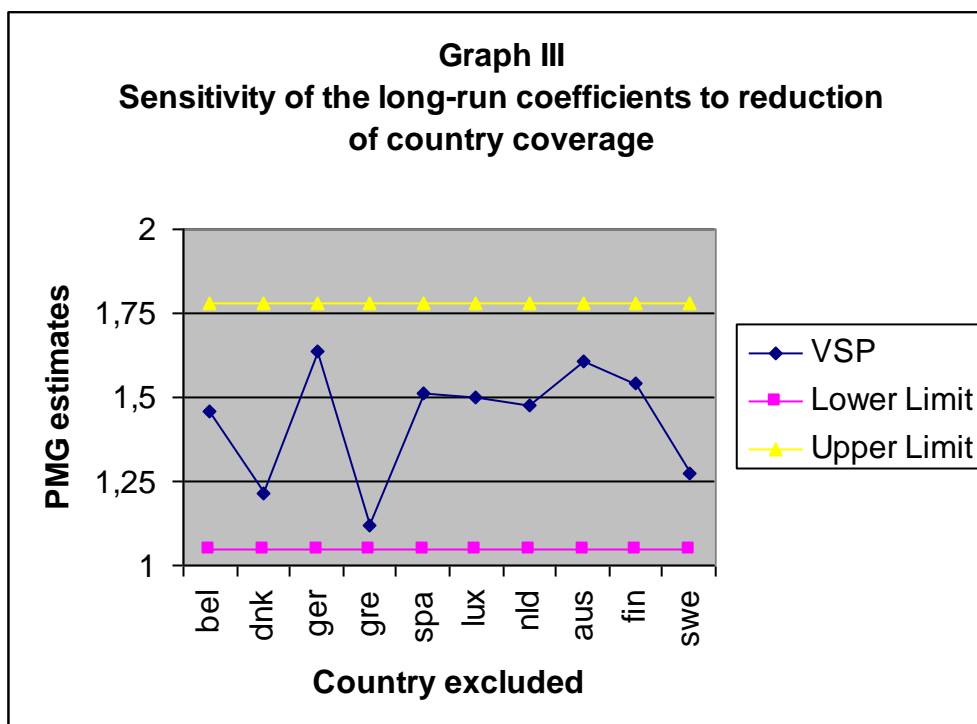


Table VII presents the maximum and the minimum values of the long-run coefficients when the country coverage is reduced to nine countries. A more detailed information regarding each PMG re-estimation is presented in Table G in the appendix.

The table below shows that only VSP and LPS seems to be stable, with a positive sign and statistically significant, despite of the nine countries included in the analysis. Simultaneously, the CPI variable presents a stable behaviour although not statistically significant.

In what concerns the UER variable, it cannot be stated that the coefficient of this variable is statistically significant, given its sensitivity to the countries included in the PMG estimation. However, the variable sign does not change, being in accordance with the prior expectations.

**Table VII - Stability Analysis**

Variable	Maximum	Excluded country	Minimum	Excluded country	PMG-Corrected Estimative
uer(l)	-0,000013 <i>-0,0064</i>	GRE	-0,006413 <i>-3,2982</i>	LUX	-0,003718 <i>-1,8948</i>
cpi(l)	-0,064489 <i>-1,032</i>	GRE	-0,001254 <i>-0,0328</i>	BEL	-0,006922 <i>-0,1885</i>
ideol(l)	0,011793 <i>2,6014</i>	BEL	-0,003718 <i>-0,8777</i>	FIN	0,003682 <i>0,8241</i>
lps	0,312314 <i>9,6917</i>	BEL	0,098804 <i>2,7798</i>	FIN	0,238263 <i>8,0803</i>
vsp(l)	1,639151 <i>4,7881</i>	GER	1,118185 <i>5,0523</i>	GRE	1,413155 <i>7,5199</i>

t-student statistics are in italic. Equation specification includes a constant term for each country not reported here.

The IDEOL variable is not stable both in statistical significance and sign. In fact, it cannot be assumed that the ideology does not influence the weight a government assigns to public expenditures by function. In fact, taking either Belgium or Spain out of the PMG estimation induces a statistically significant budget bias prone to pro-voters expenditures.

The present stability analysis is based on a particular model specification, which was found to be the best specification, given certain values attributed to the missing values.

However, using other simulated values for the missing values <sup>74</sup>, identified as EXPF2 in table A in the appendix, a different model specification fits better the data.

At this point evaluating how sensible the PMG estimates are to the imputed missing values becomes relevant. Putting it differently, it is necessary to check if the sign and

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<sup>74</sup> *Amelia* generates five alternative values for each missing value. The present work only uses the values that retrieve model specifications, on a country by country basis, whose regressions are robust to the four diagnostic tests: residual serial correlation, functional form specification, residuals normality and homocedasticity.

statistical significance of the regressors included in PMG estimation are reliable in the sense that changing missing values imputation may induce variations in the long-run as well as in the short-run coefficients.

Using another set of simulated values, the following model specification is re-estimated by PMG:

$$\begin{aligned} \exp f_{it} = & \mu_i + \lambda_i \exp f_{i,t-1} + \delta_{10,i} uer_{it} + \delta_{11,i} uer_{i,t-1} + \delta_{20,i} cpi_{it} + \delta_{21,i} cpi_{i,t-1} + \\ & + \delta_{30,i} ideol_{it} + \delta_{31,i} ideol_{i,t-1} + \delta_{40,i} lps_{it} + \delta_{41,i} lps_{i,t-1} + \delta_{50,i} vsp_{it} + \varepsilon_{it} \end{aligned}$$

Conditional on the long-run homogeneity hypothesis, the above model can be re-written as:

$$\begin{aligned} \Delta \exp f_{it} = & -\phi_i \left( \exp f_{i,t-1} - \theta_0 - \theta_1 uer_{i,t-1} - \theta_2 cpi_{i,t-1} - \theta_3 ideol_{i,t-1} - \theta_4 lps_{i,t-1} - \theta_5 vsp_{it} \right) + \\ & + \delta_{11,i} \Delta uer_{it} + \delta_{21,i} \Delta cpi_{it} + \delta_{31,i} \Delta ideol_{it} + \delta_{41,i} \Delta lps_{it} + \varepsilon_{it} \end{aligned}$$

$$\text{where } \phi_i = (1 - \lambda_i), \theta_z = \frac{\delta_{z0} + \delta_{z1}}{1 - \lambda_i}, \text{ with } z = 1, 2, \dots, 5 \text{ and } \theta_0 = \frac{\mu_i}{1 - \lambda_i}.$$

The above re-specification of the empirical model includes only eight countries. Although the fifteen countries have passed the individual regression robustness test, seven countries present non-reliable PMG estimation results when all countries are considered. Six of them have a negative adjusted R-square: Germany, France, Portugal, Ireland, Italy and Austria and the other (UK) have a positive adjustment speed, implying that it does not have a long-run equilibrium.

Table H in the appendix presents the estimation results of the DFE, MG and PMG estimates under this alternative specification.

With a comparison purpose PMG procedure is re-run with the former model specification considering the same eight countries included in the second specification.

Table VIII summarises the PMG estimates of the long-run coefficients under the two specifications, being on the left hand the former model specification, including only eight countries and, on the right hand the alternative model specification allowing a different missing value imputation.

**Table VIII**

**PMG estimates of long-run coefficients  
allowing different model specifications and  
different missing values imputation**

Variable	PMG-Corrected Estimative	Variable	PMG-Corrected Estimative
uer(l)	-0,001305 <i>-0,6859</i>	uer(l)	-0,000092 <i>-0,0412</i>
cpi(l)	-0,005847 <i>-0,1512</i>	cpi(l)	-0,016828 <i>-0,3568</i>
ideol(l)	-0,001245 <i>-0,3162</i>	ideol(l)	-0,010063 <i>-1,9822</i>
lps	0,251098 <i>8,4679</i>	lps(l)	0,073199 <i>1,8258</i>
vsp(l)	1,838484 <i>4,2936</i>	vsp	1,959286 <i>16,1581</i>

Included countries: BEL, DNK, GRE, SPA, LUX, NLD, FIN and SWE.

t-student statistics are in italic. Equation specification includes a constant term for each country not reported here.

Apart from the long-run coefficients associated with VSP and CPI regressors, being the former statistically significant, all the other long-run coefficients included in the model estimation appear to be very sensitive to the missing values that have been input.

Although the coefficients' signs do not change between the two specifications with the same eight countries considered in the analysis, the significance of the coefficient as well as the coefficient itself evidences a wide variation.

The IDEOL long-run coefficient that under the former model specification can be positive and statistically significant appears in the latter model specification that can also be negative and statistically significant.

The long-run coefficient associated with the LPS variable that seems to have a great statistical importance in the former model specification loses significantly its statistical relevance under the second specification. The interpretation of this result can be that when different missing value inputs are used in the estimation procedure, the coefficient changes too much to be considered reliable.

In this sense, it cannot be concluded what is the statistical significance of the IDEOL and LPS variables in the composition of public expenditures by function.

In what concerns CPI variable it can be expected with some certainty that this variable does not determine the budget bias to pro-voters expenditures.

The VSP regressor, the prior interest, seems to be positive and always statistically significant, although with a large difference on its significance.

This result allows to state, with a reasonable trust, that the number of effective voters in society restrains governments' welfare expenditures, considered more prone to non-voters. Putting it differently, a more participatory society gives the governments an incentive to increase those types of expenditures that mostly please the electorate.

The present result validates the prior expectations that were enunciated in the Proposition 2 of the theoretical model.

## 8.5. Comparison of the results of Proposition 1 and Proposition 2

At this point it is reasonable to ask how is the convergence of the results presented to Proposition 1 and to Proposition 2. The electoral participation in society links the two propositions since it determines simultaneously government's manipulation of public expenditures prone to voters' preferences and, in accordance, restrains budget bias to current expenditures.

With this purpose, the dependent variable EXPF is replaced by EXP in the latter model specification described above and the PMG procedure is re-run.

Table IX presents the estimated long-run coefficients. Under this model specification and using EXP as a dependent variable, only a restrict set of six countries are not rejected by the four robustness tests taken on a country by country regression basis, as previously described and implemented.<sup>75</sup>

Using such a restricted number of countries in estimation, the results must be analysed very carefully, since the exclusion of any country can change significantly the estimated coefficients and their significance.

Looking at Table IX it seems, as expected, that the number of voters that actually vote in society do restrain the government's incentive to engage in a budget manipulation prone current expenditures which include welfare expenditures, considered separately when EXPF is used as the dependent variable. However, despite of the sign not changing it is only necessary to reduce the estimation coverage to five countries, excluding Portugal, to have a lower statistically significant coefficient related to VSP variable. The coefficient with these five countries becomes equal to -0.127 with a t-Statistic equal to -1.54, which is only significant at 10% level.

**Table IX - Long-run coefficients  
using EXP as dependent variable to test Proposition 2**

	Long-Run Coefficients			
	MG	PMG	Hausman-Test	PMG_Corrected
uer(l)	0,001949 <i>0,3721</i>	0,002758 <i>4,8171*</i>	0,024105	0,005349 <i>4,8907*</i>
cpi(l)	0,019940 <i>0,5288</i>	0,026717 <i>5,7977*</i>	0,032734	0,023206 <i>3,7076*</i>
ideol(l)	-0,019351 <i>(-1,7217*)</i>	-0,009269 <i>(-5,9361*)</i>	0,818913	-0,012072 <i>(-3,8283*)</i>
lps(l)	-0,060677 <i>-0,3311</i>	-0,146409 <i>(-5,9486*)</i>	0,222435	-0,145804 <i>(-4,7926*)</i>
vsp	0,016910 <i>0,069</i>	0,000686 <i>0,0126</i>	0,004583	-0,148209 <i>(-2,6013*)</i>
<b>Hausman Test</b>			<b>1,102770</b>	
<b>N° of countries</b>	6	6		6
<b>N° of obs.</b>	186	186		186
<b>Log likelihood</b>	504,23	456,1248		463,916
<b><math>R^2</math></b>	0,30	0,45		0,60

Included countries: DNK, GRE, SPA, NLD, POR and FIN

t-student statistics are in italic. \*\*\*significant at 10 % level; \*\* at 5% level; \* at 1% level

Equation specification includes a constant term for each country not reported here.

Under the present results it is reasonable to conclude that the weight of effective voters in society actually reduces the prior governments' incentive to excessively manipulate current expenditures namely the non-productive component that mostly benefit that fringe of population that usually evidences a lower turnout rate in elections.

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<sup>75</sup> If the former model specification, defined to test Proposition 2 and, EXP as the dependent variable are used, after the robustness tests, only four countries can be included in the PMG estimation.

## **9. Concluding remarks**

This empirical application has applied the pooled mean group estimation method to a system of dynamic equations to analyse the effects of electoral, economic and political variables on the composition of public expenditures. This econometric technique allows for the speed of convergence as well as for the short-term dynamics and variances to be different across countries, unlike most panel data approaches that impose homogeneity restrictions on all of these parameters.

The results have confirmed that econometrics do matter in explaining the studied phenomena: the composition of public expenditures. In this sense, the choice of the estimation approach was crucial. The imposition of cross-country homogeneity restrictions on short as well as on long run parameters and speeds of convergence as in the standard dynamic fixed effects estimator produce, in some cases, extremely differentiated coefficients from those obtained when the PMG technique is used.

Using a panel of European Union countries, the budget composition regarding annual public expenditure was systematically analysed. With this purpose the two propositions established in the theoretical model were tested empirically. The first look was to the impact of election terms on public finances in what concerns the government's manipulation prone to current expenditures. Secondly, an evaluation is made on how the differences across countries in the degree of society's participation in elections through vote determine a bias of public expenditures towards pro-voters expenditures versus expenditures that benefit transversally all the society.

The findings lead to the following conclusions. First, elections still play a role in shaping the cycles of public expenditure in the European Union: central governments increase the share of current expenditure whenever they come close to electoral

contests. This result clearly states that the electoral cycle in public expenditures has a significant effect in the European Union.

Besides the electoral cycle, the dynamic analysis revealed how economic variables influence public expenditures. The component of expenditures that is directly related to the unemployment rate and to the number of older people in population translates an increase on current expenditures through the relation those variables have with public transfers. The inflation rate with a delay of one period induces a contraction of current expenditures, meaning that budget composition also plays a stabilisation role. Other variables such as government ideology or the weight of the largest party in the parliamentary structure do not prove to influence systematically the composition of public expenditures. The turnout variable reveals an ambiguous sign, which leads to an empirical test of Proposition 2, *i.e.*, the evaluation of the impact that voters' participation in elections produces on the composition of public expenditures.

This leads to the second conclusion. The budgetary bias, towards voters' preferred expenditure items, is positively and directly related with the weight of effective voters in society.

Analysing the other set of variables, namely the economic and the ideological variables it does not seem to have a significant effect on the partition of public expenditures by function. As opposed to the results obtained for Proposition 1, the level of parliamentary fragmentation appears to have contributed towards country differences in what concerns the orientation of government's manipulation of expenditures prone to voters' preferences.

A series of tests of specification and parameter stability indicate that the overall estimation results are fairly robust. Taken together, the estimation results survive to a stability test using different country coverage and different specification.

## **Appendixes**

## Description of the variables used for the econometric applications

<b>EXP</b>	Difference between central government's current expenditure weight in every year budgetary values of public expenditures and its capital counterpart weight.
<b>EXPF</b>	Difference between weights that each of the public expenditure category: productive and non-productive functions, have on central government's total expenditure.
<b>ELECO</b>	Dummy variable assumes value 1 in the pre-election year when elections take place until the fourth month of the year and in the election year when elections take place during or after the fifth month. Otherwise, the variable takes the value zero.
<b>ELEC1</b>	Dummy variable takes value 1 in the election year when elections occur during the first two months of the year and in the after election year when elections occur in or after the third month of the year. Otherwise, the variable takes the value zero.
<b>UER</b>	Unemployment rate.
<b>CPI</b>	Consumer price index.
<b>IDEOL</b>	Government's ideological position.
<b>LPS</b>	<i>Legislative share of the largest party.</i> The correspondent values are found by dividing the number of seats of the most representative party in the assembly by the assembly's total number of seats.
<b>VPR</b>	Turnout. Ratio between the number of votes cast and the number of people entitled to vote.
<b>VSP</b>	Weight of the effective votes cast into population.
<b>POP65</b>	Weight of population older than 65.

**Table A - Descriptive Statistics by variable and country**  
**Dependent variables**

	EXP				EXPF1				EXPF2			
	Mean	Maximum	Minimum	Std. Deviat.	Mean	Maximum	Minimum	Std. Deviat.	Mean	Maximum	Minimum	Std. Deviat.
<b>bel</b>	0,864415	0,98316	0,745194	0,05293	0,175857	0,24898	0,09531	0,041601	0,175857	0,24898	0,09531	0,041601
<b>dnk</b>	0,903782	0,942824	0,852543	0,027287	0,153312	0,24095	0,074568	0,043293	0,153312	0,24095	0,074568	0,043293
<b>ger</b>	0,879029	0,950138	0,797846	0,040204	0,02834	0,109891	-0,118799	0,043872	0,02834	0,109891	-0,118799	0,043872
<b>gre</b>	0,697784	0,844607	0,492382	0,082255	0,536252	0,672671	0,376741	0,082174	0,536252	0,672671	0,376741	0,082174
<b>spa</b>	0,799335	0,912708	0,657241	0,07216	*	*	*	*	0,062313	0,256175	-0,305594	0,164728
<b>fra</b>	0,899735	0,954032	0,862413	0,02039	0,113281	0,237339	-0,06934	0,061799	0,113281	0,237339	-0,06934	0,061799
<b>ire</b>	0,817262	0,874485	0,666667	0,047804	0,447743	0,561901	0,301067	0,053021	0,447743	0,561901	0,301067	0,053021
<b>ita</b>	0,853452	0,942397	0,722579	0,05896	0,301552	0,394454	0,133343	0,066649	0,294297	0,412195	0,133343	0,077593
<b>lux</b>	0,765833	0,801542	0,709953	0,026371	-0,02794	0,070824	-0,175143	0,053385	-0,027032	0,070824	-0,168718	0,050126
<b>nld</b>	0,869867	0,930277	0,824647	0,033771	0,190039	0,283806	0,011357	0,090335	0,190039	0,283806	0,011357	0,090335
<b>aus</b>	0,812848	0,894124	0,608644	0,070038	0,057049	0,19836	-0,127107	0,069893	0,073963	0,19836	-0,030096	0,046905
<b>por</b>	0,762171	0,827125	0,707112	0,032968	0,472867	0,558299	0,36301	0,044471	0,472867	0,558299	0,36301	0,044471
<b>fin</b>	0,815295	0,937776	0,577798	0,089155	0,485679	0,658997	0,342449	0,058401	0,290707	0,46047	0,043804	0,129328
<b>swe</b>	0,912543	0,973481	0,795222	0,048054	0,036359	0,153584	-0,125636	0,074847	0,02827	0,153584	-0,139025	0,077341
<b>uk</b>	0,879104	0,924253	0,799072	0,033622	0,386374	0,559777	0,256316	0,095163	0,386374	0,559777	0,256316	0,095163
<b>Panel</b>	0,835497	0,98316	0,492382	0,079168	0,239769	0,672671	-0,175143	0,198406	0,215106	0,672671	-0,305594	0,191451

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**Table A - Descriptive Statistics by variable and country**  
**Explanatory variables**

	UER				CPI				IDEOL			
	Mean	Maximum	Minimum	Std. Deviat.	Mean	Maximum	Minimum	Std. Deviat.	Mean	Maximum	Minimum	Std. Deviat.
<b>bel</b>	8,956055	13,21394	1,819141	3,71847	0,918621	1,383177	0,3512	0,334692	5,07155	6,671154	4,193284	0,9502
<b>dnk</b>	6,460931	11,42002	0,085819	2,837469	0,936498	1,528878	0,2674	0,417008	5,10153	7,005085	3,8	1,350878
<b>ger</b>	5,539112	9,799594	0,555618	2,671908	0,9681	1,359326	0,5034	0,261767	5,136794	6,324604	3,704667	1,126668
<b>gre</b>	6,216075	10,34392	1,687764	3,140802	1,950301	5,470433	0,103	1,943161	4,5	7,6	0	2,550142
<b>spa</b>	13,79637	23,81187	2,528237	7,147104	1,032074	2,049864	0,1369	0,655683	4,086515	8,4	0	3,008515
<b>fra</b>	8,087868	12,45683	2,472707	3,286765	0,89503	1,398528	0,2525	0,403719	5,483872	7,623656	2,428866	2,333372
<b>ire</b>	10,60368	17,35791	3,927534	4,366451	0,88193	1,55854	0,1555	0,466342	5,9514	6,460465	5,262189	0,29708
<b>ita</b>	9,210909	11,83071	5,278913	2,343398	0,991931	1,942955	0,1424	0,626229	6,333256	8,453489	5,920286	0,7501
<b>lux</b>	1,218861	2,743249	0	0,802025	0,91388	1,378262	0,3695	0,325872	4,803084	5,702941	4,097826	0,658021
<b>nld</b>	6,242986	11,93487	0,910259	3,128797	0,934521	1,361996	0,3998	0,282544	5,222526	6,455556	3,949485	0,942445
<b>aus</b>	2,892561	4,258168	0,971178	1,083882	0,965679	1,411005	0,4284	0,312432	5,151296	6,29	4,75	0,422364
<b>por</b>	5,852943	8,529021	1,686808	1,951693	1,214952	2,818666	0,064	1,006396	4,661571	6,405	0	2,356195
<b>fin</b>	6,87629	16,39213	1,69639	4,430095	0,953874	1,561443	0,2272	0,455271	5,595142	7,065652	4,12917	0,649153
<b>swe</b>	4,173101	10,19006	1,499779	2,975246	1,025642	1,738407	0,2688	0,531126	4,823106	7,275092	4,08	1,156524
<b>uk</b>	6,996146	11,80833	2,056395	2,999375	1,012507	1,823022	0,1959	0,541732	6,031807	7,8	2,3	2,447406
<b>Panel</b>	6,874926	23,81187	0	4,511826	1,039703	5,470433	0,064	0,73832	5,196897	8,453489	0	1,720569

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**Table A - Descriptive Statistics by variable and country  
Explanatory variables**

	LPS				VPR				VSP			
	Mean	Maximum	Minimum	Std. Deviat.	Mean	Maximum	Minimum	Std. Deviat.	Mean	Maximum	Minimum	Std. Deviat.
<b>bel</b>	0,246326	0,4	0,153333	0,079568	0,925133	0,950747	0,903102	0,01541	0,639046	0,664365	0,584766	0,028129
<b>dnk</b>	0,284832	0,4	0,125714	0,09144	0,866149	0,899255	0,828472	0,019868	0,635149	0,662506	0,572331	0,023346
<b>ger</b>	0,422873	0,51	0,350101	0,055987	0,854451	0,912958	0,777607	0,048137	0,623466	0,742983	0,585766	0,032619
<b>gre</b>	0,633826	1	0,5	0,168838	0,804734	0,844965	0,746359	0,03145	0,618845	0,676329	0,528619	0,052693
<b>spa</b>	0,621248	1	0,428125	0,226161	0,735702	0,798321	0,665351	0,032498	0,538522	0,636239	0,401534	0,064296
<b>fra</b>	0,4392	0,580448	0,251282	0,095799	0,714068	0,813125	0,66182	0,04258	0,45836	0,517334	0,358939	0,028317
<b>ire</b>	0,446434	0,583333	0,271084	0,084654	0,717576	0,769243	0,643281	0,044789	0,480739	0,506202	0,399479	0,025125
<b>ita</b>	0,396211	0,58254	0,280952	0,080074	0,884622	0,933659	0,814351	0,038375	0,685112	0,716453	0,613396	0,026381
<b>lux</b>	0,358976	0,40678	0,288136	0,036889	0,877616	0,901417	0,817736	0,016972	0,491829	0,523065	0,431369	0,029115
<b>nld</b>	0,306849	0,36	0,233333	0,039196	0,80986	0,880028	0,692662	0,053509	0,578969	0,631538	0,462799	0,038917
<b>aus</b>	0,456644	0,519126	0,284153	0,065096	0,883534	0,928955	0,776875	0,047914	0,619147	0,651141	0,559822	0,023984
<b>por</b>	0,589245	1	0,352	0,212652	0,767267	0,982163	0,583982	0,119725	0,58032	0,6265	0,512404	0,026117
<b>fin</b>	0,370188	0,890909	0,255	0,184955	0,723774	0,822306	0,636483	0,049738	0,571364	0,616345	0,514578	0,030749
<b>swe</b>	0,38134	0,536481	0,111748	0,114394	0,876478	0,917601	0,764842	0,040764	0,643138	0,673488	0,575951	0,025624
<b>uk</b>	0,543247	0,62519	0,499205	0,040925	0,731341	0,778301	0,593767	0,040727	0,539048	0,580178	0,442015	0,033349
<b>Panel</b>	0,433162	1	0,111748	0,166309	0,811487	0,982163	0,583982	0,086423	0,580204	0,742983	0,358939	0,072926

