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Political Budget Cycles and Politicians' Rents of Being in Power

Some Evidence Using a Dynamic Panel Approach with Italian Regional Data

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- Abstract

This work uses two qualitatively different panel sets of Italian regions' data from 1997 to 2007 in order to examine the relation between fiscal *Ente regionale's* policy and elections. By implementing the GMM estimator developed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998), evidence of an increase of spending of the aforementioned institutions has been detected, supporting the hypothesis of existence of political budget cycles at this sub-national level of government.

However, the abovementioned phenomenon does not arise throughout the considered sample but, as supposed by Shi and Svensson (2006) and Persson and Tabellini (2002), there seems to exist a correlation between higher spending and some institutional features of a territory, ultimately pointing to different levels of rent extraction's activity of incumbents.

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“Vorrei inoltre ringraziare, e questo in italiano,
i miei genitori,
mio fratello oggi lontano,
Carolina perché il suo entusiasmo”entusiasma anche me”,
tutti gli ‘amici miei’, vicini e non,
il professor Puccinelli P.,
per aver contribuito a farmi diventare la persona che sono quest’oggi. Grazie.”

"General Possibility Theorem: if there are at least three alternatives which the members of the society are free to order in any way, then every social welfare function satisfying Condition 2 and 3 and yielding a social ordering satisfying Axioms I and II must be either imposed or dictatorial. […].

Theorem 2 shows that, if no prior assumptions are made about the nature of individual orderings, there is no method of voting which will remove the paradox of voting […], neither plurality voting nor any scheme of proportional representation, no matter how complicated. Similarly, the market mechanism does not create a rational social choice."

Arrow J. K., *Social choice and individual values*

Contents

-1) Introduction

A great deal of the studies concerning the topic of electoral fiscal policy cycles builds on the paradigms put forward by Nordhaus (1975), Buchanan and Wagner (1977) during the 1970s. From these scholars' works, three central aspects, which have been used across several studies, have emerged.

Firstly, policymakers are assumed to be interested in remaining in charge and gaining votes for themselves and their political parties.

Secondly, voters reward government spending either because of the possible positive effects of more extended public programs (i.e. welfare benefits, economic incentives for firms, etc.) or because of macroeconomic expansions due to enhanced expenses[1]. Such a voting behaviour thus creates strong incentives for politicians to boost the economy in order to appear to be 'well performing' before elections.

Thirdly, in these early works, voters are characterized by 'fiscal illusion'[2] and so continually fooled about future costs of loose public resources spending.

However, the feature of rational voters not able to learn future consequences of higher public expenditures independently from past electoral rounds' experiences has been strongly criticized in the literature. In a recent survey about political economy of fiscal deficits, Eslava (2011) describes as quite unreasonable the hypothesis of voters repeatedly teased by politicians and unable to comprehend the government's budgeting choices. Moreover, the government's ability to bring about direct macroeconomic improvements through fiscal manipulations has been considered another drawback of the very first literature. Indeed, "*the lack of convincing evidence*

[1] Eslava (2011), p.647.

[2] This concept revolves around the proposition that *"the true costs and benefits of government may be consistently misconstrued by the citizenry of a given fiscal jurisdiction"* (Dollery, Brian and Worthington, Andrew 1996, p.261).

for a political business cycle led researchers to focus on political cycles in fiscal aggregates (election-year increases in deficits and expenditures or cuts in taxes)"[3].

Later researches have tried to explain then why rational voters would be willing to elect an incumbent regardless of social costs of running opportunistic deficits or reckless spending. Furthermore, they have focused on hypotheses whereby the electorate may care about fiscal outcomes directly and not for their macroeconomic implications[4]. An effort to take into account the presented issues has been carried out by Rogoff and Sibert (1988) by modelling fiscal cycles *"as an equilibrium signalling process"*[5] and adding temporal information asymmetry between players. In their paper, 'competency of the official' is not fully available to the electorate at the beginning of the game: the information the electorate receives about incumbents' ability is actually lagged. Hence, because of this information asymmetry, a policymaker can induce a fiscal expansion (which reflects in higher supply of public goods and transfers)[6] as the election year is approaching, in order to 'signal' higher capabilities. In fact, incumbent whom provides more government programs is inferred to be more capable by the electorate, and then rewarded at the polls.

However, in the attempt to sketch a more realistic image of the political budget cycle phenomenon together with its causes, further key concepts and comments have been recently brought to light (although not fully appreciated yet) by scholars. In particular, as Eslava (2011) points out, in order to explain how rational manipulation of fiscal deficit can be possible, the models should take into account other elements: *"voters must be unable to observe all the details of the budget",*[7]or at least some individuals need to be uninformed about fiscal imbalance. Eslava's argument is logical: if information about the budget was perfect, a policymaker's ability might be

[3] Brender and Drazen (2008), p. 2203.
[4] Eslava (2011), p.648.
[5] Rogoff and Sibert (1988), p.1.
[6] Brender and Drazen(2008), p.2203.
[7] Eslava (2011), p. 648.

anticipated directly by observing this type of information. According to Alt and Lassen (2006) [8], a lack of clear and transparent[9] accounting practices (which can help both voters and authorities in the task of controlling policymakers' operating) could realistically create such asymmetry. Besides, not 'rugged' budget institutions seem to be further elements needed by politicians to tilt the budgeting process[10], particularly when sub-national instead of national governments are considered.

This last observation seems to be supported by recent findings of Bank of Italy's researchers about political budget cycles. Cioffi *et al.* (2012) consider a wide range of observations covering 8100 Italian municipalities[11], for a nine-year period (1998-2006), using both 'capital' and 'total per capita spending' as dependent variables in their econometric specifications. In all of the regressions run, proof of the existence of a manipulation of public spending was detected. However, as it is stressed by the authors commenting on their own results, obscure accounting processes together with ineffective expenditure limits are likely to be at the basis of the existence of potential fiscal imbalances. Referring to budget rules, the behaviour of the sub-national

[8] According to Alt and Lassen (2006) a greater level of transparency should ease the task for observers to distinguish real efforts of the incumbent from his opportunistic behaviours. In order to test such hypothesis empirically, a 'Transparency index' exploiting information about nineteen countries from questionnaires sent to all Budget Directors of OECD member states, is then defined. This indicator is scaled from 0 for the lowest transparent country, to 11 for the highest one: the sample is thus split up in 'higher transparency countries' and 'lower transparency countries' according to the value of the index. To the question "Is there an electoral cycle in fiscal balance, and is it diminished where transparency is higher?", according to the paper's findings a positive answer is provided.

[9] *"Fiscal transparency is defined … as openness toward the public at large about government structure and functions, fiscal policy intentions, public sector accounts, and projections. It involves ready access to reliable, comprehensive, timely, understandable, and internationally comparable information on government activities … so that the electorate and financial markets can accurately assess the government's financial position and the true costs and benefits of government activities, including their present and future economic and social implications"* (Kopits and Craig 1998, p. 1 in Alt and Lassen 2006)

[10] In a notable study, findings by Von Hagen (1992-2005) seem to confirm the linkage between "*flexibility of execution"* (depending on the binding power of the budget law), and transparency , with better fiscal performances of a government. To similar conclusions even Alesina et al. (1996) considering budget institutions and fiscal discipline for Latin America's countries.

[11] This is the lowest Italian level of government. Likewise to Besley and Case (1995, 2003), a sub-national dimension is considered.

governments in Italy, both at regional and municipal levels, is subject to the rules stated in the *Patto di stabilità interna*[12]. Introduced in 1999, it requires regional and local governments to reach expenditure targets and/or budget balances and is enforced through a system of sanctions and incentives for compliance. *"However, no evidence is available on the effective implementation of these sanctions, and this is likely to have undermined the credibility of the Domestic Stability Pact, together with the fact that the rules have changed frequently over time."*[13]

In order to understand the nature of the incentives that may lead an incumbent to undertake opportunistic behaviours before an electoral round, some clarifications about types of economic policies need to be made. Persson and Tabellini (2002) group different policies on the basis of the benefits' receivers. A policy may have beneficial implications for a large part of inhabitants, on a narrower group of individuals, or on specific group of politicians. Providing general public goods and wide redistributive programs (e.g. pensions, health care) is a typical example of policy whose effects are enjoyed by a large part of the citizens. Local public goods or specific redistributive programs (e.g. transfers to enterprises, agriculture subsidies) are instead examples of policies with a smaller part of individuals as beneficiaries. These latter types of spending are referred to as 'pork barrel' and they often reflect discretionary policy decisions.

The third type of economic policy instead, generates direct rents to politicians. It can take several forms: *"literally, they are salaries for public officials or the financing of political parties. Less literally, one can consider various forms of corruption and waste as ultimately providing rents for politicians"*[14].

Moreover, *"rents for politicians are at the core of the political agency problem,*

[12] Domestic stability pact. See section 2 for details about the pact for Italian regions.
[13] Cioffi *et al.* (2012), p. 11.
[14] Persson and Tabellini (2002), p.20.

pitting voters as large against politicians (or other government officials)"[15]; easy-extra profits in fact, clearly represent a strong motivation encouraging the incumbent to fiscal indiscipline to remain in office.

Some evidence corroborating the linkage between politicians' opportunistic behaviour and personal rents can be found in Shi and Svensson (2006).

The authors define a moral hazard model where incumbent concerns about own career and then is willing to signal high capabilities to voters before elections[16]. In *t*, election period, current competence (shock) is calculated by the electorate as sum of quantity of public goods g_t less total optimal taxes τ_t^* , deficit d_t and competency (shock) showed by the policymaker the year before[17] $\mu_{i,t-1}$:

(1) $\mu_t = g_t - \tau_t^* - d_t - \mu_{t-1}$

and the probability of get re-elected depends on the value μ_t : the higher is the signal (i.e. incumbent's skills in *t*), the higher is the chance of being voted. All agents are expected utility maximizers.

At this point, two key assumptions are need. First, a share of 'uninformed voters' $(1-\sigma)$, namely a part of the electorate which is not able to exactly determine the

[15] *Ibidem.*.

[16] One can think voters' set as containing the electorate as well as other individuals, *observers* (Alt and Lassen 2006, p.1) interested in evaluating incumbent's performances and so, call to "vote" (judge) for her/his conduct at the end of the legislature (for instance, at a sub-national level of government an incumbent may be interested to signal greater capabilities to higher levels of government as well)

[17] The authors assume competence as a MA(1), namely $\eta_t = \mu_t + \mu_{t-1}$, where each element on the right hand side is an i.i.d. random variable with zero mean, finite variance, cumulative distribution function $F(\mu)$ and density function $f(\mu)$with $f(0) > 0$. Then, competence can change over time but is persistent. *"This is a plausible assumption since circumstances change over time and a policy-maker that is competent in some tasks in one period need not to be competent on other tasks in other periods"* (Shi and Svensson 2006, p.1376). Then, since a public good in this game is $g_t = \tau_t^* + d_t + \eta_t$, (1) and (2) are easily understandable.

amount of deficit run by the incumbent due to *"clever accounting techniques"*[18]. Second, there is an additional gain *X* for the policy-maker when in office: *"one can conceptualize this rents in a variety of ways, from non-monetary benefits [...] to misuse of public office for private gains"*[19].

Since the share of the electorate $(1-\sigma)$can only infer the true value of d_t, (i.e. $\hat{d}_t$), then, knowing the equilibrium strategy of the incumbent, and on the basis of g_t, τ_t^*:

(2) $\hat{\mu}_t = g_t - \tau_t^* - \hat{d}_t - \mu_{t-1} = \mu_t + d_t - \hat{d}_t$,

and the formula for incumbent's odds of receiving at least 50% of votes reduces to:

(3) $1 - F((1-\sigma)(\hat{d}_t - d_t))$

where *F* is a cumulative distribution function for μ, defined as i.i.d. random variable with zero mean and density function $f(\mu)$, with $f(0) > 0$. In equilibrium, the maximization problem for the incumbent ends up having the following solution:

(4) $1 + (1-\sigma)F'\left((1-\sigma)(\hat{d}_t - d_t)\right)X - R'(d_t) \leq 0$;

and, since expectations must be consistent (i.e. 'incumbent's solution' $d_t^* = \hat{d}_t = d_t$), solution (4) becomes:

(5) $1 + (1-\sigma)f(0)X - R'(d_t^*) = 0$; $with\ \frac{\partial d_t^*}{\partial X} > 0$; $\frac{\partial d_t^*}{\partial \sigma} < 0$

[18] *Ivi*, p. 1377.
[19] *Ivi, p.1376.*

where d_t^* is the solution of the incumbent optimization problem, positive, and $R'(d_t^*)$ the marginal cost of borrowing[20].

Noting that in equilibrium, since debt is fully expected by voters, it has no effect on the re-election's likelihood. Voters know that the incumbent will run debt exploiting the existing information asymmetry, thus in the solution, even if expectations are consistent, it is $d_t^* > 0$. According to Shi and Svensson (2006), the magnitude of pre-electoral deficit depends on the variable *X* and σ: *"the higher the politicians' rents of remaining in power X, the stronger are their incentives to increase spending […]. On the other hand, a greater share of informed voters has the opposite effect since the voting decision of fever voters can ex-ante be influenced by an electoral spending boom."*[21]

With the purpose of testing such hypothesis, the scholars constructed a proxy for politicians' rents of being in power by implementing an international index of level of corruption, and used this indicator to split their group of countries in two sub-samples. Some important results stand out considering their sample of 85 countries and 1683 observations over a 21-year period (1975-95): in the sample of those nations where the level of corruption is particularly high *"the electoral effect […] is as large as 1.9% of GDP"*[22] whilst it turns out to be equal to 0.1% in the others. Therefore, in spite of proof of electoral manipulation in both the two sub samples, the outlined difference in amplitude suggests the existence of a relationship between fiscal discipline and personal gains from being in power for incumbents.