(Continues to next page)

**Table A - Descriptive Statistics by variable and country**  
**Explanatory variables**

	<b>POP65</b>			
	Mean	Maximum	Minimum	Std. Deviat.
<b>bel</b>	0,146927	0,1695	0,133	0,010868
<b>dnk</b>	0,144934	0,156	0,122	0,010256
<b>ger</b>	0,150558	0,1661	0,135	0,006887
<b>gre</b>	0,13729	0,1772	0,11	0,018123
<b>spa</b>	0,126194	0,1718	0,095	0,023968
<b>fra</b>	0,139925	0,161315	0,128	0,01005
<b>ire</b>	0,110715	0,114	0,106	0,00287
<b>ita</b>	0,140696	0,1835	0,108	0,022039
<b>lux</b>	0,134398	0,143	0,125	0,004793
<b>nld</b>	0,120573	0,1372	0,101	0,011442
<b>aus</b>	0,148698	0,155	0,14	0,004553
<b>por</b>	0,122896	0,1562	0,092	0,019845
<b>fin</b>	0,124402	0,1503	0,09	0,017406
<b>swe</b>	0,165271	0,178	0,136	0,013188
<b>uk</b>	0,149409	0,158	0,13	0,008716
<b>Panel</b>	0,137526	0,1835	0,09	0,019505



**Table B1 - Estimated Panel Data Unit Root Tests for the dependent variable EXP (1970-2001)**

	IPS PANEL TEST with intercept			IPS PANEL TEST with intercept and trend			CHANG PANEL TEST			SURADF TEST(15)		SURADF TEST(10-I)	
	ADF test	Lags	LM TEST(3)	ADF test	Lags	LM TEST(3)	Zi	Lags	LM TEST(3)	Crit.V.(5%)	Test	Crit.V.(5%)	Test
AUS	-6,510924	1	2,617362	-3,265709	3	2,316189	-1,52226	3	3,129419	-3,166254	-5,371804		
BEL	-1,169652	1	3,888623	-3,388662	5	1,700074	-2,556148	2	1,783327	-3,272074	<b>-1,51815</b>	-2,688801	<b>-1,75794</b>
DNK	-2,201944	0	1,320884	-0,585193	3	2,008807	-1,411165	1	1,208476	-3,287809	-5,328129	-2,176182	-3,648916
FIN	-1,833707	3	1,533472	-3,46378	0	2,546086	-0,374987	6	4,205493	-3,155946	<b>-2,84016</b>	-2,129569	-2,276228
FRA	-3,121199	6	3,834904	-2,993	6	4,139984	-0,444681	5	5,961813	-3,395923	-7,476542	-2,730274	-6,27578
GER	-1,380542	0	4,212476	-2,886886	0	2,790251	-2,069483	2	1,19902	-3,046424	<b>-2,46158</b>	-2,492956	-2,788478
GRE	-2,20818	3	3,959167	-1,216528	3	4,860507	-1,648507	2	5,553929	-3,119144	-4,748904	-2,247931	-2,869618
IRE	-1,298384	3	4,889689	-1,941913	0	4,200529	-0,726104	2	1,607682	-3,068338	<b>-0,91163</b>		
ITA	-2,265012	0	1,56438	-4,316726	7	6,552451	-0,361472	8	5,227434	-3,022965	<b>-2,35279</b>	-2,408086	-2,766141
LUX	-2,405566	0	2,897127	-4,066833	3	1,896026	-3,014067	0	4,890997	-3,425306	<b>-1,65849</b>	-2,480771	<b>-2,44421</b>
NLD	-1,265386	0	2,281905	-1,70648	0	2,664863	-1,307018	0	1,229003	-3,064305	<b>-2,40678</b>		
POR	-2,713695	0	1,138772	-1,941495	2	2,352143	-1,262112	5	1,094645	-3,260518	-4,900291	-2,605572	-4,245173
SPA	-1,446036	0	2,697054	-2,916286	3	1,072895	-2,895151	0	2,895768	-3,384192	<b>-1,96609</b>	-2,565148	<b>-2,27703</b>
SWE	-2,425504	5	4,582379	0,088814	4	2,088339	-0,872576	5	3,789354	-2,101154	<b>-1,03898</b>		
UK	-2,604051	0	1,843684	-2,344798	0	1,817692	-1,419418	4	3,203938	-2,734831	-4,657075		
PANEL(15)	-13,61826	Rejects Ho		-16,0685808	Rejects Ho		-5,650809	Rejects Ho					
Crit. Value(5%)	-1,9			-2,53			-2,576						
PANEL(10-I)	-11,78695	Rejects Ho		-19,044703	Rejects Ho		-5,071589	Rejects Ho					
Crit. Value(5%)	-1,99			-2,6			-2,576						

Table B2 - Estimated Panel Data Unit Root Tests for the regressor UER (1970-2001)

	IPS PANEL TEST with intercept			IPS PANEL TEST with intercept and trend			CHANG PANEL TEST			SURADF(15)		SURADF(10-I)		SURADF(10-II)		
	ADF test	Lags	LM TEST(3)	ADF test	Lags	LM TEST(3)	Zi	Lags	LM TEST(3)	Crit.V.(5%)	Test	Crit.V.(5%)	Test	Crit.V.(5%)	Test	
AUS	-1,499594	0	2,593714	-1,807266	1	2,239594	-0,841584	5	5,011692	-4,896533	<b>-1,816389</b>			-3,705677	<b>-1,83163</b>	
BEL	-3,212698	7	1,397131	-1,570596	7	2,196259	-1,818763	1	2,13247	-5,599943	<b>-4,885123</b>	-3,348329	-4,792535	-4,070264	-4,57698	
DNK	-2,547766	1	3,86582	-2,516446	3	1,387169	-2,865842	0	1,798266	-4,262334	<b>-4,155602</b>	-2,906592	<b>-2,803334</b>	-3,364567	-3,72545	
FIN	-1,688846	3	1,340768	-2,080156	2	5,165996	-2,445693	0	4,656541	-4,996099	<b>-2,115606</b>	-2,519359	<b>-1,977364</b>	-3,679544	<b>-1,7071</b>	
FRA	-1,954472	2	2,002584	-0,570964	2	2,012444	-1,036293	5	1,5109	-5,257343	<b>-4,249564</b>	-3,265443	<b>-2,997788</b>			
GER	-2,158598	1	2,137544	-3,228046	1	2,485664	-1,252722	6	2,574331	-5,215172	<b>-2,397697</b>	-3,436258	<b>-2,49556</b>	-3,793235	<b>-2,49167</b>	
GRE	-1,554744	2	1,322883	-2,598742	1	2,351968	-1,612887	1	1,743143	-4,956396	<b>-2,178757</b>	-3,254525	<b>-2,788314</b>	-3,669134	<b>-2,1159</b>	
IRE	-1,436666	2	1,502764	-0,547121	2	2,761606	-2,231727	7	3,308047	-4,826097	<b>-2,395544</b>					
ITA	-2,193169	5	1,366648	-0,219989	5	1,896181	-0,656562	6	1,068261	-3,11138	<b>-2,375993</b>	-1,444227	-3,518743			
LUX	-1,879899	3	1,704845	-3,180434	2	2,884049	-2,959446	1	3,531255	-5,14185	<b>-3,178797</b>	-3,225067	<b>-3,010729</b>	-3,71601	<b>-2,91876</b>	
NLD	-1,782444	6	2,373355	-1,618295	6	4,69174	-2,562281	7	1,953955	-4,11921	-4,725371			-2,476536	-3,36614	
POR	-2,457177	8	3,494814	-3,548112	4	2,668085	-2,414014	8	4,089029	-3,237164	-3,584871	-1,540446	-2,919321			
SPA	-2,078361	2	3,530589	-0,970216	2	3,529085	-3,088928	8	5,315368	-5,055428	<b>-4,773012</b>	-3,199044	<b>-3,195555</b>	-3,653999	<b>-3,6034</b>	
SWE	-1,616214	2	1,323169	-2,67503	1	2,677804	-2,576418	1	1,667145	-5,206076	<b>-2,212497</b>			-3,865156	<b>-1,48198</b>	
UK	-1,745895	2	1,87849	-1,057988	2	3,336399	-1,376552	5	1,823979	-5,015143	<b>-3,761861</b>					
PANEL(15)	-8,684131	Rejects Ho		-6,8397575	Rejects Ho		-7,678761	Rejects Ho								
Crit. Value(5%)	-1,9			-2,53			-2,576									
PANEL(10-I)	-7,819609	Rejects Ho		-6,41023226	Rejects Ho		-6,372354	Rejects Ho								
PANEL(10-II)	-5,835568	Rejects Ho		-8,14235409	Rejects Ho		-6,964779	Rejects Ho								
Crit. Value(5%)	-1,99			-2,6			-2,576									

Table B3 - Estimated Panel Data Unit Root Tests for the regressor CPI (1970-2001)

	IPS PANEL TEST with intercept			IPS PANEL TEST with intercept and trend			CHANG PANEL TEST			SURADF(15)		SURADF(10-I)		SURADF(10-II)		
	ADF test	Lags	LM TEST(3)	ADF test	Lags	LM TEST(3)	Zi	Lags	LM TEST(3)	Crit.V.(5%)	Test	Crit.V.(5%)	Test	Crit.V.(5%)	Test	
AUS	-2,18603	1	1,264136	-0,798481	3	1,577018	-0,160308	4	2,803372	-5,661321	<b>-3,42034</b>			-4,125662	<b>-3,31162</b>	
BEL	-2,193506	4	2,675317	-0,041942	4	2,584858	-0,974356	6	4,044891	-5,666448	<b>-1,681924</b>	-4,230077	<b>-1,456274</b>	-4,092822	<b>-1,94411</b>	
DNK	-2,458887	5	3,713535	-1,780343	1	3,194735	-0,445418	8	5,430045	-4,540149	<b>-4,045309</b>	-3,398555	<b>-2,895825</b>	-3,229641	-3,87383	
FIN	-2,0903	1	2,65011	-1,204802	1	1,79388	-0,69517	4	5,149811	-5,834269	<b>-3,433059</b>	-4,306434	<b>-3,047752</b>	-4,106213	<b>-3,16006</b>	
FRA	-2,488727	1	3,722989	-2,100124	1	3,253304	-1,15455	2	1,348105	-5,742206	<b>-4,125326</b>	-4,257765	<b>-3,852312</b>			
GER	-1,572493	2	2,934284	-2,069213	3	2,59082	-0,394054	6	1,705709	-5,286386	<b>-3,124604</b>	-3,783106	<b>-2,234288</b>	-3,779102	<b>-2,92612</b>	
GRE	-2,887831	1	1,440016	-3,21775	1	2,936901	0,603384	0	5,345677	-4,376696	<b>-2,466424</b>	-2,924364	-2,990784	-3,011081	<b>-2,58393</b>	
IRE	-1,108574	1	4,83205	-1,566224	3	4,661517	-1,565859	1	4,018996	-5,633785	<b>-1,594171</b>					
ITA	-1,297115	1	1,405274	-1,936867	3	2,899411	-1,100535	3	1,952153	-5,662256	<b>-1,386176</b>	-4,17283	<b>-1,604536</b>			
LUX	-2,001586	2	1,979226	-0,625804	2	1,958698	-0,487577	5	5,218596	-5,692797	<b>-2,446525</b>	-4,193074	<b>-2,157298</b>	-4,055282	<b>-2,27872</b>	
NLD	-1,971974	2	1,280679	-2,888305	1	3,226205	-1,491018	1	2,32363	-4,881771	<b>-3,05532</b>			-3,634692	<b>-2,89619</b>	
POR	-0,549316	2	3,128915	-2,398304	2	4,109163	-1,275351	2	4,908982	-4,564506	<b>0,365914</b>	-3,386235	<b>-0,630548</b>			
SPA	-1,051718	1	3,757134	-2,447459	1	2,795961	-1,369923	1	2,137224	-4,761902	<b>-1,184583</b>	-3,38769	<b>-1,170833</b>	-3,173363	<b>-1,18714</b>	
SWE	-1,045712	1	1,384104	-1,597931	1	2,843726	-1,173156	1	1,132289	-4,65804	<b>-1,443159</b>			-3,233183	<b>-1,33862</b>	
UK	-3,090265	8	2,252339	1,085173	8	3,008035	-1,289563	4	2,602584	-4,945031	<b>-4,514506</b>					
PANEL(15)	-8,254319	Rejects Ho			-1,66492552	Accepts Ho			-3,349731	Rejects Ho						
Crit. Value(5%)	-1,9				-2,53				-2,576							
PANEL(10-I)	-6,048727	Rejects Ho			-3,23473519	Rejects Ho			-2,306423	Accepts Ho						
PANEL(10-II)	-7,029351	Rejects Ho			-1,93762683	Accepts Ho			-2,083181	Accepts Ho						
Crit. Value(5%)	-1,99				-2,6				-2,576							

Table B4 - Estimated Panel Data Unit Root Tests for the regressor IDEOL (1970-2001)

	IPS PANEL TEST with intercept			IPS PANEL TEST with intercept and trend			CHANG PANEL TEST			SURADF(15)		SURADF(10-I)		SURADF(10-II)	
	ADF test	Lags	LM TEST(3)	ADF test	Lags	LM TEST(3)	Zi	Lags	LM TEST(3)	Crit.V.(5%)	Test	Crit.V.(5%)	Test	Crit.V.(5%)	Test
AUS	0,327524	1	0,299164	-2,728051	0	1,666726	-0,217677	1	0	-3,266567	<b>2,653615</b>			-2,286128	<b>1,26405</b>
BEL	-1,471489	0	0,882469	-2,61471	1	2,117856	-1,798392	0	4,281924	-2,730817	<b>-0,858282</b>	-1,941936	<b>-1,609538</b>	-2,127667	<b>-0,56132</b>
DNK	-2,177444	5	2,339013	-1,914109	5	2,167106	-1,545614	5	0,429927	-2,876495	<b>0,181443</b>	-2,278397	-3,889086	-2,249168	-4,23475
FIN	-2,172312	0	1,033906	-2,087714	0	1,657954	-2,105787	3	1,494137	-3,210292	-4,599654	-2,5736	-3,091907	-2,284961	-4,11844
FRA	-2,201	0	1,300253	-3,197357	1	4,826672	-1,629569	0	3,31385	-3,154758	<b>-1,34209</b>	-2,281845	<b>-1,183104</b>		
GER	-1,07424	0	3,250582	-0,201838	0	1,721213	-1,445459	3	3,989406	-3,16239	<b>-2,669916</b>	-2,334333	-2,744049	-2,260643	-3,2571
GRE	-3,796162	6	3,893534	-3,92306	6	5,942034	-1,381585	0	0,833675	-3,113538	-6,382517	-2,263598	-5,138073	-2,509018	-7,24256
IRE	-2,295881	0	2,024303	-2,521617	0	1,415206	-2,242982	0	3,114958	-2,865692	<b>-2,347279</b>				
ITA	-2,366008	0	4,012279	-3,590314	1	4,839076	-3,070066	0	2,871388	-2,68833	-4,517212	-1,75404	-4,527874		
LUX	-1,559588	2	2,938237	-1,696012	3	2,683699	-1,526538	1	5,262966	-2,751868	-3,025568	-1,596151	-2,290395	-2,156575	-2,30009
NLD	-2,109274	0	2,218286	-2,104416	0	2,88868	-1,757749	5	1,46813	-2,970234	-3,597026			-2,113547	-3,31417
POR	-1,390387	6	3,265902	-1,619393	6	4,775063	-0,17755	0	0	-2,761232	-6,891255	-1,996238	-3,952615		
SPA	0,153888	8	3,331812	-1,971332	0	2,65533	-0,849957	0	0,499082	-2,646311	<b>0,905901</b>	-1,816138	<b>-0,36594</b>	-1,969893	<b>2,96937</b>
SWE	-3,068714	1	3,652594	-3,047848	1	4,109688	-1,781447	0	1,907155	-3,043983	<b>-2,307872</b>			-2,307424	<b>-2,28327</b>
UK	-1,472165	5	2,033816	-0,637884	5	2,925421	-2,39829	8	3,418463	-2,841516	-4,165892				
PANEL(15) Crit. Value(5%)	-5,121459 -1,9	Rejects Ho		-12,6255768 -2,53	Rejects Ho		-6,178354 -2,576	Rejects Ho							
PANEL(10-I)	-3,863011	Rejects Ho		-8,72534068	Rejects Ho		-4,911181	Rejects Ho							
PANEL(10-II) Crit. Value(5%)	-2,522187 -1,99	Rejects Ho		-8,07593922 -2,6	Rejects Ho		-4,556907 -2,576	Rejects Ho							

Table B5 - Estimated Panel Data Unit Root Tests for the regressor LPS (1970-2001)

	IPS PANEL TEST with intercept			IPS PANEL TEST with intercept and trend			CHANG PANEL TEST			SURADF(15)		SURADF(10-I)		SURADF(10-II)	
	ADF test	Lags	LM TEST(3)	ADF test	Lags	LM TEST(3)	Zi	Lags	LM TEST(3)	Crit.V.(5%)	Test	Crit.V.(5%)	Test	Crit.V.(5%)	Test
AUS	0,49688	0	3,480969	-1,754094	0	2,628854	-1,615889	0	0	-3,220076	<b>-0,655481</b>			-2,452749	<b>0,95763</b>
BEL	-1,601017	0	0,119869	-2,720029	0	2,374728	-1,447311	0	0	-2,665105	-4,295349	-1,217562	-1,972483	-2,010616	<b>-1,99135</b>
DNK	-3,050818	0	4,049864	-3,024502	0	4,451396	-2,909789	0	4,053267	-2,89835	-5,208863	-2,16196	-4,026068	-2,194586	-3,34837
FIN	-3,203549	8	4,476056	-3,185695	8	4,714002	-0,342569	8	2,404833	-3,080455	<b>-2,306896</b>	-2,626274	<b>-1,771175</b>	-2,397244	-2,47136
FRA	-4,057778	1	0,454201	-4,027715	1	0,782758	-2,768561	0	3,095121	-2,771118	-7,089814	-2,383676	-4,342339		
GER	-1,89202	0	0,576262	-1,398712	0	0,697622	-1,363791	0	0	-2,876234	<b>-1,568484</b>	-2,080896	<b>-1,961726</b>	-2,221722	<b>-2,1351</b>
GRE	-2,234176	0	2,076004	-1,64327	0	1,979938	-1,253362	5	5,39707	-2,66724	<b>-2,423657</b>	-1,857779	-1,939939	-1,894989	<b>-1,48288</b>
IRE	-2,618986	0	3,030241	-4,395126	3	2,482884	-2,536827	0	4,467972	-3,215398	-3,327793				
ITA	-1,768424	0	2,535969	-2,548835	0	2,182421	-1,3627	0	0	-2,391716	-4,139203	-1,995259	-2,642533		
LUX	-1,849687	4	1,251307	-2,982085	3	5,493848	-2,063176	4	0	-3,324412	<b>-2,225512</b>	-2,666204	<b>-1,633946</b>	-2,30505	<b>-1,3943</b>
NLD	-2,107952	0	0,663141	-2,032976	0	0,751833	-2,062162	0	0,259193	-2,939214	<b>-2,502926</b>			-2,183639	-2,30677
POR	-1,838863	6	0,54492	-1,863156	6	2,254377	-1,369381	6	0,066304	-2,302326	-3,829583	-2,046134	<b>-0,61258</b>		
SPA	-1,727218	8	2,291343	-14,56924	7	4,609518	-1,767987	8	3,856687	-3,142204	-5,475728	-2,68934	-2,94106	-1,664139	-2,85685
SWE	-2,602661	0	2,193963	-2,551565	0	1,89998	-2,313982	0	1,88884	-2,578922	-2,96688			-1,593993	-3,03484
UK	-1,757345	0	2,946341	-1,859021	0	2,862101	-1,665568	0	0,479479	-3,341947	-3,112573				
PANEL(15)	-10,54347	Rejects Ho		-30,6691105	Rejects Ho		-6,930847	Rejects Ho							
Crit. Value(5%)	-1,9			-2,53			-2,576								
PANEL(10-I)	-9,317838	Rejects Ho		-24,8896863	Rejects Ho		-5,264758	Rejects Ho							
PANEL(10-II)	-5,543317	Rejects Ho		-22,8021635	Rejects Ho		-5,42015	Rejects Ho							
Crit. Value(5%)	-1,99			-2,6			-2,576								

Table B6 - Estimated Panel Data Unit Root Tests for the regressor VPR (1970-2001)

	IPS PANEL TEST with intercept			IPS PANEL TEST with intercept and trend			CHANG PANEL TEST			SURADF(15)		SURADF(10-I)	
	ADF test	Lags	LM TEST(3)	ADF test	Lags	LM TEST(3)	Zi	Lags	LM TEST(3)	Crit.V.(5%)	Test	Crit.V.(5%)	Test
AUS	0,966237	4	1,021672	-1,512433	3	1,265435	-0,291749	5	1,076512	-2,296957	<b>3,660007</b>	-2,829508	-4,290722
BEL	-1,517012	2	3,692599	-2,985433	8	5,410642	-1,562434	1	3,212522	-3,823694	-4,546444	-2,829508	-4,290722
DNK	-1,625323	1	1,339437	-1,214158	3	1,013319	-0,993513	0	5,546512	-2,990429	<b>-2,288842</b>	-2,088934	<b>-1,705734</b>
FIN	1,561856	8	2,624406	-1,177721	8	1,383253	-1,076949	8	1,848417	-3,736807	<b>2,986444</b>	-2,713309	<b>1,470443</b>
FRA	-2,192054	3	3,941326	-3,483196	4	2,91345	-1,834852	5	1,439226	-3,78614	-5,50037	-2,955717	-4,88797
GER	-2,194312	4	4,863684	-2,658608	4	3,89001	-1,421408	1	3,957619	-3,339057	<b>-2,991652</b>	-2,107964	<b>-1,767988</b>
GRE	-1,539731	1	4,81277	-1,605969	1	3,775782	-1,339846	1	4,022085	-3,24878	<b>-2,003876</b>	-2,728914	<b>-2,490739</b>
IRE	0,242891	0	3,108949	-2,560978	0	3,743487	-1,855653	2	1,001861	-3,646066	<b>0,311019</b>		
ITA	-0,227166	1	1,396083	-2,788818	1	1,114738	-1,848891	3	1,266237	-3,79468	<b>-1,805212</b>	-2,920661	<b>-1,28488</b>
LUX	0,280853	7	3,09112	-2,443967	6	3,180266	0,000885	5	3,371895	-2,911637	<b>-0,250173</b>	-2,002255	<b>-0,087568</b>
NLD	0,33792	2	1,781693	-3,856764	0	1,950892	-0,012063	7	1,776831	-3,816313	<b>0,14251</b>		
POR	-2,258801	8	3,396564	-3,466132	8	2,309028	-0,247119	8	5,996998	-3,740746	-4,321882	-2,898972	-5,017801
SPA	-3,571178	1	2,777046	-3,491677	1	2,622551	-3,572922	1	2,386389	-3,073493	-3,140777	-2,24074	-3,872452
SWE	0,566314	2	1,924881	-1,371825	1	1,47971	-0,277872	3	4,301497	-3,126274	<b>0,342718</b>		
UK	-0,798694	3	5,788138	0,090135	3	1,147096	-0,705884	3	1,033597	-3,404992	<b>0,0522</b>		
PANEL(15)	10,007158	Accepts Ho		-13,656042	Rejects Ho		-4,399779	Rejects Ho					
Crit. Value(5%)	-1,9			-2,53			-2,576						
PANEL(10-I)	0,9855364	Accepts Ho		-11,6054025	Rejects Ho		-4,394633	Rejects Ho					
Crit. Value(5%)	-1,99			-2,6			-2,576						