The percentage of public sector expenditure administrated by the *Ente regionale*[23] is

[20] The latter is a continuous function of public borrowing with $R(0)=0$, $R'(0)=1$ and $R''(d)>0$ $\forall d$. It is worth noticing that in this model incumbent completely internalizes the cost of borrowing and, despite this, he/she runs deficit in equilibrium.
[21] Shi and Svensson (2006), p. 1379.
[22] *Ivi*, p. 1381.
[23] Regional administration.

around 22% of the total. Increases in this value have been astonishing during the last decade: in the years 2000 – 2010 expenses grew by 74,6% reaching 208,4 billion euros, despite a totally different path of average inflation which increased by 23,9% during the same period[24]. According to a recent analysis by the CGIA *Associazione Artigiani Piccole Imprese* study centre of Mestre, the main voices leading this unclear 'skyrocketing' seem to be, among others, 'health care' (+79,6%), 'social assistance' (+154,4%), 'general administration' (+72%) and 'non attributable liabilities' (+113,8%). In absolute value, per capita expenditures attributable to the regions' government reached 3048 euros in 2010, from a value of approximately 1700 euros in 2000 considering the so-called *Regioni a statuto ordinario*[25]. In case of the *Regioni a statuto speciale*[26]and *Province autonome*[27], expenses jumped from 3200 to 5737 euros per capita over 10 years.

A new institutional role gained by regions as consequence of a recent constitutional reform, is likely to be among the main reasons for the previously described growth. Indeed, with the constitutional law n.3 promulgated on October 18th 2001, a paramount modification of the V Title of the Italian Constitution led to a completely new separation of powers held by central and peripheral Italian governments. In particular, the new institutional text has brought about a different division of legislative powers among state, regions and local authorities, in response to principles of subsidiarity and federalism. Inter alia, Article 119 of the Constitution has been modified by re-considering the financial autonomy of the regions and local authorities. An equal dignity to municipalities, provinces, metropolitan cities and regions has been given in relation to financial autonomy by defining both own

[24] Source: CGIAMestre.com.

[25] Regions with ordinary statute. This denomination refers to: Abruzzo, Basilicata, Calabria, Campania, Emilia-Romagna, Lazio, Liguria, Lombardy, Marche, Molise, Piedmont, Puglia, Tuscany, Umbria and Veneto.

[26] Regions with special statute. This denomination refers to Friuli Venezia Giulia, Sardinia, Sicily, Valle d'Aosta.

[27] Autonomous provinces. This denomination refers to the provinces of Trento and Bolzano.

sources of financing, share of central tax revenues and by instituting equalization funds.

However, in this new architecture of the government's structure, something, at least at the regional level, is still missing. Indeed, as outlined by the National Institute of Statistics (ISTAT), in spite of new functions of withdrawing and spending, clear regulation about standard accounting processes valid for every region has been left out. Since 1986, all the regions together with the autonomous provinces (Bolzano and Trento), have accepted the request made in the circular of the Ministry of Economy and Finance - Department of the Treasury (n . 18 of the March 1986 Protocol. 32337) to adopt a common scheme for their budgets, defined as SIR (Regional Information System) [28].

Despite this effort toward developing common accounting practices, legislative and functional changes occurred over time have undermined the capacity of SIR classification to faithfully represent the financial activities of such institutions. In some cases, more suitable schemas according to different budgetary needs have been adopted, whilst other regions have completely abandoned the standard classification[29]. As stressed by ISTAT, this has forced authorities to encoding and reclassifying regional government's balance sheets, in order to make them consistent and comparable, leading to *"a loss, in most cases, of the accuracy of data"*[30] [31]. It seems thus reasonable to think the possibility for regional administration to manipulate key information at the moment of editing the budget. Indeed, as outlined by Eslava (2011), "*the body of empirical literature seems to support the theoretical prediction that […] electoral cycles are a phenomenon of environments where voters*

[28] Source: ISTAT (National Institute of Statistics), *L'Italia in 150 anni. Sommario di statistiche storiche 1861-2010*, chapter 22, 2011.

[29] According to Alt and Lassen (2006), p.4: *"budgets that include numerous special accounts and that fail to consolidate all fiscal activity into a single 'bottom line' measure are not transparent."*

[30] Source: ISTAT, op. cit., p. 903.

[31] A striking episode: regions Abruzzo and Calabria, "*up to now have escaped to be 'commissariate' due to lack of accounting data"* (www.datodifatto.it).

cannot effectively monitor the choices of fiscal policymakers"[32]. Additionally, as election rounds approach, strong political and personal incentives might sharpen such a phenomenon.

In this work, the hypothesis of political budget cycles at a sub-national government level (other than Cioffi *et al.* 2012, see also Drazen and Eslava 2010 and Besley and Case 1995) is tested with the usage of Italian regional data covering a period from 1997 to 2007. In order to accomplish in this task, two qualitatively different panel data sets, and in accordance two different econometric models, are then defined and results compared to each other, hoping to detect convincing analogies. One set comprehends the total regional surplus/deficit over (regional) GDP ratio of all the twenty-one Italian regions, but the elements have been defined in a 'nonstandard' way. In fact, the entire Italian total deficit has been regionalized via the usage of a formula in Mauro *et al*. (2012) specifically defined to reconstruct such data type[33]. These data then permit to study the impact of increases in spending (during election periods in this case) of the *Ente regionale* on the overall regional public administration's deficit, as well as to implement the Persson and Tabellini's (2002) econometric specification[34]. Indeed, in order to correctly use the covariates of the aforementioned model, which was originally designed to describe the demand of public goods in a country as a whole, working with regionalized national deficits is likely to be the better way to get coherent and precise estimations of the parameters of interest. However, Mauro *et al.* (2012) reconstructed the deficit/surplus over GDP variable just for 4 macro-areas including all of the Italian regions (North-west, North-east, Centre and South). The issue here is that, since electoral rounds do not take place all in the same years, but rather timing differs for *Regioni a Statuto*

[32] Eslava (2011), p. 650.

[33] They are obtained from a US-NAS account identity specification and not by a standard 'revenues minus costs formula'. This is also the reason why it has been tested just the 'regionalized' surplus/deficit over GDP ratio by using the Persson and Tabellini's (2002) model.

[34] See Persson and Tabellini (2002), chapter 8.2 for details about the original specification.

Speciale, Province autonome and *Regioni a Statuto Ordinario* excluding *Molise*[35]. The regional election dummies are likely to poorly detect deviations if such aggregates are considered. This work overcomes the problem by considering the pattern of the variable of interest for each regional territory and creating a complete panel data set[36]. Such a model is estimated with the adoption of the GMM techniques developed for dynamic panel data by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998).

Furthermore, since evidence of opportunistic behaviours is more likely to come out from the side of regional expenses (see section 2 and 3), the hypothesis of political budget cycles is tested by considering 'annual per capita expenditures' as dependent variable. Even in this case, calculation is performed with a GMM estimator.

The idea of greater amplitude of fiscal manipulation linked with higher level of 'rent-extraction' of a policymaker is ascertained in this work as well. With the help of a recent research conducted by Charron *et al.* (2012), the entire sample of Italian regions has been split up in two sub-samples with respect to the level of corruption perceived by the population. According to Persson and Tabellini (2002) perceived corruption and quality of public-service provision and enforcement[37] seem to be a reasonable proxy for politicians' rents, which in turn may signal a greater propensity of an incumbent to tilt the budget process[38].

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[35] See section 3 for details about regional elections' schedule.

[36] Another observation: the authors specify four autoregressive distributed lag models, one for each macro-area, whilst this work uses a dynamic panel data approach.

[37] Persson and Tabellini (2002), p. 56.

[38] Regional elections are scheduled every 5 years, with a different calendar for *Regioni a statuto ordinario*, *Regioni a statuto speciale* and *Province autonome*. Over the period covered by this study, the so-called *Legge Tatarella* n.43, February 23rd, 1995 is the main legislative reference for the *Regioni a statuto ordinario*'s electoral rules. This law provides for direct election of the President (*Governatore)* as well as the Regional Council *(Consiglio regionale*). Structured as a single round of voting, it introduces a mixed electoral system that attributes 80% of the board's seats with a proportional preferential mechanism, and the remaining 20% with a multi-member district system of majority voting (some minor modifications to the general law were made by Tuscany, Puglia and Calabria between 2004 and 2005). About the rest of the sample, regional elections' rules are stated in

The work is structured as follows: section 2 spells out the main steps of the evolution of the fiscal policy characterizing Italian regional governments over the time considered for this research. Section 3 delineates the methodology adopted to define the data set and the general empirical strategy employed. In section 4 the results obtained are reported together with comments and observations. Section 5 concludes.

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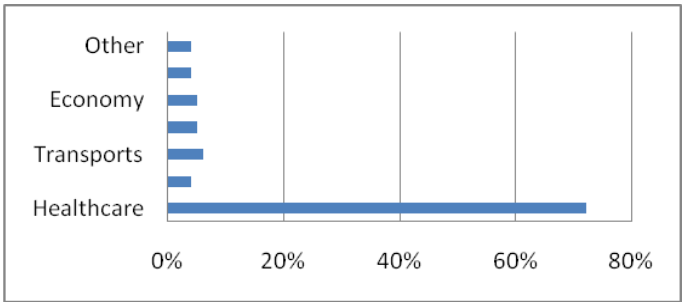
their own statutes, but differences do not invalid the analysis: the form of government is identical and timing of election strictly scheduled.

With the law n.165, July 2nd, 2004 (thus during the considered period) an important modification, which is worth to be mentioned, was introduced: the non immediate re-eligibility of the president elected by direct universal suffrage for a new mandate, as the second consecutive term ends (Article 2). However, both Besley and Case(1995, 2003) and Cioffi *et al.* (2012) find evidence of political budget cycles at sub national level regardless of the possibility for an incumbent of being re-elected. As stressed by the latter authors in fact, this is still in line with Shi and Svesson's (2006) moral hazard model.

-2) Main stages of the evolution of the regional fiscal policy framework over the sample period

The sub national public sector in Italy comprises three different levels with respect to territorial jurisdiction and types of public expenditures. They are respectively: municipalities, provinces and regions. The share of expenses of both municipalities and provinces together is around 6% of the Italian GDP whilst the value goes up to 12% considering the *Enti regionali*[39]. Municipalities are mainly responsible for local transports, social aid, primary schooling and waste disposal, while provinces perform road maintenance functions as well as natural environment safeguard's operations[40]. Regions provide primary health care assistance and services which take up around 72% of their total financial sources. The remaining share of spending includes a wide variety of sectors: vocational training, public works, schooling, transports and administration expenses are just a few examples[41].

-Figure 2.1) Structure of the regions' expenditures[42]



[39] Longobardi Ernesto, *Il lungo e lento cammino della finanza regionale: verso quale federalismo fiscale?*, Ganfemi editore, 2011.
[40] Cioffi *et al.* (2012).
[41] Sources: www.centridiricerca.unicatt.it, study centre's website of Cattolica University of Milan, and CGIAMestre.com.
[42] Ibidem.

Over the period covered by this work (1997-2007), two paramount reforms, involving the discretion in spending of regional administrations, took place.

In 1999, the so-called *Patto di stabilità interno*[43] introduced instruments for fiscal discipline to prevent Italian sub-national governments from financial disequilibria[44]. Compulsory annual targets and budgetary balances were thus defined for the aforementioned Italian institutions. The introduction of such budget bounds had become necessary as Italy ratified the Maastricht treaty in 1992 which indicated a mandatory ceiling for annual deficit and total debt limits, valid for every countries joining the European union.

However, criteria to evaluate financial performances, as well as the fulfilment of obligations and incentives indicated by the *Patto di stabilità interno*, were changed year by year [45], "*creating difficulties in interpretation and generating adaptation costs for the concerned institutions, with repercussions on the credibility of the pact and its financial planning capabilities"*[46] [47].

A second breakthrough in 2001 probably exacerbated such a necessity of regulation.

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[43] Law 488/1998, article 34, *Patto di stabilità interno* (Domestic stability pact).

[44] Since 2002, the mechanism of the *Patto di stabilità interno* has also been extended to the *Regioni a statuto speciale* and the *Province autonome* of Trento and Bolzano (art. 1, Decree Law 347/2001; Law 405/2001).

[45] Rules of the *Patto di stabilità interno* are stated every year in the so called *Legge finanziaria* (financial law). The relevant legislation for the period covered by the data (1997-2007) is the following: law n.448, December 23rd , 1998; law n.448, December 23rd , 1999; law n. 388, December 23rd , 2000; law n. 488, December 28th , 2001; law n. 289, December 27th , 2002; law n. 350, December 24th , 2003; law n. 311, December 30th 2004; law n. 266, December 23rd , 2005; law n.296, December 27th , 2006.

[46] Local financial office of the autonomous region of Friuli Venezia Giulia, *Il patto di stabilità interno. Un'analisi sugli enti locali del Friuli Venezia Giulia*, by the, pag.20, in www.regione.fvg.it.

[47] Furthermore the bulk of *Ente regionale's* expenses, namely healthcare, since 2002 have been differently regulated with respect to the others. Indeed, with the *accordo Stato-Regioni sulla spesa sanitaria* on August 8th, 2001[47] the pact for regions was re-formulated merely as a *limitation to the increase* in regional current expenditures for healthcare (source: www.camera.it, website of the lower house of the Italian parliament).