Table B7 - Estimated Panel Data Unit Root Tests for the regressor POP65 (1970-2001)

	IPS PANEL TEST with intercept			IPS PANEL TEST with intercept and trend			CHANG PANEL TEST			SURADF(15)		SURADF(10-I)	
	ADF test	Lags	LM TEST(3)	ADF test	Lags	LM TEST(3)	Zi	Lags	LM TEST(3)	Crit.V.(5%)	Test	Crit.V.(5%)	Test
AUS	-3,327234	1	1,143324	-2,928234	2	2,764647	-2,70526	1	2,121613	-4,677534	-5,096004		
BEL	0,312723	1	1,677001	-1,422638	1	1,94899	-1,083854	3	1,865267	-5,154051	<b>-0,574342</b>	-3,839906	<b>-0,452401</b>
DNK	-2,493717	2	3,160574	-2,251656	3	2,785857	-1,137692	2	2,701695	-2,776685	-4,534174	-1,86335	-3,45634
FIN	-1,918902	2	2,297984	-4,513407	4	5,434649	-0,944515	2	1,389599	-4,246317	-5,498857	-3,255255	-3,481751
FRA	-1,129603	1	2,210439	-2,503953	1	1,057954	-1,255998	3	1,454353	-4,793594	<b>-1,990887</b>	-3,699438	<b>-1,687453</b>
GER	-1,124029	1	4,364446	-2,204322	1	4,745314	-1,620421	1	3,627956	-4,241617	<b>-1,097814</b>	-3,231578	<b>-1,123381</b>
GRE	2,058477	8	5,046356	-3,426874	5	2,656549	-3,146407	5	1,155456	-2,883364	<b>1,962788</b>	-2,273149	<b>3,154112</b>
IRE	-0,563986	0	4,753875	-3,278401	4	2,370063	-1,115742	0	1,492425	-3,828064	<b>-0,144762</b>		
ITA	1,091887	1	3,431875	-1,091563	1	2,643207	-0,857145	1	1,667356	-4,769218	<b>0,4972</b>	-3,312993	<b>0,049674</b>
LUX	-1,481919	1	2,131032	-2,938666	2	2,08844	-0,440323	1	1,330753	-4,103709	<b>-2,437447</b>	-2,565763	<b>-1,625697</b>
NLD	-1,991094	1	1,512173	-0,566588	1	1,835898	-0,485919	2	2,333358	-4,159499	-4,211269		
POR	0,863999	6	4,238758	-2,491153	6	4,162236	-1,875106	6	5,037616	-4,06098	<b>-0,28178</b>	-3,24307	<b>-0,464128</b>
SPA	4,419935	1	1,407303	-0,771138	1	2,174825	0,034618	0	2,044374	-3,310529	<b>4,769899</b>	-2,572578	<b>4,993507</b>
SWE	-2,429499	2	1,229202	-0,657551	1	2,867523	-1,127634	2	1,363026	-2,912588	-4,025737		
UK	-2,574671	1	1,277231	-1,283449	1	1,650808	-0,237106	2	1,445556	-4,195217	-4,517077		
PANEL(15)	12,772428	Accepts Ho		-10,9898638	Rejects Ho		-4,647194	Rejects Ho					
Crit. Value(5%)	-1,9			-2,53			-2,576						
PANEL(10-I)	16,19464	Accepts Ho		-9,55113976	Rejects Ho		-3,89809	Rejects Ho					
Crit. Value(5%)	-1,99			-2,6			-2,576						

**Table B8 - Estimated Panel Data Unit Root Tests for the dependent variable EXPF1 (1970-2001)**

	IPS PANEL TEST with intercept			IPS PANEL TEST with intercept and trend			CHANG PANEL TEST			SURADF(14)		SURADF(9-II)	
	ADF test	Lags	LM TEST(3)	ADF test	Lags	LM TEST(3)	Zi	Lags	LM TEST(3)	Crit.V.(5%)	Test	Crit.V.(5%)	Test
AUS	-1,469758	0	3,717212	-2,308925	6	2,656481	-0,004708	6	2,154671	-3,225017	-4,16962	-2,88079	-5,047042
BEL	-1,747493	0	5,149931	-3,317074	3	3,919196	-1,696655	0	1,63847	-2,115643	-2,280386	-1,339544	-2,607725
DNK	-2,152753	0	5,642398	-2,227453	0	4,451161	-1,867099	0	4,424665	-3,010236	-3,803108	-1,683412	<b>-1,081125</b>
FIN	-2,220193	2	0,430584	-2,969374	2	1,076978	-1,788691	0	0	-3,738212	-8,220118	-2,993645	-7,550532
FRA	-4,057194	1	1,013561	-4,619664	1	3,045243	-3,669557	1	1,316002	-2,940051	-3,015001		
GER	-2,515723	1	4,865467	-2,95624	1	1,654721	-2,119329	1	0	-3,321417	-3,118134	-2,281092	-3,01665
GRE	-1,690458	0	0,553032	-2,102314	0	3,801023	-1,526218	0	0	-3,002685	<b>-2,204453</b>	-2,557111	<b>-1,415061</b>
IRE	-3,176938	1	3,333497	-2,912643	1	3,729462	-3,116162	1	4,608313	-3,527273	-5,488834		
ITA	-2,996746	0	0,619433	-3,476655	4	2,415977	-2,944897	0	0,137092	-2,726261	-4,162299		
LUX	-1,728913	0	0,569406	-2,727621	0	3,568058	-1,806047	0	0	-3,12081	<b>-2,952973</b>	-2,780163	-3,988948
NLD	-2,27462	7	2,813737	-1,847805	7	1,636197	0,468541	7	0	-2,918305	-4,274388	-2,673137	-3,405768
POR	-2,474907	0	4,615471	-3,964271	0	1,185667	-4,289841	0	0,572554	-3,369499	-3,867454		
SPA	*			*			*	*	*				
SWE	-1,524072	1	2,882386	-2,869885	1	3,490992	-0,82972	0	2,585723	-3,859219	-5,339279	-2,747589	-3,850073
UK	-1,861158	4	2,470302	-3,06523	1	2,228421	-0,720164	1	0,229932	-2,164746	<b>-1,415313</b>		
PANEL(14)	-11,97865	Rejects Ho		-22,2629438	Rejects Ho		-6,924885	Rejects Ho					
Crit. Value(5%)	-1,9			-2,53			-2,576						
PANEL(9-II)	-4,237428	Rejects Ho		-10,8769363	Rejects Ho		-3,723308	Rejects Ho					
Crit. Value(5%)	-1,99			-2,6			-2,576						

Table B9 - Estimated Panel Data Unit Root Tests for the dependent variable EXPF2 (1970-2001)

	IPS PANEL TEST with intercept			IPS PANEL TEST with intercept and trend			CHANG PANEL TEST			SURADF(15)		SURADF(10-II)	
	ADF test	Lags	LM TEST(3)	ADF test	Lags	LM TEST(3)	Zi	Lags	LM TEST(3)	Crit.V.(5%)	Test	Crit.V.(5%)	Test
AUS	-0,73817	6	5,278513	-2,380603	4	5,212272	-1,877251	6	3,978979	-3,002465	<b>-0,967422</b>	-2,643763	<b>-1,107944</b>
BEL	-1,747493	0	5,149931	-3,317074	3	3,919196	-1,696655	0	1,63847	-2,359685	-3,730349	-1,894584	-2,873099
DNK	-2,152753	0	5,642398	-2,227453	0	4,451161	-1,867099	0	4,424665	-3,380544	-3,502618	-2,176753	-3,276679
FIN	-1,129809	1	0,651448	-3,142043	1	0,711917	-0,752565	0	0	-3,159548	-5,839456	-1,703829	-3,303106
FRA	-4,057194	1	1,013561	-4,619664	1	3,045243	-3,669557	1	1,316002	-3,448682	-5,690992		
GER	-2,515723	1	4,865467	-2,95624	1	1,654721	-2,119329	1	0	-2,802296	-2,982274	-1,901912	-2,400332
GRE	-1,690458	0	0,553032	-2,102314	0	3,801023	-1,526218	0	0	-2,853663	-3,021361	-2,265515	<b>-2,19187</b>
IRE	-3,176938	1	3,333497	-2,912643	1	3,729462	-3,116162	1	4,608313	-3,476978	-6,225029		
ITA	-3,012864	0	2,018343	-3,029966	0	1,663681	-2,818598	0	0	-2,729701	-3,289741		
LUX	-2,184595	0	0,022044	-2,879524	0	2,124449	-2,249063	0	0	-3,083595	-3,357787	-2,333665	-2,895841
NLD	-2,27462	7	2,813737	-1,847805	7	1,636197	0,468541	7	0	-2,800215	-4,079999	-2,504684	-3,74038
POR	-2,474907	0	4,615471	-3,964271	0	1,185667	-4,289841	0	0,572554	-3,11143	-4,236425		
SPA	-1,4494	0	3,428381	-2,11107	0	2,961012	-1,601987	0	4,696074	-3,343289	<b>-2,240757</b>	-2,46696	<b>-2,281929</b>
SWE	-1,512804	2	1,310551	-3,449182	4	0,334873	-3,119417	3	3,7502	-3,717012	-7,483596	-2,400267	-3,206751
UK	-1,861158	4	2,470302	-3,06523	1	2,228421	-0,720164	1	0,229932	-2,941727	-3,612509		
PANEL(15)	-10,54234	Rejects Ho		-23,5025138	Rejects Ho		-7,992641	Rejects Ho					
Crit. Value(5%)	-1,9			-2,53			-2,576						
PANEL(10-II)	-2,829957	Rejects Ho		-12,5358875	Rejects Ho		-5,167491	Rejects Ho					
Crit. Value(5%)	-1,99			-2,6			-2,576						

**Table B10 - Estimated Panel Data Unit Root Tests for the regressor VSP (1970-2001)**

	IPS PANEL TEST with intercept			IPS PANEL TEST with intercept and trend			CHANG PANEL TEST			SURADF(15)		SURADF(10-II)	
	ADF test	Lags	LM TEST(3)	ADF test	Lags	LM TEST(3)	Zi	Lags	LM TEST(3)	Crit.V.(5%)	Test	Crit.V.(5%)	Test
AUS	1,127278	0	3,768265	0,075101	0	1,183358	0,349361	0	0	-3,15475	<b>0,76537</b>	-1,81509	<b>1,908758</b>
BEL	-6,391236	8	4,120329	-5,013729	8	4,685197	-0,876015	5	1,174345	-3,616769	-14,73267	-2,060723	-12,99403
DNK	-2,959765	4	4,807456	-2,48669	4	4,66358	-1,14101	1	0,009006	-2,947143	-4,44708	-2,000759	-3,411762
FIN	-0,965906	3	2,316093	-4,508211	2	2,165699	-0,988218	3	0	-2,797104	<b>-0,11314</b>	-1,715233	<b>-0,597256</b>
FRA	-3,823129	1	1,964051	-3,777696	1	2,017413	-2,407478	1	2,550047	-3,192015	-4,818024		
GER	-2,830433	0	1,823157	-2,793704	0	1,855013	-2,797475	0	1,840124	-2,747669	-3,201448	-2,029858	-3,314343
GRE	-1,662363	1	1,050101	-0,758751	1	1,269332	-0,470418	1	0,747464	-3,099471	<b>-1,819812</b>	-2,31892	<b>-1,604504</b>
IRE	-3,252145	1	3,305463	-3,45334	0	4,486844	-1,087178	1	1,891581	-3,689932	-7,567069		
ITA	-2,256409	1	0,39307	-2,535872	1	0,688436	-0,846008	1	0	-3,036231	<b>-1,685529</b>		
LUX	-2,301208	7	1,796702	-3,062436	5	4,219561	-2,760261	6	1,388655	-4,065784	-8,33453	-2,32787	-4,410547
NLD	-0,0181	2	0,776932	-1,214163	2	2,266287	-1,238707	2	0,374394	-4,015373	<b>-2,765546</b>	-2,220396	<b>1,276377</b>
POR	-1,152442	7	4,979947	-3,953352	7	4,074437	-3,047204	7	1,836519	-3,864156	-6,401397		
SPA	-2,06045	1	1,061574	-2,038034	1	1,109089	-1,161518	1	0,429909	-2,486326	-4,162381	-1,995446	-2,641364
SWE	-0,63628	1	1,849774	-1,301067	1	2,411428	-0,35083	1	0,78686	-2,733207	<b>0,570154</b>	-2,063918	<b>-0,825443</b>
UK	-1,295123	1	0,738366	0,385143	1	0,369542	-1,27681	1	0,293835	-3,416965	<b>0,5587</b>		
PANEL(15)	-9,099322	Rejects Ho		-15,4303657	Rejects Ho		-5,189738	Rejects Ho					
Crit. Value(5%)	-1,9			-2,53			-2,576						
PANEL(10-II)	-4,43537	Rejects Ho		-9,07512244	Rejects Ho		-3,616093	Rejects Ho					
Crit. Value(5%)	-1,99			-2,6			-2,576						

**Table C - Granger Causality (Lag=2)**

	EXPIRE	EXPAUS	EXPBEL	EXPFRA
EXPBEL	7,57816			
EXPSWE		10,648	6,46972	6,73862
EXPSPA				8,93673

	UERFRA	UERSPA	UERITA	UERUK	UERBEL	UERGRE
UERITA	7,22326	16,6264		8,40117	6,94015	
UERSPA			6,18496			
UERNLD			7,03584			
UERFRA						6,71073

	CPIBEL	CPIFRA	CPIIRE	CPILUX	CPIPOR	CPISPA	CPISWE	CPIGRE
CPIDNK	8,22576		12,0723	11,1849	6,42169			
CPIBEL		7,62868						
CPIFIN					6,41331	7,29218	7,15777	
CPIPOR								6,863
CPIUK							6,1886	

	IDEOLAUS	IDEOLBEL	IDEOLGRE	IDEOLLUX	IDEOLPOR	IDEOLSWE
IDEOLGER	9,29362			36,7614		
IDEOLIRE		8,0475				
IDEOLDNK			7,39843			
IDEOLGRE					19,1438	8,72266

	LPSFIN	LPSSPA	LPSPOR
LPSGRE	43,4483	6,23878	21,1861
LPSFIN		18,2841	
LPSPOR		13,4621	

	VPRGRE	VPRNLD	VPRAUS	VPRFIN	VPRBEL	VPRLUX	VPRDNK	VPRFRA	VPRITA
VPRAUS	8,44701	6,18241							
VPRSWE			8,78786			10,6124			
VPRBEL				9,39189		6,16556			
VPRFRA					7,15384				
VPRLUX					8,87047				
VPRNLD					6,93401	6,25755			
VPRGER							6,01816		
VPRFIN								7,75065	9,6742
VPRIRE				8,34524					
VPRPOR								6,28766	
VPRITA		9,97082				7,16101			

	POP65FIN	POP65GRE	POP65DNK	POP65ITA	POP65FRA	POP65GER	POP65SWE
POP65AUS	6,1848						
POP65BEL		24,4922					
POP65IRE		18,0716	6,98005				25,2543
POP65FRA	8,8372	6,52867		22,1279			
POP65GER	7,97855			7,86161			
POP65GRE	6,53625						
POP65SPA				7,98417	7,4907	6,01195	
POP65NLD						6,46071	

(continues to next page)

Table C - Granger Causality (Lag=2)

	EXPF1LUX	EXPF1DNK	EXPF1POR
EXPF1AUS	6,28339		
EXPF1FRA		10,9002	
EXPF1SWE			6,59737

	EXPF2AUS	EXPF2DNK	EXPF2SPA	EXPF2ITA	EXPF2LUX
EXPF2ITA	7,69263				
EXPF2FRA		10,9002			
EXPF2GRE			7,1439		
EXPF2UK				13,2502	
EXPF2POR					7,05162

	VSPAUS	VSPNLD	VSPGRE	VSPBEL	VSPLUX	VSPIRE	VSPSWE	VSPSPA
VSPFIN	10,9689	9,25578						
VSPLUX	6,69573	22,0333					6,26654	
VSPAUS		10,4238						
VSPSWE	11,0365	16,6041						
VSPBEL			15,2154					
VSPIRE				6,25617				
VSPDNK					6,75445			
VSPFRA						6,06008		
VSPGRE		7,08081						
VSPSPA		6,36684					6,3561	
VSPUK		19,4593						7,03644

**Table D – Countries included in each initial model specification**

	Country included				
	Model A	Model B	Model C	Model D	Model E
BEL	*			*	*
DNK	*	*	*	*	*
GER	*	*	*	*	*
GRE	*	*	*	*	*
SPA	*	*	*	*	*
FRA	*	*	*	*	*
ITA		*	*	*	*
LUX	*	*			*
NLD	*		*	*	
POR	*	*	*	*	*
FIN	*	*	*	*	*
UK		*	*		

**Legend:**

$$\text{Model A: } \exp_{it} = \mu_i + \lambda_i \exp_{i,t-1} + \delta_{10,i} \text{elec}0_{it} + \delta_{20,i} \text{elec}1_{it} + \delta_{30,i} \text{uer}_{it} + \delta_{31,i} \text{uer}_{i,t-1} + \delta_{40,i} \text{cpi}_{it} + \delta_{41,i} \text{cpi}_{i,t-1} + \delta_{50,i} \text{ideol}_{it} + \delta_{51,i} \text{ideol}_{i,t-1} + \delta_{60,i} \text{lps}_{it} + \delta_{70,i} \text{vpr}_{it} + \delta_{80,i} \text{pop}65_{it} + \varepsilon_{it}$$

$$\text{Model B: } \exp_{it} = \mu_i + \lambda_i \exp_{i,t-1} + \delta_{10,i} \text{elec}0_{it} + \delta_{20,i} \text{elec}1_{it} + \delta_{30,i} \text{uer}_{it} + \delta_{40,i} \text{cpi}_{it} + \delta_{41,i} \text{cpi}_{i,t-1} + \delta_{50,i} \text{ideol}_{it} + \delta_{51,i} \text{ideol}_{i,t-1} + \delta_{60,i} \text{lps}_{it} + \delta_{70,i} \text{vpr}_{it} + \delta_{80,i} \text{pop}65_{it} + \varepsilon_{it}$$

$$\text{Model C: } \exp_{it} = \mu_i + \lambda_i \exp_{i,t-1} + \delta_{10,i} \text{elec}0_{it} + \delta_{20,i} \text{elec}1_{it} + \delta_{30,i} \text{uer}_{it} + \delta_{40,i} \text{cpi}_{it} + \delta_{41,i} \text{cpi}_{i,t-1} + \delta_{50,i} \text{ideol}_{it} + \delta_{60,i} \text{lps}_{it} + \delta_{70,i} \text{vpr}_{it} + \delta_{80,i} \text{pop}65_{i,t-1} + \varepsilon_{it}$$

$$\text{Model D: } \exp_{it} = \mu_i + \lambda_i \exp_{i,t-1} + \delta_{10,i} \text{elec}0_{it} + \delta_{20,i} \text{elec}1_{it} + \delta_{30,i} \text{uer}_{it} + \delta_{41,i} \text{cpi}_{i,t-1} + \delta_{50,i} \text{ideol}_{it} + \delta_{60,i} \text{lps}_{it} + \delta_{70,i} \text{vpr}_{it} + \delta_{80,i} \text{pop}65_{i,t-1} + \varepsilon_{it}$$

Model E (selected model):

$$\exp_{it} = \mu_i + \lambda_i \exp_{i,t-1} + \delta_{10,i} \text{elec}0_{it} + \delta_{20,i} \text{elec}1_{it} + \delta_{30,i} \text{uer}_{it} + \delta_{41,i} \text{cpi}_{i,t-1} + \delta_{50,i} \text{ideol}_{it} + \delta_{51,i} \text{ideol}_{i,t-1} + \delta_{60,i} \text{lps}_{it} + \delta_{70,i} \text{vpr}_{it} + \delta_{80,i} \text{pop}65_{it} + \varepsilon_{it}$$

The PMG estimation of model A has the highest Log Likelihood, being equal to 822.2. However, the Hausman-test rejects ELEC1, the long-run coefficient homogeneity assumption, thus leading to the next specification with the highest Log Likelihood, model D, with a value equal to 793.6. After controlling for contemporaneous correlation, the Log Likelihood falls to 675.5, thus implying the selection of the model with the highest value after this control, which is found in the specification selected, with a Log Likelihood equal to 791.2, raising to 803 after contemporaneous correlation correction. The other models: B and C have Log Likelihood values equal to 783.9 and 785.6, respectively.

Table E - Sensitivity analysis of long-run coefficients to reduction of country coverage

Variable	Excluded Country									
	BEL	DNK	GER	GRE	SPA	FRA	ITA	LUX	POR	FIN
elec0	0,011690 <i>3.6512</i>	0,008389 <i>2.4705</i>	0,009914 <i>3.9208</i>	0,009910 <i>3.7662</i>	0,011879 <i>3.3915</i>	0,015309 <i>6.6572</i>	0,010195 <i>3.7447</i>	0,007248 <i>2.5003</i>	0,009873 <i>3.0773</i>	0,015261 <i>5.5343</i>
elec1	0,003548 <i>1.2015</i>	-0,000977 <i>-0.3629</i>	0,005244 <i>1.6853</i>	-0,001736 <i>-0.5822</i>	0,002119 <i>0.6166</i>	0,002927 <i>0.964</i>	0,000597 <i>0.2595</i>	0,002931 <i>0.9409</i>	0,001868 <i>0.6638</i>	0,001250 <i>0.3784</i>
uer	0,005726 <i>11.1919</i>	0,005586 <i>10.2904</i>	0,004731 <i>10.2647</i>	0,004897 <i>9.6377</i>	0,004765 <i>6.7882</i>	0,007246 <i>14.6544</i>	0,005196 <i>12.5843</i>	0,005764 <i>12.6301</i>	0,005575 <i>13.1064</i>	0,005512 <i>11.4367</i>
cpi(-1)	-0,025309 <i>-4.4361</i>	-0,031934 <i>-5.3627</i>	-0,032456 <i>-7.2119</i>	-0,023080 <i>-3.5194</i>	-0,018388 <i>-2.4744</i>	-0,017987 <i>-3.4258</i>	-0,026318 <i>-5.6616</i>	-0,029998 <i>-6.5571</i>	-0,028252 <i>-6.0816</i>	-0,027519 <i>-4.7652</i>
ideol(l)	-0,003819 <i>-2.6248</i>	0,001303 <i>1.219</i>	-0,001525 <i>-1.2547</i>	0,000371 <i>0.3131</i>	0,003932 <i>2.0646</i>	-0,003504 <i>-1.6287</i>	-0,000991 <i>-1.0186</i>	0,000221 <i>0.1926</i>	0,000397 <i>0.343</i>	-0,001039 <i>-0.751</i>
lps	-0,052784 <i>-1.9107</i>	-0,016461 <i>-0.9515</i>	-0,031071 <i>-1.4496</i>	0,002028 <i>0.102</i>	-0,000106 <i>-0.0041</i>	-0,048165 <i>-1.903</i>	-0,048857 <i>-3.1152</i>	-0,021799 <i>-0.8998</i>	-0,008189 <i>-0.4487</i>	-0,073165 <i>-1.8605</i>
vpr	0,069335 <i>1.3962</i>	0,075075 <i>1.9707</i>	0,207089 <i>3.5657</i>	0,096673 <i>1.815883</i>	0,117986 <i>2.2872</i>	-0,109086 <i>-3.108</i>	0,023609 <i>0.5508</i>	0,048263 <i>1.0577</i>	0,128832 <i>2.7202</i>	0,092851 <i>2.257</i>
pop65	2,129420 <i>7.8833</i>	1,928219 <i>8.3123</i>	2,482684 <i>10.3332</i>	1,978726 <i>9.1213</i>	2,701742 <i>13.1698</i>	1,618446 <i>4.7315</i>	1,756757 <i>8.5771</i>	1,937135 <i>8.8547</i>	2,078686 <i>9.5177</i>	1,861288 <i>7.0108</i>

t-student statistic are in italic.