With a reform involving the fifth title of the Italian Constitution[48], to regions and local authorities was constitutionally conferred greater autonomy of withdrawing taxes and spending[49]. In fact, an allocation of autonomous financial resources deriving from own taxes, as well as from co-partnership to state's tributes, was brought about by the aforementioned reform. Such financial independence still found its own limits in the concurrent legislation of the Central government due to a necessity of guaranteeing the "*harmonization of public accounts and coordination of public finance and the tax system*"[50]. Nonetheless, *"many times a need of coordination among the actors whom concur jointly in determining the economic policies of the state emerged"*[51]during the last decade. The comment clearly points to a system of enforcing the new budgeting rules partially unable to assure fiscal discipline of peripheral levels of government. And this weakness in monitoring, as stressed by Cioffi *et al.* (2012), turns to be a critical issue in a political budget cycles' theory framework at a sub-national government level (see section 1). Related to this problem, as underlined by several Italian public finance researchers, the "*bailout problem and the connected problem of a perceived "soft budget" constraint at the local level have been rampant in Italian local finance"*[52]. In particular, recalling the types of regional spending (see figure 2.1), it is worth noticing as "*these problems are likely to be particularly important in sensitive political fields such as health care, as the central government can hardly allow local governments to "fail" in providing essential health care services"*[53].

Turning attention to the core of legislative reforms which involved the regional

[48] Costitutional law n.3, October 18th 2001.
[49] See article n.119 of the Italian Constitution.
[50] Source: article n.117 of the Italian Constitution.
[51] See note n. 7, pag.158.
[52]Bordignon (2000), p.6.
[53] Bordignon and Turati (2005), p. 307. See also Levaggi and Menoncin (2013) about this issue.

withdrawals' side, over the second half of 1990 the financial autonomy of *Regioni a statuto ordinario* was enhanced by establishing both new own taxes and by allocating shares of national revenues. With the law n. 662 of December 23rd , 1996, and the subsequent legislative decree n. 446 of December 15th , 1997, the regional tax on productive activities (IRAP) and the additional regional tax on personal income (personal income tax) IRPEF were established[54].

The former affects the net value of production of enterprises. During the sample's period (1997-2007), the share percentage was initially set to 4.25% in case of private firms, and 8, 50% for public administrations (with the possibility to vary the rates depending on sector of activity and category of subjects). The possibility of raising the former rate to a maximum of 1% was contemplated by the law, but only after three years from the approval of the aforesaid legislative decree [55]. With the budget law for 2005, the possibility for regions to raise the standard rate of a further 1% in case of health expenditure overruns was provided[56].

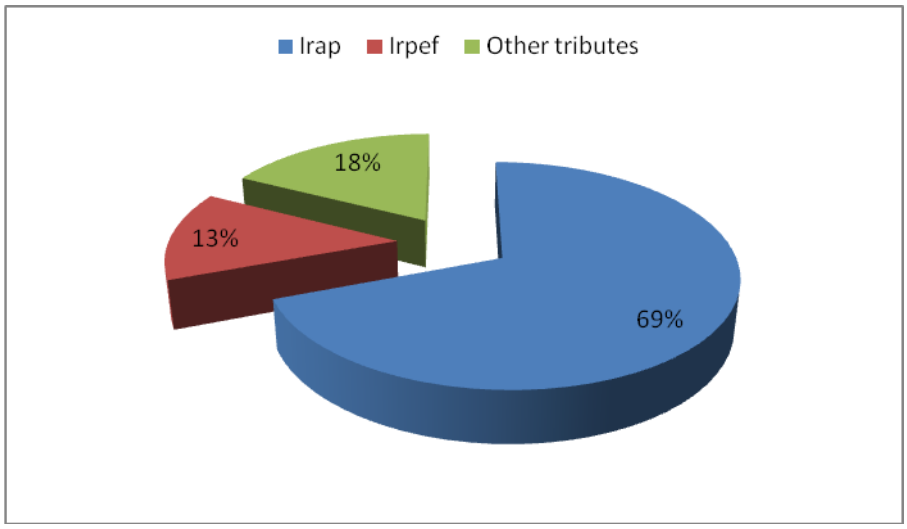
For the years 1998 and 1999, the additional regional tax IRPEF had been set at an amount equal to 0.50% but regions had the power to increase the rate up to 1%[57] depending on the own financial needs. In 2000, both rates were raised by 0.4% (new min. 0.9% - max. 1.4%)[58].

In 2001, a share of the *IVA*[59] tribute was granted to the regions with ordinary statute in replacement of some government suppressed transfers. However what it is

[54] Together, they represent approximately 84% of total own regional tributes (referring to *Regioni a statuto ordinario*). Sources: www.senato.it, www.centridiricerca.unicatt.it.
[55] Article n.16 of the Legislative Decree n. 446, 1997.
[56] Source: www.camera.it.
[57] Article n.50 of the Legislative Decree n.446, 1997.
[58] Article n.3 of the Legislative Decree n.56, 2000.
[59] *Imposta sul valore aggiunto* (tax on the added value). Article n. 2, Legislative Decree n. 56, 2000. Financed by part of this transfers, a solidarity common fund was established called *Fondo perequativo*, with the function of increasing the revenue of the territories with less fiscal capacity per inhabitant, for the purpose of financing the duties that are fundamental. "*The goal is to ensure the same standards of performance in the provision of expertise despite the economic and social imbalances"* (art.119, Italian constitution, paragraph 4).

important to stress at this point is that, "*this is not considered a real tax and for some regions is, in fact, a transfer. On it, the regions have no power to change any rate*."[60] Then, the main tributes under direct *Ente regionale's* control (at least considering the *Regioni a statuto ordinario*, the bulk of the sample) remained basically IRAP and IRPEF over the sample period and this helpful information will be exploited later in this work (see section 3).

-Figure 2.2) *Regioni a statuto ordinario's* withdrawals[61]



In 2009, the total amount of own tributes represented in mean 40 % of revenues of the all regional governments with ordinary statute; the other main voice corresponded to transfers from central and the European government, to such institution[62].

Considering the *Regioni a statuto speciale* and *Province autonome*, since the

[60] Source: www.camera.it, lower house's website of the Italian parliament.
[61] Source: www.camera.it, website of the lower house of the Italian parliament.
[62] Sources: www.centridiricerca.unicatt.it, study centre's website of Cattolica University of Milan.

foundation they have detained greater authority than the other regional governments in subjects such as legislation and administration. Their statutes, which in some cases (e.g., Sicily) were issued even before the 1948 Italian Constitution, have the rank of constitutional laws. Each of these has a different assignment of resources and functions, depending on its statute and the approved implementing laws. Their main sources of revenues are shares of national taxes, and which national taxes are shared, and to what extent, depends on the statute of each special region[63]. In 1997 IRAP and IRPEF were established for these regions as well, but evident expression of their greater level of autonomy is a different rate of co-participation in National revenues with respect to the rest of *Enti regionali*.

In spite of a totally different taxation regime, dependency from Central (and European) government's transfers has been outstanding over the last years: in 2007 just a share equal on average to 57.05% of the total amount of regional administration's expenses was covered by own revenues[64].

[63] Bordignon (2000).

[64] Source: Italian Ministry of Economic Development's website: www.dps.tesoro.it (*Conti pubblici territoriali*).

- 3) Methodology

-3.1) Dataset

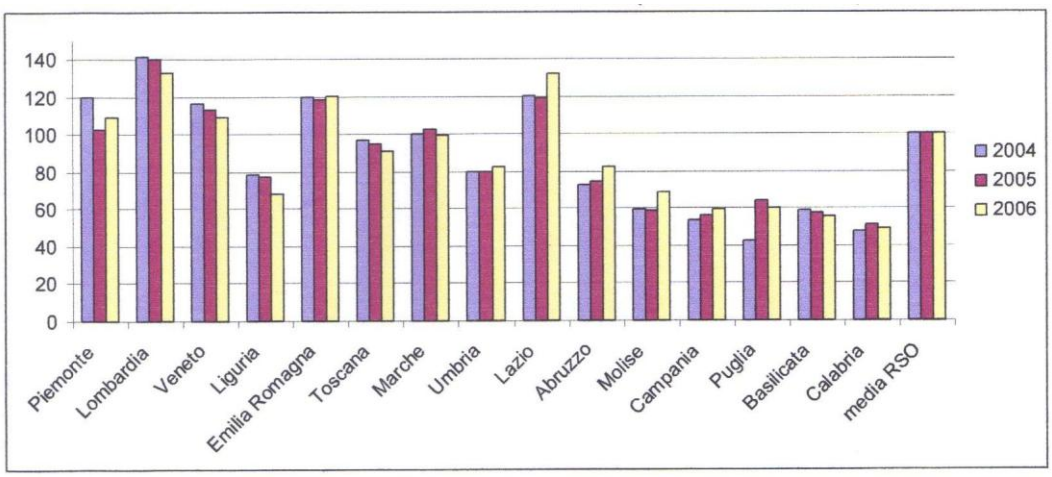
In order to detect evidence of political budget cycles in the 21 Italian regions over the period 1997-2007, two slightly different approaches are taken. The first relies upon the specification put forward by Persson and Tabellini (2002) and considers regional surplus/deficit to GDP ratio as dependent variable whilst in the second exercise, the same hypothesis is tested via the usage of a model designed by 'taking a glance' at Cioffi *et al.*'s (2012) paper. In this latter case, the variable of interest is 'total per capita expenditures'[65] of each regional administration. The overall dataset is composed of 231 observations in both cases, thus, strongly balanced panels have been considered.

Excluding 'revenues' from the analysis is not an arbitrary choice. Persson and Tabellini (2002) find evidence of cuts in tax revenues in large and diverse samples of countries during election years[66]. Such a phenomenon turns out to be consistent with either an effort to 'push' the economy as elections approach or an attempt to delight voters by directly increasing their income. However, as stressed in section 2, in case of the Italian regions' this possibility can be plausibly ruled out. Throughout the sample's period 'transfers from the central government' represented a paramount financial resource for the *Ente regionale*[67]. Additionally, until 2001, the possibility to raise the tax rate of the regional withdrawal *IRAP*, which in 2005 was equal to 70%

[65]Dependent variable and all the covariates in the model are expressed in nominal per capita euros (current chain-linked euros with reference year 2005).
[66] See Persson and Tabellini (2002), p. 202.
[67] See section 2 for details.

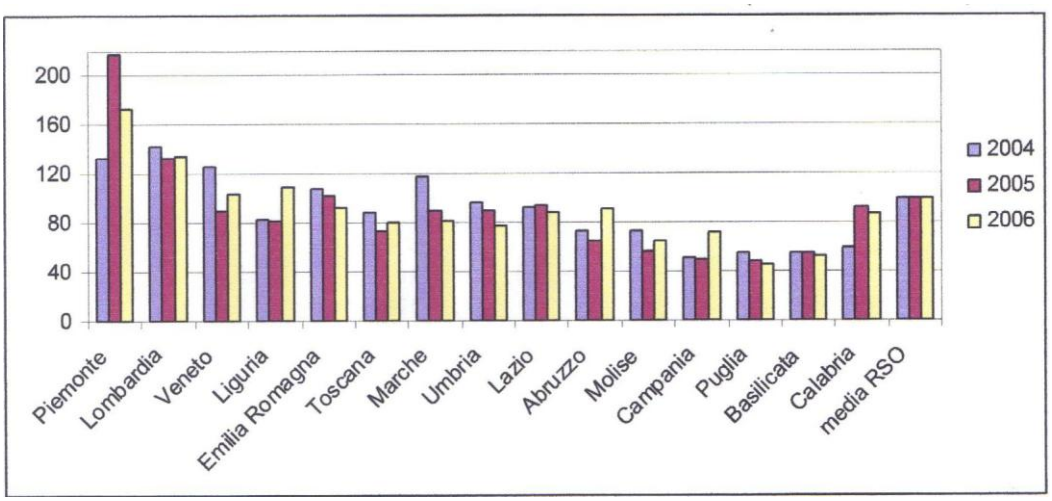
of own revenues[68] of the *Regioni a statuo ordinario* (the bulk of the sample), was suspended. Noting that over the sample period electoral rounds for all the *Regioni a statuto ordinario* occurred in 2000 and 2005 (2001 and 2006 for *Molise*), then, opportunistic variations of the IRAP' s tax rate were possible neither before or during the former election. Concerning the latter year, figure 3.1 and 3.2 display the patterns of 'per capita IRAP amount', as well as 'per capita IRPEF amount'[69], both the primary taxes of *Regioni a statuto ordinario*. To make it easier to understand, the average value of the two quantities is placed conventionally equal to 100.

-Figure 3.1) Per capita IRAP amount of *Regioni a statuto ordinario* (years 2004, 2005, 2006)[70]



[68] Source: www.camera.it (website of the Italian parliament's lower house).
[69] In 2005 the IRPEF share of total own revenues was equal to 13.2%.
[70] Source: *L'attuazione dell'articolo 119 della Costituzione: il federalismo fiscale*, Servizio del bilancio, Servizio bilancio dello stato, Servizio studi, 2008, p. 21.

-Figure 3.2) Per capita IRPEF amount of *Regioni a statuto ordinario* (years 2004, 2005, 2006)[71]



In both figures, systematic changes of the two quantities are not observed, but a 'patchy' behaviour seems to characterize the path of each withdrawal. Then, manipulations tented by regional administrations as the election year (i.e. 2005 in this case; 2006 for *Molise*) approached can be quite safely excluded in this case.

Taking into account now the first type of model, since Persson and Tabellini's (2002) specification was designed for national aggregates, 'regionalizing' the national deficit can be considered a logical way to proceed if covariates similar to the original (but from regional datasets) one wants to contemplate as controls. To help in this task, a formula in Mauro *et al.* (2012) is then exploited. The authors started by considering a national account identity as defined in the US-NAS system. Then, they moved to the Italian classification Sec95 by harmonizing the two accounting practices, in order to avoid mismatches. The final formula for the time period covered by this analysis (i.e.

[71] Ibidem.