Equation specification includes a constant term for each country not reported here.

**Table F - PMG estimates including only countries where coalition governments dominates**

	Long-Run Coefficients					
	DFE	MG	Hausman-Test	PMG	Hausman-Test	PMG_Corrigido
elec0	0,017134 <i>6,6038 *</i>	0,005359 <i>0,7483</i>	3,048103	0,015918 <i>5,6225 *</i>	2,511680	0,013887 <i>4,5026 *</i>
elec1	0,012070 <i>4,0846 *</i>	0,001107 <i>0,1844</i>	4,209610	0,006881 <i>2,6439 *</i>	1,102604	0,004144 <i>1,8137 **</i>
uer	0,002805 <i>3,4845 *</i>	0,004517 <i>0,734</i>	0,078565	0,001920 <i>2,3053 *</i>	0,180946	0,002719 <i>3,5333 *</i>
cpi(-1)	0,012793 <i>1,172</i>	0,017222 <i>0,1994</i>	0,002669	0,043555 <i>4,5802 *</i>	0,093988	0,023493 <i>2,0885 *</i>
ideol(l)	0,002805 <i>3,4845 *</i>	0,004646 <i>0,7796</i>	0,410589	0,003233 <i>1,9223 **</i>	0,060326	0,005581 <i>3,3204 *</i>
lps	-0,093553 <i>(-5,7844 *)</i>	-0,188428 <i>(-1,9174 **)</i>	0,954232	-0,045429 <i>(-1,7889 **)</i>	2,245852	0,014874 <i>0,7499</i>
vpr	0,024808 <i>0,4356</i>	-0,474855 <i>-0,9649</i>	1,042957	0,131048 <i>1,8503 **</i>	1,543411	0,194882 <i>3,0588 *</i>
pop65	1,710613 <i>5,5004 *</i>	1,462582 <i>1,261</i>	0,048746	1,561565 <i>6,4262 *</i>	0,007568	2,426867 <i>11,0516 *</i>
<b>Hausman Test</b>			<b>9,795470</b>		<b>7,746374</b>	
	Adjustment speed					
exp(-1)	0,668091 <i>-0,331909</i>	0,471492 <i>-0,528508</i>				
	Short-Run Coefficients					
d(ideol)	0,000858 <i>0,5279</i>	0,004068 <i>1,2281</i>	0,000477			
<b>Hausman Test</b>			<b>0,000477</b>			
<b>N° of countries</b>	7	7		7		7
<b>N° of obs.</b>	217	217		217		217
<b>Log likelihood</b>	688,1836	617,4858		582,3202		586,3992

Included countries: BEL, DNK, GER, FRA, ITA, LUX and FIN. t-student statistics are in italic.  
 \*\*\*significant at 10 % level; \*\* at 5% level; \* at 1% level  
 Equation specification includes a constant term for each country not reported here.

**Table G - Sensitivity analysis of long-run coefficients to reduction of country coverage**

Variable	Excluded Country									
	BEL	DNK	GER	GRE	SPA	LUX	NLD	AUS	FIN	SWE
uer(l)	-0,004422 <i>-1,989</i>	-0,000259 <i>-0,1171</i>	-0,002665 <i>-1,2943</i>	-0,000013 <i>-0,0064</i>	-0,005851 <i>-2,5248</i>	-0,006413 <i>-3,2982</i>	-0,003652 <i>-1,3893</i>	-0,002719 <i>-1,2268</i>	-0,003123 <i>-1,3387</i>	-0,002662 <i>-1,5528</i>
cpi(l)	-0,001254 <i>-0,0328</i>	-0,020242 <i>-0,5718</i>	-0,010206 <i>-0,2764</i>	-0,064489 <i>-1,032</i>	-0,003130 <i>-0,0607</i>	-0,009206 <i>-0,242</i>	-0,005191 <i>-0,155</i>	-0,006217 <i>-0,1683</i>	-0,002083 <i>-0,0624</i>	-0,011358 <i>-0,2974</i>
ideol(l)	0,011793 <i>2,6014</i>	0,002430 <i>0,5007</i>	-0,002770 <i>-0,6073</i>	0,001702 <i>0,3087</i>	0,011228 <i>2,6479</i>	0,002167 <i>0,5894</i>	0,005200 <i>1,3307</i>	0,003387 <i>0,7298</i>	-0,003718 <i>-0,8777</i>	0,002535 <i>0,5539</i>
lps	0,312314 <i>9,6917</i>	0,224317 <i>5,5994</i>	0,205279 <i>6,6143</i>	0,244504 <i>7,0401</i>	0,210329 <i>5,0235</i>	0,239336 <i>7,6357</i>	0,283607 <i>7,7248</i>	0,279148 <i>8,7677</i>	0,098804 <i>2,7798</i>	0,258287 <i>8,5366</i>
vsp(l)	1,457063 <i>6,6833</i>	1,213615 <i>6,1598</i>	1,639151 <i>4,7881</i>	1,118185 <i>5,0523</i>	1,509800 <i>7,7745</i>	1,497054 <i>8,0417</i>	1,473722 <i>5,667</i>	1,608067 <i>7,0228</i>	1,543661 <i>7,05</i>	1,272125 <i>5,9578</i>

t-student statistics are in italic.

Equation specification includes a constant term for each country not reported here.

**TABLE H - Estimation results under an alternative model specification**

	Long-Run Coefficients					
	DFE	MG	Hausman-Test	PMG	Hausman-Test	PMG_Corrected
uer(l)	0,012350 <i>8,3002*</i>	0,000400 <i>0,0445</i>	1,809462	0,002561 <i>1,5459***</i>	0,059688	-0,000092 <i>-0,0412</i>
cpi(l)	-0,058009 <i>(-9,5242*)</i>	0,000689 <i>0,0096</i>	0,676521	-0,028819 <i>(-5,8763*)</i>	0,170664	-0,016828 <i>-0,3568</i>
ideol(l)	-0,012260 <i>(-4,1626*)</i>	-0,013666 <i>-1,0795</i>	0,012933	-0,006844 <i>(-1,5437***)</i>	0,328106	-0,010063 <i>(-1,9822**)</i>
lps(l)	0,268893 <i>8,2446*</i>	-0,068185 <i>-0,6167</i>	10,039348	0,188821 <i>4,2075*</i>	6,388389	0,073199 <i>1,8258*</i>
vsp	2,048278 <i>10,4122*</i>	0,937815 <i>1,6072***</i>	4,009506	1,663122 <i>15,3711*</i>	1,596399	1,959286 <i>16,1581*</i>
<b>Hausman Test</b>			<b>16,547770</b>		<b>8,543246</b>	
	Adjustment speed					
expf(-1)	0,742987 <i>-0,257013</i>	0,275251 <i>-0,724749</i>		0,662974 <i>-0,337026</i>		0,610480 <i>-0,389520</i>
	Short-Run Coefficients					
d(uer)	-0,002011 <i>-0,63</i>	-0,002058 <i>-0,4152</i>	4,69194E-08	-0,001859 <i>-0,5447</i>		-0,004196 <i>-1,2253</i>
d(cpi)	0,093737 <i>1,3988***</i>	-0,146514 <i>-0,6623</i>	5,942793	-0,024886 <i>-0,9432</i>		-0,040973 <i>-1,1625</i>
d(ideol)	-0,003258 <i>-0,9391</i>	-0,002036 <i>-0,3404</i>	0,000038	0,000853 <i>0,1621</i>		-0,000102 <i>-0,02</i>
d(lps)	-0,011540 <i>-0,2237</i>	-0,098669 <i>-1,2829</i>	0,171303	-0,062864 <i>-0,6875</i>		-0,102928 <i>-1,0371</i>
<b>Hausman Test</b>			<b>6,114134</b>			
<b>N° of countries</b>	8	8		8		8
<b>N° of obs.</b>	248	248		248		248
<b>Log likelihood</b>	581,7549	528,10445		463,8638		479,7434
<b><math>R^2</math></b>	0,94	0,35		0,50		0,58

Included countries: BEL, DNK, GRE, SPA, LUX, NLD, FIN and SWE.  
t-student statistics are in italic. \*\*\*significant at 10 % level; \*\* at 5% level; \* at 1% level  
Equation specification includes a constant term for each country not reported here.

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## **PART III**

### **A Political Economy Analysis of Jurisdiction**

#### **Formation**

Analysing a government's "failure" in the pursuit of general societal preferences in democratic decision-making is described through the theoretical model and corresponding empirical application in the first two parts of the dissertation. The analysis shows that a public choice theory approach *per se* does not solve the intercommunication problem between collective decision-making and societal preferences, given that it assumes delegation of decision power to a restricted group of individuals, namely the government, through a voting process.

In this part of the dissertation, we look to allocate, according to society, collective choice concerning the provision of a public good, that of "government" and, discuss the conditions that meet the consensus of society.

The approach looks to a social welfare theory in the sense that in a first phase, government implementation should proceed from a collective decision, without impairing delegation of power of a political process of the elected government to follow.

Although Olson (1977) demonstrated that failure in collective action results from the rational behaviour of individuals that act according to a Prisoner's Dilemma, reality demonstrates that under correct incentives society is able to organise itself in deciding or influencing public decisions. Pressure groups are a good example of such behaviour.

In democratic regimes, it is known that political decisions are established among institutions, in which elected incumbents make collective decisions according to specific rules. The fundamental role of institutions is not here relegated to second plan, rather it allows society as a collective whole to decide which institutions are preferred before the process of delegating power to political entities.

The decision relative to the provision of a public good, namely “government”, is presented in the theoretical model proposed in the third part of this dissertation resulting from the collective choice of society. When considering processes of government decentralisation, although popular consultation procedures such as referendums can occur, it is generally public choice that determines the decision process. The third part of the dissertation looks to complement this approach with another focused strictly on societal preferences.

In this sense, the third part of the dissertation discusses the ideal decentralised regime as an institutional organisation for the provision of a specific public good “government”, as an alternative to an implemented regime denoted by centralisation. The theoretical model proposed intends to evaluate under what circumstances is it necessary to define jurisdictions, either through regionalisation or segregation, bearing in mind that the decentralisation process is a reconfiguration of how power is shared among individuals in society.

This third part contemplates a survey of the major developments in the field and how it relates to the proposed theoretical model. The survey serves as a framework for the model, which is later introduced.

The survey presented in Chapter 1 looks to systematise previous theoretical strands of literature that provide for an evolutionary study on the problem of defining jurisdictions. These approaches precede a political economy analysis of the issue.

In this sense, the survey follows two perspectives.

In what concerns the previous theoretical branches of literature, the perspective is to summarise the main contributions that lead to the definition of jurisdictions. With this purpose a descriptive approach is made, covering the first part of the Chapter 1.

In the second part of the Chapter, a comparative perspective is adopted. Firstly, the primer model that relies on a political economy approach to explain the territorial partition into smaller units is presented. Secondly, the main points of convergence and divergence between subsequent works in the field and the theoretical model proposed in Chapter 2 are evidenced.

Part Three of this dissertation is as follows. A survey of the literature is introduced in Chapter 1. The basic theoretical model is presented in Chapters 2 and 3. An extension to accomplish region formation is described in Chapter 4. Chapter 5 introduces the compensatory transfers between communities. Chapter 6 provides conclusions.

## **1. The political economy models and the definition of jurisdictions - A survey**

### **1.1. The descriptive approach**

#### **1.1.1. Previous theoretical models**

The papers that rely on a political economy perspective to explain the partition of a territory in nations or in jurisdictions are related to the local public good literature as well as to the fiscal federalism literature, to which Tiebout (1956) and Oates (1972) were the seminar contributors.

The Tiebout's work (1956) defined a way to efficiently allocate the public goods provision through a mechanism called "voting with the feet". With this mechanism, the populations reveal their true preferences for the provision of the public goods, solving the known problem of free riding.

That revelation of preferences and corresponding demand for public goods are made when the so called "consumer-voter" sorts himself in a certain community, choosing between available jurisdictions according to the set of public goods offered in each one. That moving possibility presented in Tiebout's model acts like a market mechanism.<sup>1</sup>

Oates (1972) defined that the choice between a decentralised and a centralised system should reflect a trade-off between spillovers and taste heterogeneity - result often referred to as Oates' Decentralisation Theorem. With no spillovers and no identical districts, a decentralised system is superior. With spillovers and identical

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<sup>1</sup> Bewley (1981) presents an extensive critique to the main assumptions taken on the sorting mechanism defined by Tiebout to work.

districts, a centralised system is preferred. With spillovers and non-identical districts, the issue can only be resolved by comparing the magnitude of the two effects.

Oates stated that the preference for centralisation over decentralisation when high spillovers exist is due to two factors. First, the free rider problem between the jurisdictions becomes aggravated with decentralisation. Second, high spillovers lead citizens to prefer more equitable spending on public goods and hence centralisation reduces the conflict of interest between jurisdictions.

The decentralisation theorem assumes that central governments are unable to distinguish differences on individuals' preferences in what concerns public good provision. Besley and Coate (1999) present a model where the central entity can differentiate the public good provision according to the preferences of each jurisdiction. In this framework centralisation produces a policy outcome that is responsive to taste heterogeneity. Thus, centralisation delivers the benefits of decentralisation without generating any of the costs.

The theory of fiscal federalism makes use of Musgrave's (1959, 1969) three fiscal functions: allocation, redistribution and stabilisation. The distribution and stabilisation functions should be fiscal competencies of a central government. The allocation function appeals for a decentralisation process, in which fiscal autonomy is given to governments closer to the constituents.

Another branch of literature that also explains the configuration of jurisdictions is the club theory. A club is a voluntary group of individuals which commonly agree in the production and consumption of one or more public goods, sharing between them the cost and benefits resulting from that. It implies a cooperative perspective of action. The non-participants on the club or the excluded ones do not benefit or have any harm from the provision of the club good. Buchanan (1965) and Wooders (1978,

1980) initiated this strand of literature that is being developed until today. This strand of literature separates the definition of jurisdictions from the territorial component. In this literature the space is absent from the theoretical models.

The partition of individuals assumes that all members of a jurisdiction consume the same amount of the local public good and pay an equal share of the provision cost in which the same crowding (determined by the number of members in each jurisdiction) apply. This partition allows maximisation of the utility achieved by individuals.

Under these circumstances McGuire (1974) suggests that occasionally segregation is unattainable or meaningless. This occurs when the national population presents identical tastes and endowments, thus suggesting that a differentiation pattern cannot be found among individuals. As such, similar demand behaviour and, consequently, group formations hinder any improvement to the utility attained. McGuire also refers that even when individuals present different tastes and endowments they may display similar demand curves.

Pretending to explain the phenomenon of territorial partition, in the 90's a political economy approach is made. Alesina and Spolaore's (1997) work, which leads to an increasing number of contributions on the issue, initiates the new approach to the problematic of nations/jurisdictions definition. The political economy literature on the size and distribution of nations and jurisdictions mainly focus on the factors that determine the integration versus segregation/secession. This renewed interest for the ideal partition of population and territory appears as natural if a historical perspective on the number of states in the world was taken.

The world in 1815 was composed of 35 states and grew to 46 states in 1890, 63 in 1920, 154 in 1993 and is approximately 185 nowadays. This increasing speed of evolution in the number of countries in the world is an outcome of an increasing

implementation of democratic regimes, as stated by Hiscox and Lake (2001). The recent disintegration of both Yugoslavia and the Soviet Union has led to the emergence of a larger number of new states. The growing tendency to largest states to break up into smaller parts has been followed by an increasing fractionalisation of the states into smaller territorial partitions. The partitions assume differentiated forms: either the definition of regions or federations or partitions into even smaller territorial units like municipalities. Anyway, the territorial partition led to the definition of jurisdictions with political power. Rodríguez-Pose and Gill (2003) emphasise the great tendency towards decentralisation in Europe.

### **1.1.2. The Alesina and Spolaore's political economy model**

The political economy approach<sup>2</sup> intends, as the local public good literature and fiscal federalism literature, to address the question of the desirable partition of the territory, or equivalently how many governments should be implemented in a certain space. Although being inspired on the precedent branches of literature the political economy approach introduces a step forward. Taking explicitly in consideration the inherent implications of governments' power share when a territorial partition occurs, the new strand of literature has introduced a new look on the problematic of the definition of jurisdictions.

A major contribution on the field is given by Alesina and Spolaore (1997) (hereafter AS) presenting a political economy model to explain the efficient number of countries in the world. The model describes a trade-off between a decrease on the

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<sup>2</sup> Alesina, Perotti and Spolaore (1995) and Bolton, Roland and Spolaore (1996) review the literature on this issue. The former paper focuses on the size of jurisdictions and the latter on the size and distribution of nations.

individual utility associated with the distance that mediates individual location and the local where the public good is provided and an increase on the individual utility when the public good financing is shared with a larger number of individuals. Using a model formulation where individuals are uniformly distributed on a segment  $[0,1]$ , the authors derive the efficient number of countries ( $N^*$ ) in a world <sup>3</sup> and analyse its stability.<sup>4</sup> The model can easily be seen in a framework of a state.

In AS model population is already territorially sorted according to Tiebout's (1956) preferences assumption and the main issue is to have jurisdictions with partitions of population of equal size, replicated  $N$  times,<sup>5</sup> where each citizen pays an equal cost share for the public good provision.<sup>6</sup>

The optimal number of countries is increasing in the benefits of the public good and cost of distance and decreasing in the cost of the public good.

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<sup>3</sup> Some related works, namely, Alesina and Spolaore (2000) and Alesina, Baqir and Hoxby (2000) also derive the efficient number of countries.

<sup>4</sup> Using a discrete model where individuals are separated with a length of one between neighbors, Cechlárová, Dahm and Lacko (2001) also found the efficient and stable partition of the world population into  $N$  countries. Dahm (2002) extended the analysis and discuss the implications to the location of the public good when one more individual is added to a country.

<sup>5</sup> Using a model with three types of individuals regarding the preferences for a public good with equal size but not totally territorially sorted, Bjorvatn and Cappelen (2002) find that centralisation may welfare dominates decentralisation. That outcome is conditioned to the degree of heterogeneity in individual's preferences, the degree of geographical segregation of individuals and the degree of their mobility across regions.

<sup>6</sup> In contrast, using also an equal cost sharing model but where citizens are defined as having a differentiated taste for public goods, translated into a correspondent differentiated demand, Jehiel and Scotchmer (1997) (hereafter JS) present a model that shows that in the equilibrium, under free mobility and after sorting, high-demand jurisdictions are much larger than low-demand jurisdictions.

The conditions to ensure that the optimal number of countries is a stable one are then reported. Subsequently, the authors defined the compensatory schemes in order to guarantee the stability of the territorial partitions.

At this point it is important to distinguish the model that is introduced in Chapter 2 from other related models, thus modifying a descriptive perspective followed until now to a comparative one.

## **1.2. The comparative approach**

### **1.2.1. The distance concept**

“Government” is the public good that is provided in the AS model, which has a territorial dimension.<sup>7</sup> Simultaneously, the AS model assumes that individuals in the world (state) are homogeneous and the differentiating element between individuals is the distance each one is from the public good location, which implies a physical dimension.

Panizza (1999, forthcoming) also derives a model where the distance as a physical measure is considered: one from the centre of the country and the other from the centre of jurisdiction, where the mainland is already partitioned in jurisdictions of the

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<sup>7</sup> Having a territorial implementation this “government” differs from Frey’s (2001) notion of government. In fact, Frey solves what he called the “geography of problems” defining political units in a network of competing jurisdictions in which government has no territory configuration. The author refers to quasi-governmental organisations as the United Nations as an example of such government without territory. In those jurisdictions named FOCJ, the political units have functions, which extend over variable areas that can overlap. Having in mind a nation, this type of government does not apply since in this case governments have authority over some specific territory.

same size. However, its main concern is different from the one present in the AS paper since the author intends to evaluate the ideal degree of centralisation that prevents secession. For that, the author uses those distances and a per capita amount spent on a certain public good by two levels of government: a central and a local one.

The distance concept can be captured by a measure of political influence, which is not a physical measure. Crémer and Palfrey (1999) use the concept of influence coefficients in which a district influence could not necessarily be equal to the population weight it has when districts form what they called a confederation. To those authors the influence coefficients evaluate how policies of different districts are influenced by the preferences of other citizens of other districts under an institutional arrangement defined as confederation. The confederation is a collection of districts with rules regarding the aggregation preferences of the members of the various districts, producing policy outcomes that can vary across those districts.

Crémer and Palfrey's work considers that centralisation (confederation) produces outcomes that are different from citizens' ideal points. In their model the benefit of centralisation relies on the risk reduction that each district faces of having too differentiated policies when policies are made independently.

Wittman (2000) also uses a non-physical distance measure defined as the distance an individual is from an ideal point on a continuum of political preferences. The loss from a political position implementation different from the one preferred by individuals is established as being quadratic.<sup>8</sup>

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<sup>8</sup> Although inspired in AS model, the model described by Wittman differs from AS model both because it allows migration and because it introduces a production function as well as an extortion function.

The theoretical model that is proposed tries to reconcile these two perspectives of distance introducing a measure of individual political power evaluated by the weight that each group of individuals has on society.

### **1.2.2. Centralisation vs. Region/Segregation in opposition to Centralisation vs. Segregation**

The common approach to study the implementation of a decentralised regime is made through full segregation. Although there are other intermediate forms to implement decentralised outcomes they are less broadly analysed. In this point of Chapter 1, the most important papers in the field that describe decentralisation as a one level outcome are surveyed. The decentralisation processes that allow two level outcomes are also presented, although with a differentiated approach from the one that is made in the model introduced in Chapter 2.

Using the AS model, Goyal and Staal (2003) (hereafter GS) derive the group size dimension that vote by majority on union (centralisation) or on two regions (segregation). GS use a uniform distribution of individuals partitioned between those who are located on the left of the middle preferences and those who are on the right, which is analogous to Haimanko, Breton and Weber (2002-a and b) (hereafter HBW) approach. In the model considered by GS, the size of a region constrain the separation argument since in that case the tax advantage of sharing the public good cost dominates the loss in political influence traduced by a closeness loss to the public good. Consequently, GS model induces an excessive bias towards the centralised regime.

GS also found that under a majority voting the aggregate welfare is not maximised. The equilibrium solution brings more regions than socially desirable. This is so because the GS model introduces excessive incentives for a unilateral separation. With a unanimous voting rule, as the one specified in the model of Chapter 2, the unilateral separation without the approval by the other groups is not allowed.

Piketty (1996) describes a mechanism with majority voting that determines the existence of federalism or independence between several countries, thus allowing also two political levels. The author identifies the federalism as a centralised outcome in which each country has the same weight in the federal voting process, independently from the population size.

The Piketty model processes in two stages. Firstly each country votes on a federal policy and secondly, through voting it decides to adopt the federal policy or to leave the federation. In the last case, the leaving country pays a fixed cost to the remaining federation. In this sense, federalism, as described by the author, is a commitment device to obviate an undesirable federal break-up in stage 2. The compensatory mechanisms described in Chapter 5 of this part are in accordance with such argument.

The *status quo* could also be seen as a disincentive to extremely small groups to separate. However, the independence, in the model of this part, does not necessarily imply a payment between groups, since it allows independence to be preferable to centralisation to all groups, thus not necessarily generating a loss to the other participants under centralisation when one group separates, as in Piketty model.

The models that were briefly referred above focus on two political outcomes: centralised public good provision or full segregated public good provision.

The model proposed here includes a third possibility, which is one of the contributions of the model. As a special case, two groups can find advantage in

merging into a region as an intermediate solution between centralisation and segregation. In this sense, the model allows either centralisation, which occurs when all groups share the public good provision; or full segregation when all groups provide in isolation the public good; or a region in which some groups merge and provide the public good collectively.<sup>9</sup>

The inclusion of a third group in the analysis opens a whole range of interesting issues, that the two-country (region) models as the ones already referred are unable to capture.

Differences on the size of the groups determine the form how groups organise in order to provide the public good, bringing to alternative solutions, according to the groups' dimension that composes each society.

Ellingsen (1998) also analyses the trade-off between centralisation and segregation between two regions, but where only one region produces the public good, which leads to an externality to the other region. Regions are different in size and in taste parameters. Again the solution of the trade-off is by majority voting.

Harstad (2000) extends Ellingsen's work considering an inclusion of a third region. However, the paper differentiates from the model introduced in the following Chapter, since in the former only one region produces the public good and the other regions can free ride, which permits to incorporate the externality problem in the analysis.

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<sup>9</sup> Vorsatz (2003), using three heterogeneous players, follows a closer argument. If players have different sizes, then they have a differentiated efficient effort. Then, the utility each player achieves is differentiated according to the solution of having isolated players or players united into a coalition. Thus, the non-cooperative bargaining appears here as a fundament to the formation of unions between players. Instead, in the theoretical model proposed here, when it is considered that two groups can merge into a region, the model is assuming that groups only prefer to unite if there are no alternative outcomes that bring them the same utility, namely full segregation.

Alesina, Angeloni and Etro (2001-b) (hereafter AAE), using a partition of population into countries with similar size but where individuals value differently the public good, study the benefits of a union versus segregation<sup>10</sup> when the public good provided in one country generates externalities to another country.<sup>11</sup> The authors extend their work in other paper (2001-a) where they investigate an optimal institutional design of fiscal federalism relying on decentralisation of expenditures and a system of subsidies and transfers between countries. They argue that since some of those transfers can be politically unfeasible, the existence of flexible unions can mitigate the problem.

The model introduced in this part distinguishes from AAE model in its argument to have centralisation as well as in the model formalisation. In the model of Chapter 2, centralisation is beneficial once it allows the public good financing to be shared with more individuals and in AAE model the centralisation allows to internalise the externality effects. Moreover, the provision by a certain group or a set of groups in the theoretical model of this part does not bring any externality to the other individuals that do not belong to that group(s). The only effect on the other groups is merely financial in the sense that if one group does not have enough size to sustain the public good provision, the other group(s) might co-finance its provision.

Using two regions, one coastal and the other hinterland and where the former region is the biggest one, Arzaghi and Henderson (2002) discuss the conditions that

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<sup>10</sup> Etro (2001) defines a model with three countries that allows an intermediate solution defined as a decentralised equilibrium. In spite of that, the trade-off of its model is different from the one used in the model presented in Chapter 2. Etro defines the trade-off between the internalisation of the externalities caused by a certain policy on other country and the cost of having a country outside a union free riding.

<sup>11</sup> Gradstein (2000) follows a related research line, although with a differentiated formal model.

make desirable to both regions engage into a federal structure where the local public good is decided collectively or into a separation process. Although considering only two regions this model also allows three outcomes: federation, separation or the remaining of the *status quo* defined by a unitary government. The model differs from the one that is proposed in Chapter 2 either because it only considers two types of citizens or because the decision processes on public expenditure is made with majority voting. At first, the model also considers that population and income are immobile as well as a differentiated income across regions. As an extension, the authors present the case of a mobile population where population size and income in the two regions are endogenous.

Seabright (1996) also approaches the question of the appropriate level of decentralisation allowing a local, a regional or a central government. However, the article is focused on a different problematic, since Seabright intends to identify which level motivates most governments to act in the interest of citizens. In this sense, the trade-off is between the benefits on policy coordination with centralisation and the corresponding decrease on government's accountability.

### **1.2.3. Majority voting rule vs. unanimous voting rule**

The unanimity rule, as an ensuring mechanism to achieve both efficiency and stability with a collective decision, finds support on social choice literature. In this literature the Buchanan and Tullock's (1962) work is the classic contribution. In *The Calculus of Consent*, the authors state that in the absence of what they called "decision-making costs", the unanimity rule is socially optimal. With decision-making costs equal to zero and allowing compensatory mechanisms ("side-

payments”)<sup>12</sup> between those who support a certain decision and those who oppose, then any inefficient proposal will certainly be rejected, thus only the efficient decisions will be accepted. In fact, if a certain individual is harmed with a certain proposal, then it will not be a movement towards Pareto principle.

The economic literature has produced arguments in which the right to secession is viewed as a disciplining device that prevents the exploitation of a minority by a majority (see Buchanan and Faith, 1987), that a majority voting system allows, but is eliminated with a unanimous voting system. In an extreme point of view, there is a possibility for the reverse to occur. In that case a minority group dictates the outcome of a collective decision, thus exploiting the majority.

In this sense, a relation to Olson’s (1977) argument can be made. The author originally referred to the concept of the “exploitation of the great by the small”.

The works that explain the territorial partition based on the AS approach rely on the majority voting rule. The only exceptions were the AAE (2001-a) and Lockwood (1998) papers.

The AAE paper discusses the role that differentiated institutional rules play on the country’s institutional organisation. Explicitly, the AAE paper compares the implications for the institutional form of countries related with the voting rule that is implemented in each of them: simple majority, qualified majority or unanimity.

Lockwood considers the possibility of unanimous voting using three region model, allowing an outcome between centralisation and segregation. In Lockwood model the public good also generates externalities across regions. The major implication is that

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<sup>12</sup> For the cases in which those side-payments between individuals are not allowed, Guttman (1998) derives a minimum efficient majority-voting rule, given that under these circumstances, the unanimity rule is found to be sub-optimal.

with this voting rule the decentralisation (segregation outcome) is implemented only if the constitution allows side payments between regions.

#### **1.2.4. The efficiency and stability issues and the role of transfers**

The present Section describes the role of transfers as an ensuring mechanism to the stability of jurisdictions. The previous works on the subject are summarily reviewed and the link to the theoretical model described in this part is pointed out.

Individuals located on the border between two jurisdictions can provoke instability, as indicated by AS. On the border the individuals can be indifferent to belonging to one or another jurisdiction, given that at that point they are at the same distance from the public good. In this view, the author defines compensatory mechanisms within a jurisdiction in order to ensure that an individual on the border has no incentive to belong to a neighbour jurisdiction.

Following an approach much in line with AS paper, Josselin and Marciano (2000) describe a unitary state as a heterogeneous spatial club in which the individual willingness to accept the constitutional power of the government is decreasing with distance from its location. Thus, peripheral regions become important in threatening unity. The model discusses optimal constitutional status for those regions on the periphery in order to sustain the unity, thus putting the attention on stability issues.

Breton and Weber (2002) and HBW (2002-a and b) also discuss efficiency and stability when the population has a continuous cumulative distribution of preferences. That preference arrangement leads to a population partition between citizens on the left and citizens on the right relatively to the middle of a country. The HBW (2002-a) paper introduces the polarisation question, described as being the case in which

individuals are more homogenous within a jurisdiction than across jurisdictions. With this interpretation the transfer mechanism is introduced in order to prevent those individuals too distant in terms of their own preferences to have an incentive to separate. The model only allows two levels for the public good provision: centralisation or segregation outcomes, given the population partition into two groups. In those models, transfers are designed to be an equalisation mechanism between advantageous and disadvantageous regions of a country in order to prevent secession threats that might occur by those who are in disadvantage.

The model that is proposed here considers that individuals do not have an incentive to change between groups since groups are sorted according to homogeneous characteristics. In this sense, mobility is not attractive. The stability in the model depends on the size that each group has, determining to each group a different incentive regarding the desired regime for public good provision. More precisely, some groups can be better with decentralisation while others can be better with a centralised regime. This differentiated incentives can difficult the finding of a dominant solution to all groups, thus leading to solutions that are a compromise between groups. The existence of multiple equilibrium solutions is the main source of a potential political instability. In this sense, the model of Chapter 5 defines transfer mechanisms between groups in order to redistribute the net gains of a decentralisation process by all groups. With appropriate transfer amounts any blocking incentive that a group might initially have is obviated, which will turn impracticable the decentralisation process, given the unanimous voting rule.<sup>13</sup>

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<sup>13</sup> The redistribution here has a different meaning from the one usually described in regional redistribution models, where rich regions make transfers to poor regions as in Persson and Tabellini (2000). In the model of Chapter 2 as in AS model, citizens have the same income, thus here the

In the model extension described in Chapter 5, transfers are a way to prevent that some group, finding more advantageous the centralised provision, can block a decentralised public good provision. Transfers in this sense are a mechanism to prevent that secession does not occur, contrarily for example to HBW (2002-a) model.

Bolton and Roland (1997) also present a model that only allows centralisation or segregation and where the compensatory mechanisms between regions are introduced as a way to prevent secession. Once again, in this model, the remaining of the *status quo* at the hands of those who want centralisation, given the majority-voting rule, differentiate from the mechanism present in the model of the third part of this dissertation.

The transfer mechanism that is proposed in the theoretical model of this dissertation, which allows the implementation of a decentralised process in the cases in which full segregation is not feasible, is in line with the following Alesina's (2002-pp.13) argument.

*“By Coase (1960) theorem, precisely because the optimal configuration of countries maximises total welfare, it generates enough total welfare so that transfer schemes between winner and losers can make the optimal number of countries (jurisdictions)<sup>14</sup> at least weakly preferred to any other configuration of borders”.*

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redistribution mechanism intends to prevent any group from blocking the decentralisation process, given the unanimity-voting rule.

<sup>14</sup> The word in parenthesis is a reinterpretation of mine.

Alesina also states that if transfers are not allowed, the voting in a referendum to the configuration of borders may generate partitions of the territory, which are too small comparing with the optimum. The main question that can be pointed out is that in practice transfers can be difficult to implement or unfeasible namely because of a commitment problem.<sup>15</sup>

In order to avoid this problem, in Chapter 5 is assumed that the compromises regarding transfers, after being negotiated, accepted and established between groups, are translated into a constitutional obligation, ensuring that any group unilaterally will not break their compromises without law violation. The constitution can be seen as a pact between groups.<sup>16</sup> Each group must be better with a specific compromise than without it, which a unanimous voting mechanism that constrains the best interest of all groups seems to guarantee. Under these circumstances the collective decision on the configured decentralised form of the public good provision will remain stable. Further, as pointed out by Wittman (1991-pp.129):

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<sup>15</sup> Collective action problems have been frequently solved under a non-cooperative environment between individuals, assuming that each individual faces differentiated incentives, thus eliminating any cooperative behaviour. However, very often, a cooperative behaviour between individuals is found. What makes this happen? Robert Putnam (1993) introduced the concept of social capital that helps to explain some of the social cooperation that happens in real world. Social capital is described as being the accumulation of social relations capable of providing individual incentives to take part in collective actions, which prevents society from being a set of individuals acting as if they were in a social vacuum. Paldam (forthcoming) defines social capital concept in the language of game theory, as being the excess propensity groups have to play cooperative solutions in prisoners' dilemma games.

Bjornskov and Svendsen (2002) prove, using a set of European countries, that social capital is higher in countries with a high level of decentralisation. In these set of countries the authors include Switzerland, Denmark, Norway, Sweden and Finland. Contrarily, countries with a high degree of centralisation evidence lower social capital. Included in those countries are: Portugal, Belgium and France.

<sup>16</sup> Acemoglu (2002) states that the Coase Theorem is a good approximation of reality if it is possible to make commitments via constitutions.

*“When commitments are credible, then the size of nations (jurisdictions) tends toward the optimal.”*

The model proposed abstracts from the question of how inter-groups transfers will be implemented. After being created the government will potentially be managed by an elected authority that will collect the taxes and make the inter-municipal transfer allocations. However, despite from the functioning shape that the government will adopt, it must be emphasised that a reliable transfer mechanism must be previously settled, in order to express a credible commitment between groups, as pointed out by Bordignon and *al.* (2001). The authors also refer the role that written legislation might have, through the establishment of simple rules, as a device to ensure pre-defined inter-municipalities transfer commitments.<sup>17</sup>

Persson and Tabellini (2000) point out that with transfer mechanisms an inefficient public good provision is implied, given that the number of its beneficiaries are lower than its contributors. The authors referred this inefficient provision as the “common-pool” problem. This perspective was already identified by Olson (1969) through the violation of the “fiscal equivalence”, where there must be a match between those individuals that receive the benefits of a certain public good and those individuals who pay it. However, the public good provided by a decentralised entity must be an improvement towards Pareto optimality compared with the *status quo*.

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<sup>17</sup> The main arguments used to criticise the Coase theorem, as a reasonable outcome, appears related with the political implementation of governments in which politicians in power serve their own interests or some social group interests as the expense of the society at large. In this sense it can be said that any commitment only will be feasible if the elected politicians that will manage the government afterwards, will be moved only by benevolent incentives, thus maximising the welfare of the society. The politician must have such behaviour when the public good is provided either by a region or by a municipality.

As Le Breton and Weber (2001-pp.11) emphasise:

*“Stability of co-operation requires not only positive gains from being together but also the ability to distribute these gains without creating secession prone regions. That is, the stability requirement is stronger than the efficient one. (...) If co-operation is stable, it is also efficient.”*

Under a unanimous voting rule as the one that is considered in this Part, a group that has to co-finance the public good provision of another group could find preferable to secede by war rather than segregate or form a region. Secessions give rise to a birth of new nations, as pointed out by Bordignon and Brusco (2001). Instead, the model that is presented in Chapter 2 assumes that the war cost is sufficiently high to outweigh any cost that monetary transfers to another group (municipality) can entail. In this sense, any group only can segregate peacefully under the rules constitutionally established. The questioning of nation's unity is not explicitly exploited in the theoretical model of Chapter 2, thus setting apart the usual unilateral secession issues.

## 2. The basic model of jurisdictionary boundaries

A political economy perspective to explain the formation of countries has a substantial development during the 1990s. A closer approach can be followed in the configuration of jurisdictions, as an outcome of country partition into smaller units.

This kind of analysis becomes more relevant if the great tendency towards decentralisation in Europe was considered.<sup>18</sup>

Alesina and Spolaore (1997) introduce a political economy model to explain the efficient number of countries in the world. Their model relies on the following trade-off: a decrease on the individual utility associated with the distance that mediates individual location and the local where the public good is provided and, an increase on the individual utility, when the public good financing is shared with a larger number of individuals. Using a model formulation where individuals' heterogeneity results from the distance each individual is from the public good provided, the authors derive the efficient number of countries in the world and analyse its stability. Besides the distance from the public good location, individuals are homogeneous.

A formulation analogous to the one proposed by AS is also used in the theoretical model proposed, but here individuals reside into a municipality with other

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<sup>18</sup> As Rodríguez-Pose and Gill (2003-pp.8) state:

*“If we consider the populations of those countries implementing moves towards devolution, 87% of the total European population has experienced some sort of decentralisation since the late 1970s, covering eight out of the fifteen member countries. (...) In Europe the centralist tendencies prevalent in the continent up until the 1970s have been reversed. Belgium became a federal state in the early 1990s, Italy is currently moving in that direction and regions in Spain enjoy in some cases greater powers than states in federations. (...) Even the traditionally centralist France has introduced limited measures toward greater regionalisation.”*

homogeneous individuals, forming a homogeneous group. Groups are heterogeneous regarding the value that each one retrieves from the public good.

The groups are territorially sorted, occupying each one a different partition of the territory, as in AS model.<sup>19</sup>

The main issue in AS work is to have jurisdictions with partitions of population of equal size, replicated several times. Contrarily, in the model proposed here each group that forms a certain territorial partition (municipality) can have differentiated size. The consequences of those groups' differences in size to the organisational form that can be chosen to provide the public good is then explored.

In this sense, the model concerns the most appropriate set of individuals that should finance the public good provision.

The income is homogeneous across all individuals regardless of the group each one belongs to, as it is assumed in AS model.<sup>20</sup> In this sense, this model distinguishes from models like Bolton and Roland (1997) in which the main force leading to segregation is the existence of income differences across regions.

The analysis considers the existence of three differentiated groups. Considering that each group resides in one municipality, consequently a nation that is composed of three well-defined municipalities is established. The quantity of the public good that each individual accedes to is always the same in the present model, although being the

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<sup>19</sup> Auffhammer and Carson (2003) point out the Germany and the Switzerland cases as examples in which heterogeneous population are territorially sorted. In the former case, the north population is almost exclusively protestant and the catholic population is mostly concentrated in the south. In the latter case, different languages coexist in three different spatial domains.

<sup>20</sup> Using the European Union as a framework it can be argued that this assumption is not too stringent. In fact, Boadway and Hayashi (1999-pp.634) reinforce the argument:

*“Differences in EU country size reflect mainly population differences since per capita income differences are relatively small.”*

correspondent utility and the number of contributors differentiated when the public good is replicated, *i.e.*, when a decentralisation process is implemented.

The interest to contribute to the public good provision is a choice taken by each group (direct democracy)<sup>21</sup> and is not a result from an elected representative politician who chooses the public good provision and its financing form (representative democracy). More precisely, in the model it is taken into account that a nation is comprised of groups of citizens rather than by single agents, contrarily to models that rely on elected representatives. In those models representatives have their own interests, evidencing differentiated preferences from the ones expressed by population that elect them.

The distance concept has also a different meaning in the present model. Distance is reinterpreted as a loss in influence power that an individual has when he shares the public good provision with other individuals that do not belong to his group.

In this perspective the distance measure is not physically evaluated, rather assuming a measure of political influence.

However, the model maintains a physical bases. In fact, the implementation of the public good, defined as being the “government”<sup>22</sup> has a territorial dimension. Using a

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<sup>21</sup> Giving autonomy to each citizen as in direct democracy the model is assuming that citizens are best equipped to find their own solutions as defended by Hausken and Knutsen (2002). The authors state that the cost associated with the erection of governmental units, the adjustment of unit borders and the possible death of units can only be achieved through the inclusion of the citizens in the decision making process.

<sup>22</sup> Instead of government, this model could consider the public good provided as the one that satisfies individual preferences regarding a certain continuous political dimension as in Breton and Weber (2002) or the one that attains to individual preferences on the location of a set of public projects as in Haimanko, Breton and Weber (2002-b).

political economy model, which relies inevitably on power forces, implies a geographic dimension. As argued by Gérard-Varet and Thisse (1997-pp.22):

*“All power has a territorial base”.*<sup>23</sup>

The model presented in this Chapter assumes that when the public good provision is shared with other groups, the higher the influence power of each group on the “government” definition, the greater will be the value retrieved by each individual. This influence power is a direct effect of the group size. The individual utility is maximised when each individual does not have to share the public good provision with individuals belonging to other groups, *i.e.*, when an individual has complete influence power.

With a centralised provision of the public good each individual achieves the highest share cost of the public good provision but suffers the major loss on his influence power, since “government” profile is influenced by the other groups that comprise nation and is not an exclusive determination of his group. On the contrary, separation brings a benefit since each group alone influences the public good provision but entails a loss associated with the reduction in the number of individuals with whom the individual can share the provision cost.

When the three groups finance the public good, a centralised provision is considered, which involves the entire nation, *i.e.*, the *status quo*. When two groups merge and leave the centralised provision it is because those groups are forming a region and when one group in isolation provides the public good, that case is referred to full segregation.

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<sup>23</sup> In their work, fiscal federalism assumes a territorial emphasis and the implications of neglecting the space component in the definition of jurisdictions is also discussed.

Under this understanding any change on a departure situation, which is defined as being the centralised regime, must be evaluated by each group according to the benefits and costs<sup>24</sup> that it might bring to them.

In this sense, individual gains versus costs<sup>25</sup> obtained under each one of the two possible decentralised outcomes are compared with the *status quo*. Balancing the benefits and costs of each regime, the model allows the definition of the condition, which ensures that a decentralised process is beneficial compared to a centralised regime. Considering that population is composed of three groups, which can have different sizes, the main question is to evaluate how these differences in size constraint the preferences of groups over the regimes that should provide the public good.

Moreover, under a rule of unanimity, as proposed here, any small group has enough force to block the process leading to decentralisation, which implies that the process must be beneficial for all the intervening groups.<sup>26</sup>

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<sup>24</sup> Young (2002) states that this approach relying on an economic analysis of benefit/cost is reasonable, given the functioning democracies and industrialised welfare states where minorities have enough authority. In fact, established democracies have the necessary mechanisms to guarantee that those individuals, who belong to a minority are not oppressed.

<sup>25</sup> The economic costs and benefits of central and local public finance are the central theme in the field of fiscal federalism, being the benefits of decentralisation stated in the well-known Oates' (1972) "decentralisation theorem".

<sup>26</sup> Example of unanimity voting for a change on a *status quo* can be found either in Europe or in the United States. In 1997, in Goteborg (the second largest municipality in Sweden) three of the 21 municipality parts, namely Askim, Torslanda and Alvsborg intend to separate. On a referendum the three parts were prone to secession but only about 12 percent of the voters in the rest of Goteborg accepted that partition. In this condition, the secession of those three parts was denied as reported by Brink (2003). Los Angeles also recently faced a separatist attempt from the San Fernando Valley, Hollywood and San Pedro Harbor area. The pretensions were defected in a popular referendum in November 2002, although it passed narrowly in the Valley, as pointed out by Penn (2003).

As Alesina and Spolaore (2003) refer, majority-voting leads to inefficient outcomes since it implies the creation, under democratic regimes, of a larger number of countries than the optimal one.

This part intends to complement those works, introducing the unanimous voting as the mechanism that can simultaneously ensure an efficient and stable public good provision. In this perspective, the paper contributes to the discussion of the issue.

## 2.1. The Model

Consider a country with population of size  $N$ . Citizens of the country are territorially arranged according to their preferences for a public good, defined as “government”. According to this arrangement, the country presents three types of citizens  $i \in \{1,2,3\}$ , each one forming a homogeneous group. Preferences regarding the public good provision are heterogeneous between groups.

Consider also that each group resides in one municipality (lower territorial division of the country). In this sense, three municipalities with fixed boundaries compose the country. This means that population is already territorially sorted according to Tiebout’s (1956) preferences assumption. Thus, there is no further role for citizens’ mobility between municipalities.<sup>27</sup>

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<sup>27</sup> This argument follows directly Alesina and Spolaore (1997-pp.1030) that state:

*“If there was no relationship between location and preferences, then there would be no presumption that a country would be geographically connected”.*

Further, as emphasised by Oates (1972-pp.34) mobility of voters is not essential to the decentralisation theorem.

The weight of each group in population is denoted as  $\mu_i$ , which can be of different sizes, with  $\sum_{i=1}^3 \mu_i = 1$ . Thus,  $\mu_i = \frac{N_i}{N}$ , where  $N_i$  is the number of individuals belonging to group  $i$  and  $N$  is the national population. So, by definition,  $0 < \mu_i < 1$ .

The individuals are assumed to be perfectly foresighted and utility maximisers.

The utility of the representative individual that belongs to group  $i$  is denoted as

$$U_i = ag_i + y - t_i \quad (2.1)$$

for  $i \in \{1, 2, 3\}$ .

Individuals in the three groups earn the same exogenous income  $y$  and pay a per capita tax  $t_i$ , with  $t_i = t, \forall i$ . Thus,  $y - t$  is consumption of private goods.

The variable  $g_i$  represents the value the individual attaches to the “government” provision. The parameter  $a$ ,  $a > 0$ , is interpreted as the marginal utility of the public good.

### 2.1.1. The *status quo*

The *status quo* is a centralised regime, where a central government provides the public good “government” denoted as  $G$ .

Under the centralised regime the public good is given as  $g_i = \frac{N_i}{N} G$ .

The individual value of government is discounted by the relative size of group  $i$ . Under a centralised provision, group  $i$  does not decide in isolation the public good provision; each group must share this decision with the other. In this sense, group  $i$  retrieves only a fraction of the benefit that it would obtain if it had an absolute control over the central government’s choices regarding the public good provision. For a

given  $G$  figure, each group retrieves less value under central provision than it could achieve if it were to provide the public good “government” alone.