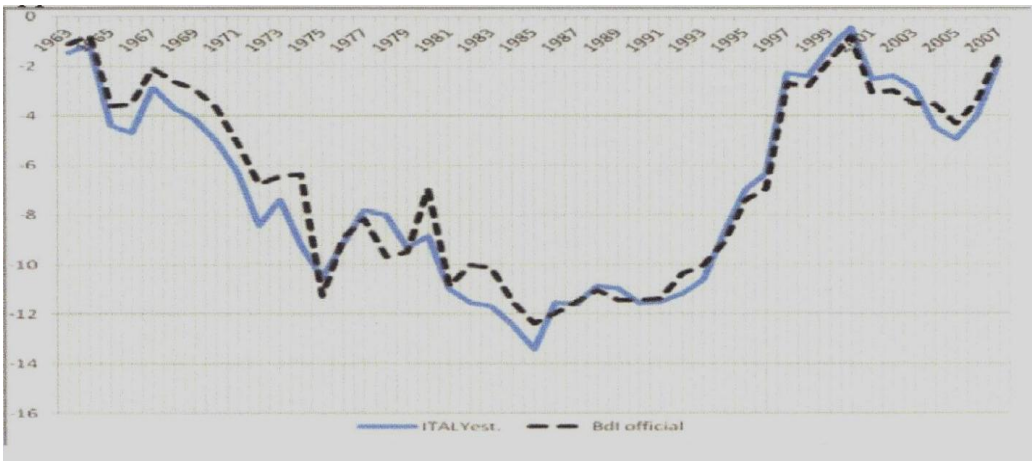
1997-2007)[72] was the following:

$$(3.1)\ \frac{DEF_i}{GDP_i} = -\frac{RDLh_i}{GDP_i} - \frac{RDLf_i}{GDP_i} + \frac{Ch_i}{GDP_i} + \frac{ILF_i}{GDP_i} + \frac{DS_i}{GDP_i} - \frac{Ig_i}{GDP_i} + \frac{NX_i}{GDP_i}\ ; i = region$$

The task of explaining each addend and its data source is left to the appendix. It is now worth noticing that, on the left hand side, the ratio $\frac{DEF_i}{GDP_i}$ represents a suitable approximation of the share of total central deficit whose region *i* is accountable for. Indeed, as showed by the authors[73], comparing the pattern of official *Banca d'Italia's* figures on Italian fiscal surplus/deficit with the reconstruction, a tight similarity between both the graphs can be noted, particularly for the most recent years of the sample (namely, the dataset considered in this study). This is a significant aspect, as it indicates that the data are reasonably close to the true values.

[72] Mauro *et al.* (2012) reconstructed longer deficit's time series (i.e. from 1963 to 2007) for each macro-region (not for each region as in this case) in their paper. However they were forced to adapt the initial accounting formula depending on availability of data over time. This brought about slightly different specifications to be carried out by the authors.
[73] *Ivi*, p. 15 for details.

-Figure 3.3) Italian government deficit/surplus over GDP with regional approximation formula[74]



However, the scholars shed light on one issue that arises when (3.1) applies to reconstruct regions' deficits. In order to avoid non-negligible biases, $\frac{NX_i}{GDP_i}$ (i.e. 'regional trade balance') should account for both regional import-export balance with the rest of the world and interregional trade flow. Mauro *et al.* (2012) tried to overcome the problem by making inferences about the general behaviour of the trade balance among regions build on the expected sign of interregional trade flows estimation done by Cherubini *et al.* [75] [76]. However, by analyzing a data set of Italian regional economic indicators, gently bestowed for this work by IRPET[77], it has been possible to correctly calculate $\frac{NX_i}{GDP_i}$ for each region. This additional comment definitely helps to make one feeling more confident when using (3.1) to assemble

[74] Source: Mauro *et al.* (2012).
[75] *Ivi*, p.16-17.
[76] Cherubini, L., L. Ghezzi, R. Paniccià and S. Rosignoli, *L'interscambio commerciale tra il mezzogiorno e il centro-nord: struttura e meccanismi di propagazione degli shock*, preliminary version, in Mauro *et al.* (2012).
[77] Regional institute for economic planning of Tuscany.

regional deficit datasets.

According to a great deal of the literature, election timing can be considered a proxy for political budget cycle. Likewise Shi and Svensson (2006) and Persson and Tabellini (2002) a dummy for the year when election occurred is then defined. It takes a value equal to 1 when a regional electoral round takes place and 0 otherwise[78]. Overall, a total of 42 electoral rounds is involved.

[78] Italian central government's elections (i.e. 2001-2006), as well as of municipalities and provinces, the other two Italian sub-national levels of government, are thought as not directly influencing the estimates of interest due to completely different schedules.

-Figure 3.4) Election timing by region (1997-2007)[79]

Regions	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Piedmont				*Election*					*Election*		
V.d'Aosta		*Election*					*Election*				
Lombardy				*Election*					*Election*		
Bolzano		*Election*					*Election*				
Trento		*Election*					*Election*				
Veneto				*Election*					*Election*		
Friuli		*Election*					*Election*				
Liguria				*Election*					*Election*		
Emilia				*Election*					*Election*		
Tuscany				*Election*					*Election*		
Umbria				*Election*					*Election*		
Marche				*Election*					*Election*		
Lazio*				*Election*					*Election*		
Abruzzo*				*Election*					*Election*		
Molise*					*Election*					*Election*	
Campania				*Election*					*Election*		
Puglia*				*Election*					*Election*		
Basilicata*				*Election*					*Election*		
Calabria*				*Election*					*Election*		
Sicily*					*Election*					*Election*	
Sardinia*			*Election*					*Election*			
Total											**42**

Regions indicated by * belongs to the 'high rents' sub-set.

Estimating the parameters of the aforementioned variables, a criticality may arise. Indeed, as outlined by Shy and Svensson (2006), treating each election dummy as endogenous may be a wrong way to operate: *"both timing of elections and fiscal*

[79] Source: www.cattaneo.org, website of the *Istituto Carlo Cattaneo* study centre.

policies could be influenced by a number of (unobserved) variables"[80] not included in the regression. In fact, there may be the case of "*incumbent governments calling early elections when the economy is doing well, or government crises — and new elections — erupting when it is doing badly"*[81]. As a result, coefficients of the covariates of interest will be biased. Nevertheless, in section 1, the main characteristics of regional elections have been sketched[82]. As previously underlined, electoral timing for regional governments is rigidly scheduled, and therefore is hard to manipulate. Furthermore, over the sample's period, no changes in the election's time have been found and so, the dummies of interest are treated as exogenous in all the specifications.

For the purpose of finding for evidence of a linkage between political budget cycles and higher politicians' rents of being in power, the entire group of regions is split up in two sub-samples; this, according to an index of perceived corruption, quality and impartiality of education system, healthcare and law enforcement within each territory presented by Charron *et al.* (2012). Similarly to Persson and Tabellini (2002) then, a measure of perceived corruption, together with quality of institutions and enforcement, is used to proxy a different level of "*rent extraction by politicians"*[83] among the sampled regions. The EQI index[84] (and the normalized EQI100 Index) used for the scope, builds on data from a survey of 34000 residents across 172 regions of 18 European countries.