The benefit that group  $i$  achieves is a direct result of its weight in national population. Given so, the larger the group  $i$ , the higher will be the benefit retrieved with the public good under central provision.<sup>28</sup>

The utility function of the representative individual expressed in (2.1) becomes, under the *status quo*, as:

$$U_i^c = aG \frac{N_i}{N} + y - t, \quad (2.2)$$

for  $i \in \{1, 2, 3\}$ .

The maximisation of problem (2.2) faces three constraints.

Firstly, recall  $G$  is the output value of the public sector. The production of this value requires resources, whose total cost is  $F$ . Hence, there is an accounting identity to bear in mind  $G = F$ .

Secondly, it is assumed that the provision cost  $F$  is totally financed out of a uniform contribution levied upon all citizens, irrespective of their location. Therefore,  $Nt = F$  is the public budget constraint.

Finally, the economy must stand for the public good provision in the sense that the fiscal effort to sustain the “government” provision does not exhaust disposable economic resources. So, the “government” provision must attain to the economic constraint given as  $F \leq Ny$ .

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<sup>28</sup> At this point, the central planner’s decision process can be seen as in a parliamentary regime, where the chamber directly reflects population interests weight, rather than as the outcome of one representative’s options.

The budget constraint is then given as  $Nt = F \leq Ny$ . Accordingly, the tax price  $t$  meets the following conditions  $t \leq y \wedge t = \frac{F}{N}$ .

Incorporating the budget constraint into the utility function (2.2), the indirect utility function is given as

$$U_i^c = aG \frac{N_i}{N} + y - \frac{F}{N} \quad (2.3)$$

So, under the *status quo*, a centralised regime provides the “government”, whose level does not correspond to the bliss valuation of each group because all of them collectively share the access to it.

At this point it is assumed that the country’s constitution imposes that any change to the *status quo* requires unanimous voting. Equivalently, the public good provision by any decentralised regime is only feasible if all groups retrieve a welfare improvement compared to the one achieved under a centralised regime. As Alesina and Spolaore (2003-pp.35) emphasise:

*“If borders can be redrawn by majority voting, and unilateral secessions are permissible, then, in general, there is no guarantee that a non-centrally planned equilibrium will produce the social optimum.”*

The unanimity voting gives voice to the minority groups since any group can block the decentralised provision of the public good no matter how small its weight is in the national population.

### **2.1.2. Segregation**

With segregation, each group determines alone the public good provision, thus retrieving the maximum benefit from the public good provision  $G$ , i.e.,  $g_i = G$ . This

is so because in isolation the group  $i$  does not share the provision outcome with the other groups, being the group on their own the relevant population for the decision of “government” implementation.

The utility obtained by the representative individual is then denoted as

$$U_i^s = aG + y - t_i. \quad (2.4)$$

Each citizen now consumes “government” according to his bliss point. This is so because each group retains full control over the public good provision. However, there is a drawback to this new arrangement: it costs more to each citizen. This is so because, with segregation there are fewer taxpayers to finance the same cost of government,  $F$ . The higher tax burden reduces individual optimal utility.

A decentralised provision of the public good “government” on each municipality implies that each group finances the fixed cost resulting from its implementation. So this cost is replicated three times. Accordingly,  $F$  can be seen as a fixed cost resulting from “government” implementation and is independent from group size.

The budget constraint of group  $i$  is now defined as  $N_i t = F$ , given uniform tax payment. Simultaneously, community  $i$  must have enough resources to support the provision by its municipality, i.e.,  $F \leq N_i y$ .

This implies that the budget constraint of group  $i$  is given as  $N_i t = F \leq N_i y$ .

So, the tax price with segregation must satisfy the following conditions:

$$t \leq y \wedge t = \frac{F}{N_i}$$

Given these conditions, expression (2.4) can be re-written as the indirect utility function

$$U_i^s = aG + y - \frac{F}{N_i} \quad (2.5)$$

Given the fixed cost in the provision of the public good, each group in isolation benefits less from scale-economies: the larger the size of the contributing group, the smaller the individual cost shares. Efficiency gains in bureaucracy or in tax collection are examples where having a centralised provision of the public good obviates the replication of such costs.

Thus, the smaller the group the higher the gains each group obtains by retaining full control over the public good provision, but the higher will be the per-capita cost associated with the “government” financing.

The value of the public good “government”, denoted as  $G$ , remains equal to the respective cost of provision,  $F$ .

Briefly, through this model two main forces are found, that can lead to a centralised or a decentralised provision of the public good. The smaller the group, the higher will be the per capita tax necessary to finance the public good, which favours centralisation. However, the centralised provision of the public good deviates from individual bliss points which lower individual utility. This central government’s deviation decreases with group size, which is an argument in favour of decentralisation.

### 3. Welfare comparison between segregation and centralisation

Under the unanimity rule, the segregation process occurs if for the three groups the following condition holds:  $U_i^s \geq U_i^c$ , where  $U_i^c$  and  $U_i^s$  are the utility that each citizen achieves with a centralised regime and with segregation, denoted by expressions (2.3) and (2.5).

Equivalently, it can be stated that the condition holds if:

$$aG + y - \frac{F}{N_i} \geq aG \frac{N_i}{N} + y - \frac{F}{N}, \forall i.$$

Otherwise, the *status quo* remains.

For group  $i$ , the net gain from segregation is defined as

$$U_i^s - U_i^c = aG \left( 1 - \frac{N_i}{N} \right) - \left( \frac{F}{N_i} - \frac{F}{N} \right). \quad (3.1)$$

The first term of expression (3.1) captures the increase in individual utility due to segregation and springs from the additional control over the public good provision that allows individuals to retrieve full value from the public good that is provided.

This effect is denoted as  $A$  and called the “control effect”, *i.e.*,  $A \equiv aG \left( 1 - \frac{N_i}{N} \right)$ . The

second term reflects the additional financing effort an isolated group must support compared to the centralised provision. This utility change is denoted as  $B$  and labels

the “scale-economies effect”, *i.e.*,  $B \equiv F \left( \frac{1}{N_i} - \frac{1}{N} \right)$ .

Thus, the former effect captures the positive impact of segregation and the latter the negative impact that results from lower scale-economies.

The analysis of both effects allows to find a minimum group size that brings the dominance of effect A over effect B. This leads to the first Proposition.

**Proposition 1:** Segregation satisfies the unanimity criterion if  $a > \frac{1}{N_i}$ .

**Proof:**

Using the identity  $G = F$  and solving (3.1) in order to the value of  $N_i$  that brings  $U^s = U^c$ , it becomes

$$aN_i^2 = aNN_i - N + N_i, \text{ or equivalently,}$$

$$aN_i^2 - (aN + 1)N_i + N = 0.$$

Using the solving formula the value of  $N_i$  is given as

$$N_i = \frac{(aN + 1) \pm \sqrt{(aN + 1)^2 - 4aN}}{2a}.$$

Then,

$$N_i = \frac{(aN + 1) \pm (aN - 1)}{2a}$$

The solution becomes

$$N_i = \frac{1}{a} \vee N_i = N. \quad (3.2)$$

The second case where  $N_i = N$  is uninteresting because in that particular case there is no room for decentralisation. The nation encompasses only one jurisdiction.

Things get appealing in the case  $N_i = \frac{1}{a}$ , or, equivalently,  $a = \frac{1}{N_i}$ . In this case segregation brings the same utility to individuals as centralisation, but there is space for the formation of jurisdictions, *i.e.*, a spatial partition of the population with a dimension inferior to the nation.

Accordingly, segregation can only be superior to centralisation when  $a \neq \frac{1}{N_i}$ . The

first case is considered with  $a > \frac{1}{N_i}$ .

Recalling (3.1) and rewrite it as

$$U_i^s - U_i^c = G \left[ a \left( 1 - \frac{N_i}{N} \right) - \left( \frac{1}{N_i} - \frac{1}{N} \right) \right], \quad (3.3)$$

then when  $a > \frac{1}{N_i}$ , it reinforces the term  $1 - \frac{N_i}{N}$  vis-à-vis the term  $\frac{1}{N_i} - \frac{1}{N}$ ,

compared to the case  $a = \frac{1}{N_i}$ . This means that in this case the scale-economies effect

dominates the control effect, *i.e.*,  $A > B$ .

As a result, when  $a > \frac{1}{N_i}$ , segregation dominates centralisation, *i.e.*,  $U^s > U^c$ .

The above result can be equivalently re-written as  $N_i > \frac{1}{a}$ . □

The intuition behind this result is that segregation is only desirable for all groups if the utility loss from the scale-economies effect is outweighed by the utility gains from the control effect and everybody votes for segregation.

The violation of Proposition 1 by at least one group, *i.e.*, if for some group  $N_i < \frac{1}{a}$ , it implies that segregation cannot be attained, given the unanimous voting mechanism. This circumstance leads to a blocking behaviour by such group(s) to the segregation process.

Given so, the following Corollary can be stated.

**Corollary 1:** The *status quo* always prevails if there is at least one group where the

following condition holds:  $0 < a < \frac{1}{N_i}$ .

**Proof:**

Returning to expression (3.3) when  $a < \frac{1}{N_i}$  it reinforces the term  $\frac{1}{N_i} - \frac{1}{N}$  vis-à-vis the term  $1 - \frac{N_i}{N}$ , compared to the case  $a = \frac{1}{N_i}$ .

As a consequence, when  $a < \frac{1}{N_i}$  centralisation is welfare superior to segregation,

i.e.  $U^s < U^c$ , since in this case the effect B dominates effect A.

If at least one group faces this case, then it will find preferable to maintain the *status quo*.

Equivalently, the above condition can be written as  $N_i < \frac{1}{a}$ . Considering that by definition  $N_i \geq 1$ , then for the result to sustain the parameter  $a$  has to be strictly positive. □

Having in mind that it is necessary to find  $\mu_i = \frac{N_i}{N}$ , then a second Corollary can be stated.

**Corollary 2:** With  $a = \frac{1}{N_i}$ , groups are indifferent between segregation and

centralisation if  $\mu_i = \frac{1}{aN}$  or if  $\mu_i = 1$ .

**Proof:**

Using expression (3.2) and dividing by  $N$ , then

$$\frac{N_i}{N} = \frac{1}{aN} \vee \frac{N_i}{N} = 1.$$

Once again the process of decentralisation only finds space for implementation when  $\mu_i = \frac{1}{aN}$ , since when  $\mu_i = 1$  the nation encompasses only one jurisdiction.

When  $\mu_i = \frac{1}{aN}$ , a spatial partition of the population with a dimension inferior to the nation becomes viable then. □

Analysing the result with  $a = \frac{1}{N_i}$ , it can be stated that segregation brings to each group the same utility as centralisation. However, the group dimension varies according with the national population. This implies that when the dimension of national population is large, for the same condition  $a = \frac{1}{N_i}$ , a group with a smaller dimension is found.

Bearing in mind that segregation is beneficial to centralisation for values of  $a > \frac{1}{N_i}$ , it is important to evaluate how the group's dimension evolves with the lag between the parameter  $a$  and  $\frac{1}{N_i}$ . This analysis introduces the following two Propositions. One when  $a > N_i$  is considered and the other when the parameter  $a$  varies between  $0 < a < N_i$ .

The first case is expressed in the following Proposition.

**Proposition 2:** When  $a > N_i$  segregation is the dominant solution for any group's dimension.

**Proof:**

Using the solution expressed in Proposition 1 it can be seen that for  $N_i > \frac{1}{a}$  and with  $a > 1$ , any value of  $N_i$  satisfies the inequality.

Returning to the “control” and the “scale-economies effects”, given as

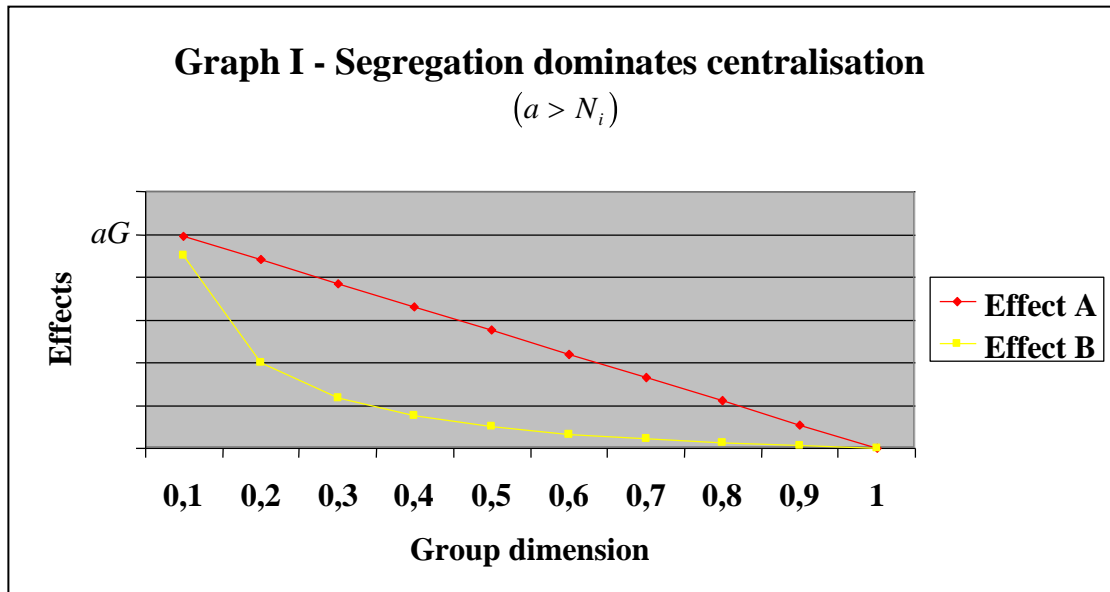
$$A = aG\left(1 - \frac{N_i}{N}\right) \text{ and } B = F\left(\frac{1}{N_i} - \frac{1}{N}\right),$$

and using the equality  $G = F$ , the two effects can be equivalently re-written as

$$A = aN_i\left(\frac{N - N_i}{NN_i}\right) \text{ and } B = \left(\frac{N - N_i}{NN_i}\right).$$

When  $\frac{1}{N_i} < a \leq N_i$  it is easily seen that  $A = B$  for values of  $N_i = \frac{1}{a}$ . However, the two effects do not intercept for values of the parameter  $a$  given by  $a > N_i$ . In this case,  $A > B$ , which means that segregation is always preferable to centralisation, even for a group dimension with only one individual.  $\square$

Summing up, when  $a > N_i$  the “control effect” always dominates the “scale-economies effect”. The gains an individual achieves by the fact of accessing in isolation to the public good are enough high, in order to compensate the cost associated with the “government” provision. This is a situation where segregation always dominates centralisation. Under this scenario the segregation process is the natural outcome. Graph I represents this scenario.



The straight line in Graph I indicates the gain that group  $i$  achieves with segregation and corresponds to the representation of effect A. The curve represents the loss in utility that group  $i$  obtains with segregation by sharing the public good financing with a fewer number of individuals, and corresponds to effect B.

When instead of  $a > N_i$ , the second case where  $\frac{1}{N_i} < a < N_i$  is considered, the

Proposition below presents the result.

**Proposition 3:** When  $\frac{1}{N_i} < a < N_i$ , the benefits of segregation arise for a group

dimension larger than when  $a = \frac{1}{N_i}$  is considered.

**Proof:**

Beginning by defining  $\frac{N'_i}{N} > \frac{1}{aN}$  as well as  $\frac{N_i}{N} = \frac{1}{aN}$  and comparing with the solution of Corollary 2, then  $\frac{N'_i}{N} > \frac{N_i}{N}$ . This implies that  $N'_i$  must satisfy the following condition:  $N'_i > N_i$ .

So, the dimension of  $N'_i$  comparing with the value of  $N_i$  that makes segregation indifferent to centralisation, is larger than when  $a = \frac{1}{N_i}$  is considered.

Under these circumstances the  $\mu'_i$  defined as being equal to  $\frac{N'_i}{N}$  becomes larger than  $\mu_i$ . The group dimension that makes segregation preferable to centralisation becomes larger the wider is the difference between  $a$  and  $\frac{1}{N_i}$ . □

As a consequence it seems that the reverse is expected when  $0 < a < \frac{1}{N_i}$  as is shown by the following Corollary.

**Corollary 3:** When  $0 < a < \frac{1}{N_i}$ , centralisation dominates over segregation for a

group dimension smaller compared with the basic case:  $a = \frac{1}{N_i}$ .

**Proof:**

Considering now  $\frac{N_i''}{N} < \frac{1}{aN}$  and  $\frac{N_i}{N} = \frac{1}{aN}$ .

The comparison between the two expressions above leads to  $\frac{N_i''}{N} < \frac{N_i}{N}$ . For the veracity of such inequality then  $\mu_i'' = \frac{N_i''}{N}$  must be smaller than  $\mu_i$ . Given this result it can be stated that as the difference between  $a$  and  $\frac{1}{N_i}$  becomes wider, the group dimension for which the *status quo* prevails becomes gradually smaller.  $\square$

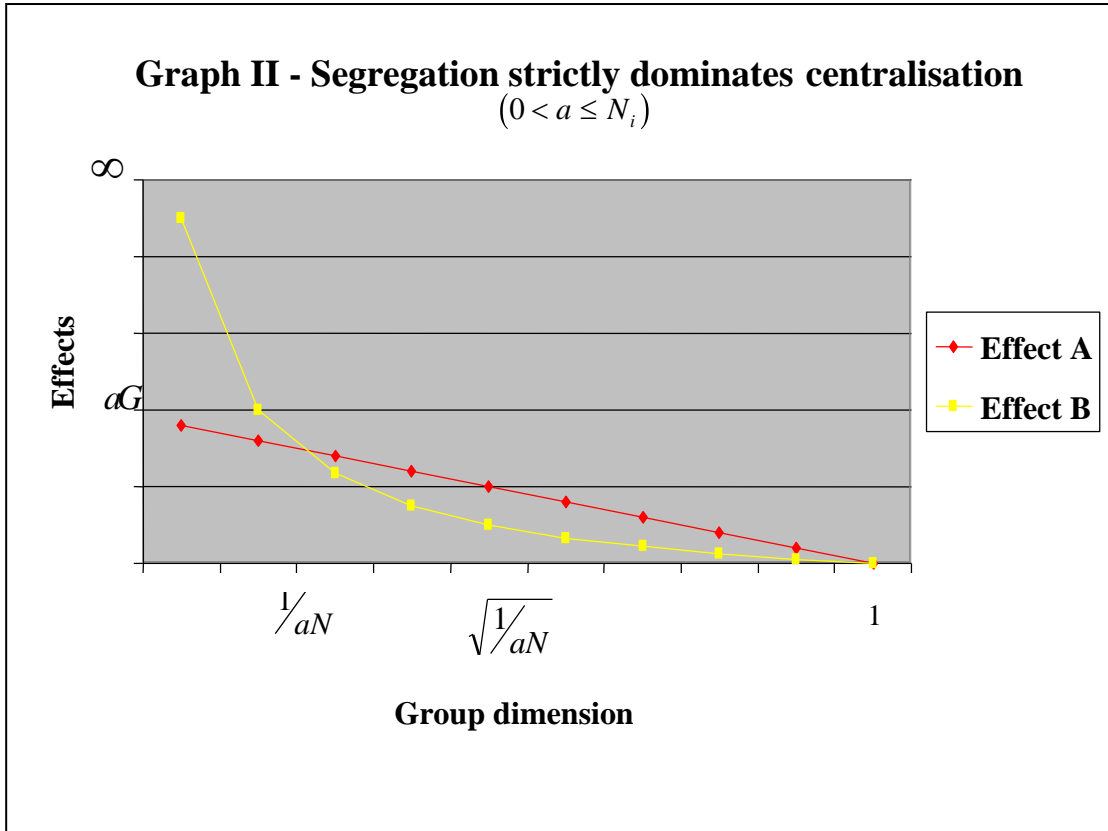
Another interesting issue is to evaluate which group's dimension maximises the net benefit of segregation. In this sense the following Proposition is introduced.

**Proposition 4:** The maximum net benefit each individual derives from segregation is attained for the group size  $\mu_i^* = \sqrt{\frac{1}{aN}}$ .

**Proof:**

See appendix 1.

To sum up, graph II shows the interval of values that strictly ensures to group  $i$  to be better segregated than with a centralised regime. That occurs for  $\frac{1}{N_i} < a < 1$  to which the correspondence is to a group dimension defined as  $\frac{1}{aN} \leq \mu_i \leq 1$ .



The solution for the problem  $A = B$ , described in Proposition 1, is given as

$\mu_i = \frac{1}{aN}$   $\vee$   $\mu_i = 1$ , when  $a = \frac{1}{N_i}$ . Under this case, the maximum gain from

segregation is obtained when group  $i$  has a dimension as  $\mu_i = \sqrt{\frac{1}{aN}}$ .

The effect on group dimension which makes segregation beneficial to centralisation when  $a > \frac{1}{N_i}$ , is stated in the following Corollary.

**Corollary 4:** When  $a > \frac{1}{N_i}$ , the group's dimension that maximised the net benefits

of segregation is larger than when the case  $a = \frac{1}{N_i}$  is considered.

**Proof:**

Under this scenario the effect A dominates the effect B. Equivalently, using

$a > \frac{1}{N_i}$  it can be stated

$$\left| \frac{dA}{d\mu_i} \right| > \left| \frac{dB}{d\mu_i} \right|$$

Solving it analogously to the Proposition 3, the following results are found

$$\mu_i' > \sqrt{\frac{1}{aN}} \vee \mu_i' > -\sqrt{\frac{1}{aN}}.$$

Using the positive solution and comparing with solution when  $a = \frac{1}{N_i}$ , then it

becomes  $\mu_i' > \mu_i$ .

□

As a synthesis of the previous analysis the following Lemma can be stated.

**Lemma 1:** Segregation is only a feasible outcome if Proposition 1 holds.

The policy implication of this result is that once the parameter  $a$  and the population sorting into groups  $\mu_i$  are known it is possible to evaluate *a priori* the feasibility of a decentralised process leading to segregation.

#### 4. The model extension

The main issue in this Chapter is to discuss the implications when groups do not face the same incentives. Under a unanimity-voting rule, the opposing vote of one group is enough to block the decentralised provision as stated in Corollary 1. The inherent reasoning for that behaviour by a group  $i$  is a dimension constraint that unables the group to be beneficial with segregation. Given the small dimension of group  $i$ , the group cannot exploit the “scale-economies effect”, thus favouring the centralised regime.

Can the dimension problem<sup>29</sup> be overtaken if two groups find beneficial to merge into a region?

This Chapter shows that when communities do not redistribute some of the net gains achieved with decentralisation to communities that prefer centralisation, the only efficient and stable regime is either centralisation or full segregation. This result sets some reasoning for the questioning of the welfare improvement when unilateral secessions are admitted, which lead to too much fragmentation of a nation without being a step towards efficiency. In fact, this is the unanimity voting that ensures that no one community will be worse off under decentralisation. In this sense, and without the possibility of transfer between communities in order to generate an increase on

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<sup>29</sup> This dimension problem is a real phenomenon. As an example the case of the recent decentralisation process in the Czech Republic can be referred. In autumn 1990, the Czech Republic implemented the Communities Act that offered an extensive list of autonomous powers to communities. This led to a rethinking of the Act in 1992 since until then communities only had power to decide on matters concerning the community itself. At that date the change of the Act included the right of communities to create their unions. Under this perspective, local governments would be divided according to their capacity to implement delegated power, thus lowering the number of communities by the creation of new regions.

national welfare, only when all communities desire to be in isolation, the decentralisation has space to occur. Otherwise, the *status quo* will remain.

#### 4.1. The formation of a region

A region is established when two groups agree to merge in order to provide the public good “government”. Therefore, the definition of regions as a union (club) of two municipalities appears as an intermediate solution between centralisation and segregation. As a member of a region, group  $i$  does not accede in isolation to the public good but, in compensation, it shares the public good with a smaller number of individuals than when the group is ruled by a centralised regime.<sup>30</sup>

The group  $j$  is defined as  $j \in \{1,2,3\}$  such that  $j \neq i$ .

With the definition of a region, the utility of the representative individual of group  $i$  is now given as

$$U_i^r = a \frac{N_i}{N_i + N_j} G + y - t_i, \quad (4.1)$$

for  $i, j \in \{1,2,3\}$  and  $i \neq j$ .

The public good “government” when provided by a region has the same fixed cost denoted by  $F$  that is financed equally by the population of the region, *i.e.*, the groups that accepted to merge. Once again, the region must stand for the public good provision so that the fiscal effort to sustain the “government” provision does not exhaust disposable economic resources. Consequently, the “government” provision still must attain to the economic constraint given by  $F \leq (N_i + N_j)y$ .

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<sup>30</sup> This argument finds support on Baleiras (2001-pp.7):

*“The more negotiators are in a club, the less power each has to influence the final choice”.*

The budget constraint is now defined as:

$$t_i N_i + t_j N_j = F \leq (N_i + N_j)y.$$

Given the uniform tax contribution, tax receipts are then given as

$$(N_i + N_j)t = F \leq (N_i + N_j)y$$

The common tax price of “government”,  $t$ , is, accordingly, denoted by the conditions

$$t \leq y \wedge t = \frac{F}{N_i + N_j}.$$

Using the budget constraint, expression (4.1) is now given as

$$U_i^r = a \frac{N_i}{N_i + N_j} G + y - \frac{F}{N_i + N_j} \quad (4.2)$$

The public constraint  $G = F$  remains valid in the sense the value of the public good provided is evaluated by the respective cost of provision.

#### 4.2. Welfare comparison between regionalisation and centralisation

The *status quo* is only changeable if groups find a better position with the definition of a region than with centralisation:  $U_i^r \geq U_i^c$ . The analysis leads to the following Proposition.

**Proposition 5:** The coalition of two groups into a region is a better outcome than a centralised regime for a coalesced group  $i$  if  $a > \frac{1}{N_i}$ , which implies that  $\mu_i \geq \frac{1}{aN}$ ,  $\forall i$ .

**Proof:**

Using expressions (2.3) and (4.2), the condition  $U_i^r = U_i^c$  holds if:

$$a \frac{N_i}{N_i + N_j} G + y - \frac{F}{N_i + N_j} = a \frac{N_i}{N} G + y - \frac{F}{N}.$$

For group  $i$  the net gain from the definition of a region is given as

$$U_i^r - U_i^c = aG \left( \frac{N_i}{N_i + N_j} - \frac{N_i}{N} \right) - F \left( \frac{1}{N_i + N_j} - \frac{1}{N} \right). \quad (4.3)$$

Defining the first term that captures the “control effect” as  $A'$  and the second term that translates the “scale-economies effect” as  $B'$  and redefining the problem as

$$A' = B', \text{ the two effects can be re-written as } A' = aGN_i \left( \frac{N - N_i - N_j}{N(N_i + N_j)} \right) \text{ and}$$

$$B' = \frac{F}{N} \left( \frac{N - N_i - N_j}{N_i + N_j} \right).$$

Stating  $A' - B' = 0$ , the equality becomes

$$aGN_i - F = 0,$$

because  $N$  is different from  $N_i + N_j$ .

Knowing that  $G = F$ , the solution is

$$N_i = \frac{1}{a}.$$

Using  $\mu_i = \frac{N_i}{N}$ , then the corresponding group size is given as  $\mu_i = \frac{1}{aN}$ .

This implies that the definition of a region is a favourable outcome compared with the centralised regime for  $a > \frac{1}{N_i}$ , *i.e.*, the same lag of values for which segregation

dominates centralisation. □

The above Proposition allows the establishment of the following Corollary:

**Corollary 5:** The *status quo* always prevails when  $0 < a \leq \frac{1}{N_i}$ , which corresponds

to  $\mu_i < \frac{1}{aN}$ .

**Proof:**

*Mutatis mutandis*, the same analysis of Corollary 1 applies.

The Corollary states that under the above conditions, if at least one group is better with centralisation than with segregation, then the group is simultaneously better than with regionalisation.

This implies that, given the present condition, and without compensatory mechanisms, groups with a dimension below  $\frac{1}{aN}$  always prefer centralisation to any one of the referred decentralised regimes.

#### 4.3. Welfare comparison between regionalisation and segregation

Even if all groups have a higher utility with segregation than with centralisation, would it be possible to have a coalition solution between two groups that bring them a higher utility compared to segregation? Putting it in another way, the definition of a region is only expected if this alternative brings a higher utility to those groups forming a region. Equivalently, it can be stated that it happens if

$$U_i^r - U_i^c \geq U_i^s - U_i^c.$$

Equivalently, it can be written as

$$aG\left(\frac{N_i}{N_i + N_j} - \frac{N_i}{N}\right) - F\left(\frac{1}{N_i + N_j} - \frac{1}{N}\right) \geq aG\left(1 - \frac{N_i}{N}\right) - \left(\frac{F}{N_i} - \frac{F}{N}\right), \quad (4.4)$$

using the expressions (4.3) and (3.1), respectively.

The next Proposition states the necessary condition for the above inequality to hold.

**Proposition 6:** The definition of a region is never the dominant strategy when

$$a > \frac{1}{N_i}.$$

**Proof:**

See appendix 2.

From Proposition 6, two consequences emerge.

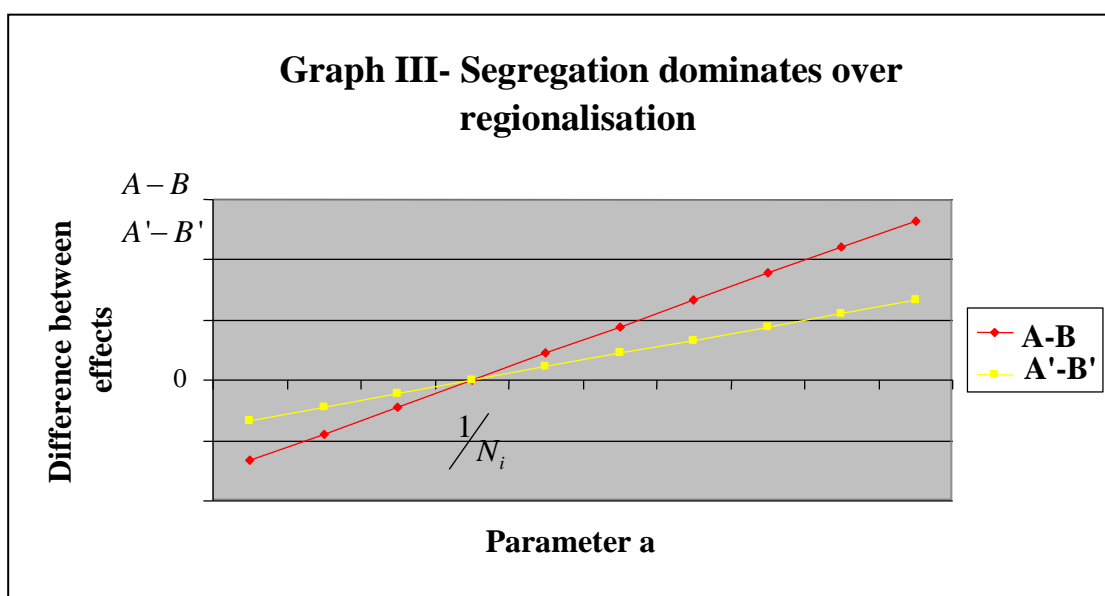
Firstly, a group that satisfies the condition  $a > \frac{1}{N_i}$  always prefers segregation to a definition of region. The above result is interesting since, given the unanimous voting, only if groups face that condition, can the decentralisation process be implemented. This implies that a group with  $a < \frac{1}{N_i}$  will block the process of independent jurisdictions: in this sense, a vote for regionalisation ends up, curiously, as a vote for the maintenance of the *status quo*.

Secondly, if the voting regime allows for the independence of a group that desires to be in isolation, then it induces a social cost. In fact, those groups that find

preferable to stand on the *status quo* will have to organise themselves into a region<sup>31</sup> in order to minimise the inflicted cost by those that prefer to be in isolation, given that in this case  $A - B < A' - B' < 0$ .

Thus, the decentralised provision, with no compensatory mechanisms, only contemplates full segregation, under a unanimous voting regime.

The following graphic presents the net gains achieved by group  $i$  and sums up the two main conclusions of this part, at this point.



Firstly, when  $a < \frac{1}{N_i}$ , the effects  $B$  and  $B'$  are respectively superior to the effects  $A$  and  $A'$ , implying in this case that centralisation is the only solution for that specific nation. In fact, as stated in Corollary 1 if one of the groups finds the above condition it will block any decentralisation process. However, if the unilateral secession was allowed, then groups that prefer centralisation would find a cost, that is

<sup>31</sup> It is assumed that Municipalities are geographically distributed around a circle, thus allowing any municipality combination to generate a region.

smaller if two groups prefer centralisation. In this case, under the formation of a region the two groups share the public good provision cost, which translates into a lower per-capita tax compared with the alternative scenario in which one of the groups finds itself in isolation because the other groups prefer segregation.

Secondly, when  $a > \frac{1}{N_i}$  the only feasible outcome is full segregation.

Summarising, in the absence of any kind of compensatory mechanisms, the decentralisation process is only a Pareto optimum if the three groups that compose the nation prefer to be in isolation, meaning that in this case full segregation maximises welfare. Instead, if there is at least one group that is worse, if centralisation is replaced by any decentralised regime, then centralisation is the only regime that guarantees the satisfaction of the Pareto criterion.

In this framework, centralisation appears as inducing a cost to some group(s) if it is not the desired outcome for all. The following Chapter analyses the impact on the theoretical model main results that emerge from the introduction of compensatory mechanisms.

## 5. Choices with compensatory transfers

If one or two groups prefer to be in isolation and by that fact retrieve a positive net benefit, they will be disposable to cede some of such gain to those group(s) that find a cost when the centralisation regime is breaking up. If they do not do it, they will suffer a major loss given that, in such case, centralisation will be the regime that maximises welfare and attains both efficiency and stability.

The efficiency condition is ensured when a Paretian view is considered, *i.e.*, none community can face a utility reduction with decentralisation in comparison with the respective level achieved with centralisation. The stability condition is guaranteed when none of the communities has an incentive to change to a different institutional regime from the one where each community is.

In this sense, four scenarios emerge. The scenarios are presented according to two views. The scenarios called *A* denote the cases in which only one group is better with segregation. The scenarios identified by *B* represent the cases in which there are two groups better with the implementation of the decentralisation process. It is important to remind here that  $N = N_1 + N_2 + N_3$ , and that  $i \in \{1,2,3\}$ .

The four scenarios are the following.

A1- Group 1 prefers to be in isolation but groups 2 and 3 find advantageous to remain with centralisation. In this scenario, groups 2 and 3 accept a regional arrangement between them if they are compensated for the loss they will suffer when centralisation is abandoned, which is a consequence of letting the group 1 be in isolation.

In this case, given the unanimity voting regime, groups 2 and 3 only accept the secession of group 1 if the group that benefits from segregation redistributes its gains

in order to compensate those that lose from separation. The compensation must be such as to allow that groups 2 and 3 are not worse when they form a region compared with centralisation, thus allowing the group 1 to be segregated.

A2- Group 1 prefers to be in isolation and groups 2 and 3 find advantageous to remain with centralisation, but in this case the two groups that are worse do not find a platform to sustain a region and prefer to be in isolation.

In this case, group 1 has to compensate groups 2 and 3 that also desire to be in isolation. Under this scenario, the nation faces complete segregation.

B1- Groups 1 and 2 are better with decentralisation and accept to form a region as well as to compensate the loss of group 3 that prefer the *status quo*.

In this case, groups 1 and 2 are ready to lose some of their net gain, obtained with regionalisation, in order to compensate for the loss inflicted to group 3 that prefers centralisation. The transfer has to restore the utility level of group 3 as it will be with centralisation. The compensation is only feasible if it still guarantees a positive net benefit to groups 1 and 2.

B2- Groups 1 and 2 are better when each one is in isolation but both compensate the loss felt by group 3 that was better with centralisation.

In this scenario the final outcome is also full segregation, although allowing a transfer from groups 1 and 2 to group 3.

The analysis of the scenarios is presented according to the separation between those cases typified as *A* and those expressed as *B*. The Propositions of this Chapter resumes the main findings of cases *A* and *B*.

Briefly, it can be stated, that when the possibility of compensatory mechanisms is introduced in the model, the decentralisation appears as the natural outcome. After comparing the scenarios, full segregation emerges as the more likely event. In this

framework, those communities that desire to be in isolation, meaning that they have a positive net gain with the change from the *status quo*, would be disposal to transfer some part of the gain to communities that would be worse with decentralisation, in order to ensure that those communities will be, after decentralisation, as well as they were with centralisation. The mechanism of compensations ensures that the Pareto efficiency as well as the stability condition will be reached.

Moreover, the regionalisation is a second-best choice. The definition of a region emerges, as being the preferable institutional arrangement, when the nation has specific characteristics, namely a nation composed of large communities that shares the national space with very small communities. In this special case, the definition of a region is a movement towards Pareto optimum but the stability cannot be guaranteed since communities prefer to be in isolation if they are allowed, rather than to be under regionalisation. This result posits a doubt about the stability of some of the territorial configurations of regions, sometimes extensively discussed and reconfigured in some countries, when regions are seen as an intermediate level between centralisation and full segregation.

### **5.1. Cases in which only one community is better in isolation**

Considering first the scenario A1, then group 1 compensates the utility loss felt by groups 2 and 3, that organise themselves into a region, by the fact that they are no longer under centralisation, their preferred regime. This means, given respectively Proposition 1 and Corollary 1, that  $N_1 > \frac{1}{a}$  as well as  $N_{2,3} < \frac{1}{a}$ .

Even with this compensation group 1 must find advantages in the segregation outcome. This means that its net gains, after the compensatory mechanism, remains positive, although smaller than if such transfer was not necessary.

**Proposition 7:** When group 1 is better in isolation and groups 2 and 3 are institutionally organised into a region, the decentralisation process with compensatory mechanisms is unanimously voted if

$$a > \frac{N(N_2 + N_3 - 2N_1) + N_1(N_2 + N_3)}{N_1(N_2 + N_3)(N_2 + N_3 - N_1)}, \text{ which is accomplished if } N_1 > N_2 + N_3.$$

**Proof:**

See appendix 3.

Considering now the scenario A2, group 1 has to compensate the other groups, which now do not form a region, staying each community in isolation. This scenario will be feasible only if, as in the previous one, group 1 has a positive net benefit after the compensatory transfer.

**Proposition 8:** When group 1 is better in isolation and groups 2 and 3 are also in isolation, the decentralisation process with compensatory mechanisms is

unanimously voted if  $a > \frac{N(N_2N_3 - N_1N_3 - N_1N_2) + N_1N_2N_3}{N_1N_2N_3(N_2 + N_3 - (N + N_1))}$ , which is

accomplished if  $N_1 > \frac{N_2N_3}{N_2 + N_3}$ .

**Proof:**

See appendix 4.

Comparing the results stated in Propositions 7 and 8, the latter holds for smaller values of  $N_1$  than for the former. This means that the values that ensure the veracity of Proposition 7 also verify Proposition 8. The implication of such observation is that the dimension of group 1 that admits the compensation of the loss inflicted to a region also allows for a compensation of the other communities if they are in isolation.

However, considering that Proposition 7 is more demanding than Proposition 8 it implies that the definition of a region is a particular case, that is only expected if there is a significant difference in size between those communities that prefer centralisation and group 1 that desires to be in isolation.

Putting it another way, when group 1 has a dimension not too much differentiated from the other groups, the group prefers to support full segregation rather than having a region that could have a larger dimension than the proper group 1. In the case expressed by Proposition 7, in which group 1 has a dimension that exceeds the dimension of the other groups taken all together, group 1 can prefer to sustain a region rather than support two communities with an excessive reduced dimension.

The analysis above leads to the following Corollary.

**Corollary 6:** Group 1 that prefers segregation supports the definition of a region between groups 2 and 3, that are worse with regionalisation than with centralisation, if  $N_1 > N_2 + N_3$ . Otherwise, the group prefers to support two independent communities.

The definition of a region appears here consequently as a second-best choice.

Analysing the three results above, full segregation is welfare improving, with compensatory transfers, if Proposition 8 is verified. The values that ensure the veracity of the necessary condition of Proposition 7 accomplish integrally the necessary condition of Proposition 8, meaning that Proposition 8 guarantees the sufficient condition for decentralisation to be an improvement towards Pareto optimum. Groups 2 and 3 face the same utility as if there were no decentralisation, implying that at least they do not oppose to the process, since they will be at least as well as they were before decentralisation. Simultaneously, even with the compensation between communities, the group 1 finds itself with a higher utility than if decentralisation did not take place. At the end, nation achieves both efficiency and stability with the decentralisation process based on full segregation.

The compensation of the smaller groups 2 and 3, when organised in a region, is only welfare improving if group 1 is large enough to be superior than the smaller ones taken jointly. The reason for this result is that group 1 will not find any advantage in supporting the utility loss of a region that has a larger dimension, and obviously a higher power, than its own. If group 1 is large enough, either regionalisation between groups 2 and 3 or their staying in isolation will reach a movement towards Pareto optimum. When group 1 has a dimension too much differentiated from the other two groups that encompass the nation, the decentralised regime can assume, either the form of full segregation or the form of a territorial partition between a region and a group in isolation. Both solutions ensure the efficiency condition.

Besides, considering that groups 2 and 3 will be compensated in both cases by the utility loss suffered with the change of the institutional regime, then they can pressure

to be in isolation. This idea can be rejected by group 1 if groups 2 and 3 are effectively too small. In this framework, it is not possible to infer about the stability of a decentralisation process that allows for the definition of a region.

On the next step it is shown the conditions that make two groups that are better with decentralisation accept to compensate the loss that the other group finds when it was not under centralisation. The following proofs accomplish the above scenarios *B1* and *B2*. In these scenarios, two groups, defined as being the groups 1 and 2, accept to compensate the loss inflicted to the third group, the group 3.

## **5.2. Cases in which two communities are better with decentralisation**

The analysis proceeds first with the scenario *B1* in which the groups 1 and 2 accept to join into a region and support the loss that group 3 faces when centralisation is dropped, which leads to the Proposition below.

**Proposition 9:** Even when compensatory mechanisms are allowed, two groups, that are better with the decentralised regime, never prefer to stay in a region to support the utility loss imposed to the third group.

### **Proof:**

See appendix 5.

Considering now the last scenario *B2*, in which groups 1 and 2 remain in isolation but accept co-operatively to compensate for the utility loss imposed on group 3 by the

fact of centralisation having been broken down. The following Proposition states the main finding.

**Proposition 10:** When groups 1 and 2 prefer to be in isolation, full segregation is unanimously voted with compensatory transfers if

$$a > \frac{N(N_2N_3 + N_1N_3 - N_1N_2) - N_1N_2N_3}{N_1N_2N_3(N - N_1 - N_2 + N_3)}, \quad \text{which is accomplished if}$$

$$N_1 < \frac{NN_2N_3}{N(N_2 - N_3) + N_2N_3}.$$

**Proof:**

See appendix 6.

The above Propositions evidence that if two groups are better in isolation they will never form a region. Those groups that prefer to be in isolation will secede and cooperatively will recess the cost that the third group would find by leaving centralisation. The compensation mechanism intends to ensure that with the secession of the two groups that desire to be in isolation, the third group is at least as well as if the decentralisation process was not implemented. Once again full segregation appears both as an efficient and stable solution to the decentralisation process.

The analysis of the present Chapter adopted the perspective of group 1 but the results sustain if the view of another group is considered.

At this point some reflection about the main results is necessary.

Firstly, looking at the theoretical model that Part Three of this dissertation presents, it appears as an evident conclusion that once groups are formed, as

previously assumed, the anticipated knowledge of the value of parameter  $a$  is determinant for the implementation of the decentralisation process. The model accepted that society, by revealing the value of parameter  $a$ , makes possible to evaluate the adequacy of implementing a decentralised institutional form. However, given that the citizens' public good valuation is not observable, the knowledge of the effective value that such parameter takes is a demanding and eventually not precise task. It seems as a final conclusion that depends on the society's capability to truly express their valuation of the public good "government" the determination of the ideal institutional form for a nation: centralisation, regionalisation or complete segregation.

Secondly, in the absence of a compensatory mechanism, the only feasible regimes that achieve both Pareto efficiency and stability are the full segregation or the maintenance of the *status quo*.

Third, when the compensatory mechanism is introduced, full segregation regime appears as a most likely event rather than regionalisation. Effectively, full segregation guarantees both an efficient and stable outcome. The configuration of a region emerges as a particular case, in which stability could not be sustained, although reaching efficiency. The definition of a region is seen, then, here as an intermediate solution and a particular one because it is only desired if two highly small groups share a nation with a group that is extremely large compared with the other ones.

## **6. Concluding remarks**

The partition of the world in nations has faced an enormous change during the last fifty years. Nations of great dimension have been successively breaking up into nations of smaller dimension. Simultaneously, the power management in each nation has been gradually shared with sub-territorial units, leading to a growing process of decentralisation. The subsidiary principle broadly defended as a way to approach political power to citizens and improve the adequacy of political decisions to citizens' preferences has definitely played an important role.

Many of the theoretical models on the territorial configuration into jurisdictions have relied on a majority voting mechanism, which allows for a unilateral secession. Such unilateral behaviour can be welfare reducing if some territorial units prefer to remain under centralisation. Thus, the majority voting does not ensure the Pareto criterion, since after the decentralisation process, some communities can find themselves worse than with centralisation. At the same time, given that secession by a community without the agreement of the other communities generates a cost to some of them, it induces instability in the configuration of the territorial partition in jurisdictions.

The voting issue is not commonly analysed and the inherent implications of a unanimity voting are frequently discarded. The unanimity voting only admits any change from a departure situation if no community finds itself worse after the change than in its absence, which is a social advantage compared with the majority voting. The unanimous voting guarantees, in this sense, both a step towards the Pareto optimum and a national stable equilibrium.

The voting by unanimity implies the definition of a redistribution mechanism between those communities that finds an increase in individual utility with the territorial partition into sub-units to those communities that face a reduction in individual utility, in order to achieve feasibility for a process leading to the definition of jurisdictions.

The third part of this dissertation discusses the implications of moving from a centralised regime to a decentralised one for the provision of a public good defined as “government”. In this sense, a *status quo* is compared with two alternative solutions to implement a process leading to decentralisation: full segregation or an intermediate solution where a region and a community in isolation share a national territory.

The conclusions of this part can be split into two categories. On the one-hand the theoretical model analyses the allowed form of decentralisation when the compensatory mechanisms are not considered or not admissible by communities. On the other-hand, considering the existence of transfer mechanisms, the model presents alternative combinations of communities which origin the possibility of having full segregation or regionalisation.

When the compensatory mechanisms are not considered, a nation with three types of individuals only accepts one of the following institutional organisation forms for the “government” provision: full segregation or centralisation.

The partition of the country into three communities is only possible, giving the unanimous voting mechanism, if to have three “governments” is welfare improving, *i.e.*, all groups that encompass the nation find themselves better with full segregation than with centralisation. This outcome satisfies simultaneously the criterion of efficiency, in accordance with the established by the Oates’ Decentralisation

Theorem, as well as the criterion of stability, since there is no territorial arrangement that would increase individual utility.

Given the absence of compensation between communities, none solution besides centralisation is welfare improving if at least one community prefers to remain under the *status quo*. In this special case there is no room for either regionalisation or segregation.

The alternative hypothesis of territorial organisation is more diversified when the compensatory mechanisms between communities are allowed for in the theoretical model.

If one group prefers to be in isolation, then it is so because it finds a positive net benefit. That benefit should be shared with the other group(s) that suffer(s) a cost with the fact of such group being in isolation. This means that the former group(s) should transfer some of the net benefit achieved to the other group(s) in order to guarantee that the decentralisation process leads to a welfare improvement.

The results present in the previous Chapters allow to conclude that full segregation, with a system that considers a mechanism of transfers, is the first-best choice, given that in such regime efficiency is attained without penalising the results on stability. The regionalisation appears as a second-best choice, whose feasibility is only expected when there is a group with an extreme difference in dimension from the other two groups.

The theoretical model presented finds evidence that the tendency is for full segregation to be beneficial compared with intermediate forms of decentralisation such as the definition of regions. The results found put in question the adequacy of implementing several regions in Portugal. It seems that dimension is effectively a central issue when the definition of the most reasonable form of decentralisation is

evaluated. From the theoretical model it can be stated that regions is only a desired institutional organisation if communities in isolation are extremely small to manage the public good “government”. Such evaluation has not been done yet.

## Appendix 1:

Returning to the “control” and the “scale-economies effects”, given as

$$A = aG\left(1 - \frac{N_i}{N}\right) \text{ and } B = F\left(\frac{1}{N_i} - \frac{1}{N}\right),$$

then the maximisation of the net benefit of segregation is evaluated through the analysis of the curves that measures the two effects.

Using  $\mu_i = \frac{N_i}{N}$  and analysing the slope of both effects the following conditions are found:

$$\frac{dA}{d\mu_i} = -aG \text{ and } \frac{dB}{d\mu_i} = \frac{-F\mu_i N - F(1 - \mu_i)N}{\mu_i^2 N^2} = -\frac{F}{\mu_i^2 N}.$$

The group size that maximises the net gain of segregation is given as

$$\left| \frac{dB}{d\mu_i} \right| = \left| \frac{dA}{d\mu_i} \right|.$$

Solving this, then it becomes  $\frac{F}{\mu_i^2 N} = aG$ .

Equivalently, it can be stated as  $\mu_i^2 = \frac{F}{NaG}$ .

Using the identity  $G = F$ , the following solution is found:  $\mu_i^2 = \frac{1}{aN}$ . This leads to

the following results,  $\mu_i = \sqrt{\frac{1}{aN}} \vee \mu_i = -\sqrt{\frac{1}{aN}}$ .

Discarding the negative result since it violates the initial assumption that  $\mu_i > 0$  then segregation brings a maximum utility to individuals when group  $i$  has a

dimension equal to  $\mu_i^* = \sqrt{\frac{1}{aN}}$ . □

## Appendix 2:

The analysis of the comparative net benefit between the formation of a region over centralisation and segregation over centralisation is found through the analysis of the difference between  $A'$  and  $B'$  effects, *i.e.*,  $A'-B'$ , correspondent to the left hand side of the inequality (4.4) and, the difference given as  $A-B$ , represented by the right-hand side.

$$aG\left(\frac{N_i}{N_i+N_j}-\frac{N_i}{N}\right)-aG\left(1-\frac{N_i}{N}\right)\geq F\left(\frac{1}{N_i+N_j}-\frac{1}{N}\right)-F\left(\frac{1}{N_i}-\frac{1}{N}\right)$$

Equivalently,

$$aG\left(\frac{N_i}{N_i+N_j}-1\right)\geq F\left(\frac{1}{N_i+N_j}-\frac{1}{N_i}\right) \quad (\text{A.2.1})$$

Using the equality  $G = F$ , the inequality (A.2.1) becomes

$$\frac{aN_i}{N_i+N_j}-a\geq\frac{1}{N_i+N_j}-\frac{1}{N_i}.$$

After some rearrangements it can be re-written as

$$aN_iN_i-aN_iN_i-aN_iN_j\geq N_i-N_i-N_j$$

Solving it in order for the parameter  $a$ , it becomes  $a\leq\frac{1}{N_i}$ .

As a consequence, segregation is always welfare improving compared to the definition of a region when  $a>\frac{1}{N_i}$ . □

### Appendix 3:

For the decentralisation process to be feasible, group 1 has to compensate the loss in utility felt by groups 2 and 3 when they change from the *status quo* to the configuration of a region.

The compensatory transfer, using the expression (4.3) that states the utility loss observed when a group moves from centralisation to regionalisation, is then given by

$$C_{A1} = aG \left( \frac{N_2}{N_2 + N_3} - \frac{N_2}{N} \right) + aG \left( \frac{N_3}{N_2 + N_3} - \frac{N_3}{N} \right) - 2F \left( \frac{1}{N_2 + N_3} - \frac{1}{N} \right)$$

Using (3.1) that expresses the net gain of group 1 when it was in isolation and the symmetric of  $C_{A1}$ , the problem is now given as

$$aG \left( 1 - \frac{N_1}{N} \right) - F \left( \frac{1}{N_1} - \frac{1}{N} \right) - C_{A1} > 0 \quad (\text{A.3.1})$$

Stating  $G = F$  and solving it in order for parameter  $a$ , inequality (A.3.1) becomes

$$a \left( NN_1(N_2 + N_3) - N_1N_1(N_2 + N_3) - NN_1N_2 + N_1N_2(N_2 + N_3) - NN_1N_3 + N_1N_3(N_2 + N_3) \right) - N(N_2 + N_3) + 2NN_1 - N_1(N_2 + N_3) > 0$$

Equivalently,

$$a \left( N_1(N_2 + N_3)(N_2 + N_3 - N_1) \right) > N(N_2 + N_3 - 2N_1) + N_1(N_2 + N_3)$$

The condition is given, then, as

$$a > \frac{N(N_2 + N_3 - 2N_1) + N_1(N_2 + N_3)}{N_1(N_2 + N_3)(N_2 + N_3 - N_1)}. \quad (\text{A.3.2})$$

Analysing inequality (A.3.2), the following observations can be made.

From Corollary 1 it is known that parameter  $a$  has to be strictly positive. Simultaneously, according to the scenario established in A1, groups 2 and 3 are

smaller than group 1, because  $N_1 > \frac{1}{a}$  and  $N_{2,3} < \frac{1}{a}$ .

The conditions assumed under the scenario A1 imply that  $N_2 + N_3 < 2N_1$ , thus stating a negative numerator. For parameter  $a$  to be strictly positive it is then necessary to ensure a negative denominator. In this sense, the necessary condition for inequality (A.3.2) to hold is given by

$$N_2 + N_3 < N_1. \tag{A.3.3}$$

Under scenario A1, group 1 in isolation finds an advantage when compensates the other groups that organise themselves into a region if its dimension is higher enough to be bigger than the region.  $\square$

#### Appendix 4:

Under the scenario A2 group 1 has to transfer an amount to other groups that ensures them in isolation the same utility as if they were with centralisation.

This implies that, using expression (3.1), the compensation is now given by

$$C_{A2} = aG\left(1 - \frac{N_2}{N}\right) - F\left(\frac{1}{N_2} - \frac{1}{N}\right) + aG\left(1 - \frac{N_3}{N}\right) - F\left(\frac{1}{N_3} - \frac{1}{N}\right)$$

The problem translates then in the following inequality:

$$aG\left(1 - \frac{N_1}{N}\right) - F\left(\frac{1}{N_1} - \frac{1}{N}\right) - C_{A2} > 0 \quad (\text{A.4.1})$$

Using the identity  $G = F$  and solving it in order for parameter  $a$ , (A.4.1) is re-written as

$$a(-N_1N_1N_2N_3 + N_1N_2N_2N_3 - NN_1N_2N_3 + N_1N_2N_3N_3) > NN_2N_3 - NN_1N_3 - NN_1N_2 + N_1N_2N_3$$

After some rearrangement it becomes

$$aN_1N_2N_3(N_2 + N_3 - (N + N_1)) > N(N_2N_3 - N_1N_3 - N_1N_2) + N_1N_2N_3.$$

Thus, the values that make the inequality (A.4.1) to hold is given by

$$a > \frac{N(N_2N_3 - N_1N_3 - N_1N_2) + N_1N_2N_3}{N_1N_2N_3(N_2 + N_3 - (N + N_1))}. \quad (\text{A.4.2})$$

Looking at expression (A.4.2), it can be seen that the denominator is negative since  $N + N_1 > N_2 + N_3$ . So, for parameter  $a$  to be strictly positive, as necessary according to Corollary 1, the numerator has to fulfil the following condition

$$N_1(N_2 + N_3) > N_2N_3.$$

Solving it in order for  $N_1$ , the necessary condition for inequality (A.4.2) to hold is given by

$$N_1 > \frac{N_2 N_3}{N_2 + N_3}. \tag{A.4.3}$$

□

## Appendix 5:

Under the scenario  $B1$ , groups 1 and 2 compensate the utility loss of group 3, expressed by expression (3.1), given as

$$C_{B1} = aG\left(1 - \frac{N_3}{N}\right) - F\left(\frac{1}{N_3} - \frac{1}{N}\right)$$

The condition that ensures the feasibility of the compensatory mechanism from groups 1 and 2 to group 3 is expressed as

$$aG\left(\frac{N_1}{N_1 + N_2} - \frac{N_1}{N}\right) + aG\left(\frac{N_2}{N_1 + N_2} - \frac{N_2}{N}\right) - 2F\left(\frac{1}{N_1 + N_2} - \frac{1}{N}\right) + C_{B1} > 0 \quad (\text{A.5.1})$$

Using the identity  $G = F$  and after some rearrangement the inequality (A.5.1) is now given as

$$aN_3(NN_1 - N_1(N_1 + N_2) + NN_2 - N_2(N_1 + N_2) - N(N_1 + N_2) + N_3(N_1 + N_2)) > 2NN_3 - N_3(N_1 + N_2) - N(N_1 + N_2)$$

Simplifying the expression it becomes

$$aN_3(N_3 - N_1 - N_2)(N_1 + N_2) > N(2N_3 - N_1 - N_2) - (N_1 + N_2)N_3$$

The parameter  $a$  must satisfy, then, the following condition:

$$a > \frac{N(2N_3 - N_1 - N_2) - (N_1 + N_2)N_3}{N_3(N_3 - N_1 - N_2)(N_1 + N_2)}. \quad (\text{A.5.2})$$

In this scenario if groups 1 and 2 prefer to be under decentralisation this means, according to Proposition 1, that  $N_{1,2} > \frac{1}{a}$ . Simultaneously, for group 3 the Corollary 1

holds, *i.e.*,  $N_3 < \frac{1}{a}$ .

The conditions assumed regarding the correspondent group's dimension make the denominator to have a negative sign, given that in this scenario  $N_3 < N_1 + N_2$ . Then,

for the parameter  $a$  to be strictly positive, the numerator has also to have a negative sign.

This is equivalent to impose that  $N(2N_3 - N_1 - N_2) < (N_1 + N_2)N_3$ . The inequality (A.5.2) is satisfied if, equivalently, it was stated that  $N < \frac{(N_1 + N_2)N_3}{2N_3 - N_1 - N_2}$ .

Since by definition  $N$  is positive, then the following condition has to be accomplished  $2N_3 - N_1 - N_2 > 0$ . The inequality can be equally expressed as

$$N_3 > \frac{N_1 + N_2}{2}.$$

Given that group 3, in this scenario, is worse with the definition of communities, then its dimension cannot be superior to either group 1 or group 2, since if it was true group 3 would also prefer segregation, facing a gain instead of a loss. Thus, a contradiction is found, meaning that the dimension of group 3 does not induce groups 1 and 2 to be in a region rather than in isolation. This implies that inequality (A.5.2) cannot be accomplished, meaning that group 1 and 2 never organise themselves into a region when they have a higher net gain with full segregation.  $\square$

## Appendix 6:

The compensation mechanism is equal to the transfer considered in scenario  $B_1$ ,  
*i.e.*,

$$C_{B1} = C_{B2} = aG \left( 1 - \frac{N_3}{N} \right) - F \left( \frac{1}{N_3} - \frac{1}{N} \right).$$

The condition that makes groups 1 and 2 to transfer some of their net benefits to group 3 is given as

$$aG \left( 1 - \frac{N_1}{N} \right) - F \left( \frac{1}{N_1} - \frac{1}{N} \right) + aG \left( 1 - \frac{N_2}{N} \right) - F \left( \frac{1}{N_2} - \frac{1}{N} \right) - C_{B2} > 0. \quad (\text{A.6.1})$$

After some rearrangements and using once again  $G = F$ , the inequality (A.6.1) can be translated in the following one

$$aN_1N_2N_3(N - N_1 - N_2 + N_3) > N(N_2N_3 + N_1N_3 - N_1N_2) - N_1N_2N_3$$

Solving it in order for the parameter  $a$ , the condition that satisfies the constraint that groups 1 and 2 find a positive net gain when compensate the loss faced by group 3 by leaving centralisation is given as

$$a > \frac{N(N_2N_3 + N_1N_3 - N_1N_2) - N_1N_2N_3}{N_1N_2N_3(N - N_1 - N_2 + N_3)}. \quad (\text{A.6.2})$$

Analysing the inequality (A.6.2) it can be seen that the denominator is positive. Then, for the parameter  $a$  to be strictly positive the numerator has also to have a positive sign.

This implies that the following inequality has to be satisfied

$$NN_3(N_1 + N_2) > NN_1N_2 + N_1N_2N_3. \quad (\text{A.6.3})$$

Solving it in order for  $N_1$ , the expression (A.6.3) becomes

$$N_1(NN_2 + N_2N_3 - NN_3) < NN_2N_3 \text{ and } N_2(NN_1 + N_1N_3 - NN_3) < NN_1N_3$$

which leads to

$$N_1 < \frac{NN_2N_3}{N(N_2 - N_3) + N_2N_3}.$$

This condition ensures that the two groups still have a positive net gain, after the compensatory transfer. □

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## **FUTURE LINES OF RESEARCH**

A PhD dissertation is only a step in the long-way that a researcher has to follow. The taste and incentive for the deepening of knowledge accompanies the researcher during his/her academic career.

This dissertation, composed of three parts, is not a closed document, in the sense that allows future development of the analysed issues. In fact, there is a space for further developments and extensions in the future.

Some of the future lines of research that could be explored in each of the parts that encompasses this dissertation are identified below.

The exposed directions of development to each part do not intend to be exhaustive, but only to be a point of reflection for future routs that a research in the field of Public Economics and Political Economy can open.

The theoretical model presented in the first part allowed the possibility that each incumbent can be a candidate in all the election periods. However, if a nation has a constitutional constraint defined in a term-limit, then incumbency at some point appears an impossible event, thus leading to a zero re-election chance in that period. In spite of that the incumbent knows that after a period in which she is unable to have a tenure, in the subsequent electoral period she can be a candidate to the exercise of the budget management again. How this interruption in tenure possibilities constrains the incumbent behaviour is not explored in the theoretical model. The evaluation on the budget bias composition resulting from an irregular incumbency over periods, given the limitation of candidate to run on elections after some time in the exercise of power emerges as an interesting point for future research.

The re-election chances appear in the theoretical model described in Part One as being an outcome of two tenure periods in office, *i.e.*, after incumbent's choices on both budgets (post-election period and pre-election period). However, it is reasonable to think that voters form an opinion about incumbent's performance in the middle of her staying in office. Putting it differently, re-election chances between the first half and second half periods are not the same. The question that arises now is: Does the existence of popularity differential given by different re-election probability at the end of post-election period do constrain the political budget cycle width that arises in pre-election period?

Any government has a critical popularity level that is a function of the forthcoming election nearing. If a government feels electorally safe, *i.e.*, with a surplus over its critical popularity level, the government evidences a differentiated behaviour rather than when the government holds a popularity deficit. This reflection could lead to a model re-evaluation in order to accommodate the scenario in which the popularity level achieved in post-election period constrains the second budget tenure's options. Such evaluation will be left for future research.

The introduction of the second state of nature in the first part: the hypothesis of the incumbent's election defeat emphasises the question that an incumbent usually does not have a short sight perspective of her future. In this sense, the incumbent evaluates her performance while in office looking also for its implications on her uncertain future, because re-election is not guaranteed.

The question that emerges is that a narrow or wider political budget cycle should be expected when it is considered an incumbent who does not care about the consequences of the defeat scenario, thus without evidencing any reputation concern.

It also seems an issue to be developed in the future.

An interesting issue for further developments of the second part is to evaluate the effects on budget that arise from the monitoring control that the Maastricht Treaty and the Stability and Growth Pact impose. Although the central governments face a restraining force imposed by the fiscal regime that elapses from EMU and leads to a reduction on the size of public finances and consequently on expenditures, the government maintains the flexibility to select the composition of public expenditures according to the electoral agenda.

The evidence of an electoral cycle on the expenditure size may vanish along the time imposed by the referred restraining forces. However, that pressure cannot be felt when analysis is focused on the weight each type of public expenditures has on budget. A test for a structural break in series related with the impact of the Stability and Growth Pact appears necessary to check if electoral budget cycles in the composition of public expenditures have in fact changed after the imposition of a European Union budget control.

The theoretical model described in the third part of this dissertation considers that communities interact co-operatively in order to obtain an efficient and stable institutional organisation to provide the public good “government”. However, when there are two communities that are better under decentralisation and one is worse under such regime, the compensatory mechanism can be guaranteed by only one of the communities that prefer decentralisation, if the second opts to free ride. This incentive to be out of the compensatory mechanism introduces another problematic that is driven away from the theoretical model described in this part. The problematic is the non-cooperative behaviour between communities when more than one has the obligation to compensate the losses inflicted in utility of the other group. Some of the

main findings of this part may change when the non-cooperative behaviour of communities is taken into consideration.

Further, the theoretical model assumes that the groups that prefer centralisation accept to be compensated by the loss they have on utility by the fact of abandoning the *status quo* in order not to be worse under decentralisation. However, given the unanimous voting mechanism nothing prevents those communities with power to block the decentralisation process from asking for more than that. This hypothesis is a very likely one and the introduction, in the theoretical model, of such constraint appears as being an area with space for future developments.

Another possible extension for the theoretical model introduced in this part is to consider that the parameter  $a$  is not an observable value, thus remaining as private information of each community, meaning that such parameter could be heterogeneous across groups instead of the homogeneous hypothesis considered in this part.

## GENERAL CONCLUSIONS

This dissertation comprehends three parts. The dissertation is classified under the Economics research area and establishes a relationship in the following research areas: public finance and political economy.

For each of the three parts that comprise the dissertation, a different question is addressed.

In an attempt to obtain an answer for each of the questions raised, the essential dilemma of public choice theory was considered and served to guide inherent discussion towards possible answers.

As such, on the one hand, detaining agents of political decision power are not directed exclusively by benevolent motivations towards the common good of society, as social welfare theory suggests. On the other, selfish interests do not solely guide agents of political action.

This dissertation looks to relate these two approaches by suggesting an integrated vision of the problem of the process leading to political decision-making.

Politically-induced manipulation of the public budget mix is analysed in the first part of the dissertation. Some literature on political budget cycles justifies manipulation in terms of asymmetry of information between the two intervening agents in the political process; often the incumbent has privileged information compared with voters. In parallel, the common approach adopted in analysing the opportunistic manipulation of the public budget according to an electoral agenda considers absolute values.

The theoretical model proposed in Part One raises the following questions. Is a politically-induced manipulation of the public expenditure composition expected if the incentive introduced by asymmetric information ceases to exist, *i.e.*, if the model

considers complete information? Is there be wide consensus about the increase of public expenditures around elections when its composition is analysed, hence that some categories of public expenditures are more electorally manipulated as elections draw nearer? The main findings from the first part of the dissertation state a definite yes to these questions.

Even when the incumbent does not have privileged information, an incentive to manipulate the public budget remains, thus generating a bias towards some categories of public expenditures. This is so because future incumbency is an uncertain event, meaning that in the next electoral period there is a possibility that the incumbent could be defeated. Therefore, the incumbent will try to maximise his or her own utility while in office, subject to constraints imposed by voter preferences regarding the public expenditure composition. The categories of expenditures do not provide the incumbent with equally distributed privileges over time. Current expenditures bring utility in the same period they are achieved, while capital expenditures require a one-period delay in order to provide utility. By understanding this difference, the incumbent has an incentive to manipulate the public budget composition prior to elections prone to current expenditures, thus inducing a public budget bias.

The model presented in the first part identifies the incumbent as having two priorities: to be re-elected and to acquire reputation, which is determinant if defeat occurs. In this sense, the incumbent has selfish interests that surpass other benevolent interests. In conserving one's reputation, which is determined by society at large and not exclusively by voters, the incumbent also faces a constraint imposed by society's preferences over the composition of the public expenditures. The model shows that when voters constitute a significant share in society, the incumbent manipulates the public expenditure composition towards those categories that are more preferred by

voters. The opposite occurs when a society has a smaller number of participating electors, reducing the incumbent's incentive to spend more in those public expenditure categories that favour voters. We observe that in these cases, other categories are taken up that benefit society at large.

The second part of the dissertation attempts to evaluate the adequacy of the theoretical model in terms of the predictions originally established in the first part under a framework confronted with contrasting literature on electoral manipulation of public budget. Although in developing countries the political budget cycles are identified as common practice, there are some controversial results when the analysis reverts to developed countries, namely, European Union countries.

As a consequence, the second part of the dissertation sets up the following questions. Does the European Union have an opportunistic political budget cycle induced by elections? Is there a manipulation of the public expenditure composition prior to elections that are more prone to some categories, hence generating a bias on the budget mix, as anticipated by the theoretical model?

Using the recent econometric technique, the Pooled Mean Group estimator, the second part supports the theoretical predictions in the European Union set of countries. Firstly, governments of the European Union do manipulate the budget mix when the timing of elections approaches. Secondly, a wider difference between the number of individuals in society and those that vote induces a decrease in the manipulation of public expenditures prone to the expenditures categories preferred by voters.

Part Three of the dissertation introduces a theoretical model that compares the most adequate institutional organisation to provide "government", as a public good, when a nation has territorial partition in three well-defined communities, with different sizes and heterogeneous preferences between them in terms of public good value.

Departing from territorial organisation without autonomous communities ruled out by a centralised government, the implications of implementing a process of decentralisation can assume two forms: full segregation or regionalisation. The full segregation scenario implies the emergence of three governments while regionalisation is based on two governments. The regionalisation hypothesis is discarded in many previous works in the political economy configuration of jurisdictions. Its inclusion leads to some interesting results.

Discussion and analysis that follow in the third part considers a constitutional framework that imposes a unanimous vote turnout for any change to the *status quo*, an approach not widely used in the literacy field which relies essentially on the majority-voting rule.

Bearing in mind the above framework, the third part explores the following questions. How do we establish an ideal institutional organisation that is able to simultaneously achieve economic efficiency and stability? Does the answer change when a transfer mechanism between communities is introduced? Is there always room for a decentralisation process that configures regionalisation?

The theoretical model demonstrates that firstly, in the absence of compensatory mechanisms between communities, the only feasible regimes are either centralisation or full segregation. These regimes fulfil both the efficiency and stability conditions. Secondly, when transfer mechanisms are introduced and communities that are better under decentralisation compensate communities that are worse, the two decentralised regimes appear as feasible, which can be either full segregation or regionalisation. However, the first-best choice is full segregation, as in the case of absence of transfers. Regionalisation emerges as a second-best choice and occurs when a larger community has to divide with two smaller communities, within the same national territory.

Interestingly, while full segregation ensures the Pareto optimum and a stable solution, a region tends to be unstable because the two communities that merge prefer to be in isolation rather than be aggregated.

This dissertation offers insight into the way that politicians manage political power and, how the desire to adjust differences in terms of preferences guides political power. The former case corresponds to Parts One and Two of the dissertation while Part Three examines the latter.

In the three parts presented, the exercise of political influence is led by selfish interests rather than by benevolent ones. The rationality of decision-making rely essentially on an individualistic perspective, leaving aside the most desired level of welfare for a society. The first part of the dissertation describes a distortion mechanism brought by elections and the opportunistic view of those that have the political power to decide how much of the public expenditure budget to spend on each category, for each period. The third part of the dissertation presents a model that directly gives voice to the population. A direct democracy perspective rather than a representative one determines “government” supplies as a choice of citizens.

The three parts point out that there is no such thing as decisions in the political economy framework that are completely isolated from individual interests because politics are made by men and women that hold specific convictions in terms of own priorities, which are not separate from their individual preferences. Such behaviour can be more or less prominent but is invariant in the political decision process. Efficiency and stability are not easy tasks to accomplish under this framework, since individuals that comprise a society are heterogeneous, holding different hierarchy of priorities and interests.

The role of public economics and political economy fields of research on the issue is to contribute towards the diagnostics of such realities and to propose ways to minimise some of the consequences that emerge from inefficiency in the economy, that appear as inevitable. This aim should guide political decisions in order to reach a better political and economic environment as well as achieve improved society welfare.