Below the score and relative position by region, both in the European and Italian ranking, are reported.

[80] Shi and Svensson (2006), p.1373.
[81] Persson and Tabellini (2002), p.201.
[82] See footnote n.38 of section 1.
[83] Persson and Tabellini (2002), p.54.
[84] European Union's Quality of Government Index.

-Figure 3.5) EQI and EQI100 of Italian regions[85].

Regions	European Ranking	Italian ranking	EQI	EQI100
Bolzano	57	1	0.766	78.74
Valle d'Aosta	67	2	0.629	75.78
Trento	79	3	0.47	72.35
Friuli-Venezia Giulia	102	4	0.128	64.96
Piedmont	118	5	-0.191	58.07
Umbria	121	6	-0.264	56.5
Emilia-Romagna	127	7	-0.417	53.2
Marche	134	8	-0.536	50.61
Veneto	135	9	-0.538	50.57
Liguria	138	10	-0.583	49.61
Tuscany	142	11	-0.627	48.65
Lombardy	145	12	-0.715	46.76
Sardinia	168	13	-0.966	41.33
Abruzzo	169	14	-0.988	40.86
Molise	179	15	-1.318	33.73
Basilicata	180	16	-1.341	33.24
Lazio	181	17	-	33.06

[85] Source: Charro *et al.* (2012)

			1.349	
Puglia	189	18	-1.821	22.87
Sicily	190	19	-1.914	20.85
Calabria	196	20	-2.278	13
Campania	197	21	-2.408	10.18
ITALY	174		-1.064	39.21

The entire sample is thus divided in 'higher rents'[86] and 'lower rents'[87] subsamples, according to the index's value of each territory. The former group refers to regions with EQI100 index equal or lower to the Italian average score, with the addition of Sardinia and Abruzzo: for this two regions the values are in fact equal respectively to 41.33 and 40.86 and thus, not substantially different from the national mean (39.21). The related election dummies are named ELE_HIGHER and ELE_LOWER[88] for election years, with respect to the abovementioned regional classification.

Turning the attention to the other explanatory variables, it has to be regarded that the dependent variable is the 'regionalized' (but still) national deficit. Then, according to Persson and Tabellini (2002) a full set of socio-demographic controls, likely to shape the government's output, but from regional datasets, is accounted in the econometric specification. In particular, level of development[89], measured by the log of regional

[86] It refers to Sardinia, Abruzzo, Molise, Basilicata, Lazio, Puglia, Sicily, Calabria and Campania.

[87] It refers to Emilia-Romagna, Liguria, Lombardy, Marche, Umbria, Tuscany, Piedmont, Veneto, Friuli Venezia Giulia, Valle d'Aosta, provinces of Trento and Bolzano.

[88] Similarly to Alt and Lassen (2006), whom, alike this work, reproduce the same econometric model of Persson and Tabellini (2002), the sample and related elections variables are split in two groups of interest.

[89] Keeping in mind that regionalized national deficits are handled, according to Persson and Tabellini (2002) one idea, originating in Wagner's Law, is that government's expenditures go up with income.

per capita income, LNINCOME, and openness[90], measured by the regional trade balance, TRADE. Moreover, but unlike the scholars' paper[91], the variable for population structure, DEPRATIO, defined as the percentage of employed population (persons between 1 and 15 years of age and above 65-70 years of age normally do not work in Italy. Furthermore, variations in number of workers are likely to influence fiscal policies as well) over the total region's population is considered. The control for fiscal policies' fluctuations, OUTPUTGAP, induced by business cycles, relies on a measure of the output gap in Italy taken from the International Monetary Fund's database since it is missing for regions[92]. Additionally, since fiscal deficit is characterized by great inertia, its lagged value has been always inserted on the right hand side of the model.

To explain $\frac{DEF_i}{GDP_i}$ by panel estimation, it is always allowed for country fixed-effects, picking up any time-invariant but country-specific unobserved determinants of fiscal policy, such as any direct effects of a different regional statute, geographic position or culture. Finally, year-effects (via the usage of time dummies) are used to capture idiosyncratic shocks.

In the second exercise, the focus of the analysis turns to the total per capita expenditures of the *Ente regionale*[93], PERCAPITAEXP, defined as the ratio between the entire amount of the institution's yearly expenses, and region's population. As stressed previously in this section, the revenues' side of the regional government can

[90] Keeping in mind that regionalized national deficits are handled, according to Person and Tabellini (2002) and Rodrik (1998) more 'openness' may reflect increased demand for social insurance in more open and hence, more risky, economies, but also readily available tax bases on exports and import.
[91] The authors considered as covariates, share of the persons between 15 and 64 years of age (PROP1564), and above 65 years of age (PROP65). Population structure is relevant for public spending, as children and elderly persons are more likely to increase expenditures on social services.
[92] However this covariate has been dropped from the final specifications due to collinearity.
[93] Likewise Cioffi *et al.*(2012), dependent variable and all the covariates in the model are in nominal per capita values express in euros (in this case, current chain-linked euros with reference year 2005).

be thought as rigid over the period considered; tax rates indeed could be manipulated only to a very limited extent. In addition, the main *Regioni a statuto ordinario's* withdrawal rates were not allowed to vary until 2001. Moreover, transfers from the central government played a central role in financing such institutions, both in case of *Regioni a statuto ordinario* and *speciale,* as well as for the *Province autonome.*

Even in this case, the explanatory variables of interest are election dummies ELE_HIGHER and ELE_LOWER as previously described. Defining the other covariates of the model[94], similarly to Cioffi *et al.* (2012) for Italian municipalities, indicators of public or private financial resources available to the *Ente regionale*, namely the amount of total transfers from other levels of government, TRANSFERS and per capita income, INCOME, are included[95]. As stressed in section 2 in fact, the former was a primary resource of revenues during the period covered by the study. Moreover, since the establishment of essential own regional tributes in 1997, the latter can help to control for substantial withdrawals' variations. Additionally, first and second lags of the dependent variable are included among the regressors. Even for this specification, regional fixed effects are accounted. As previously underlined, they account for time invariant characteristics of the region, "*either observable (for example, whether it belongs to a special statute region - which implies a different budget structure - or has a geographic characteristics which may influence the price of public goods provision) or unobservable"*[96]. However, it is worth to point out that the original model's specification contemplated a set of time-dummies, as well as DEPRATIO as demographic control but in all the regressions run, neither time-

[94] Other demographic controls such as regional POPULATION and regional DENSITY (source: ISTAT, *Conti economici regionali)*, were tested without significant changes in the results. Then, they have been left out from the final specifications.

[95] Total transfers and per capita incomes' nominal values expressed in *euros* (current chain-linked euros with reference year 2005). Since the underlined rigidities afflicting regional withdrawals over the period considered, the latter variable can be consider a sufficiently good proxy of the other *Ente regionale's* own financial resources.

[96] Cioffi *et al.* (2012), p. 12.

effects nor population structure turned out to be statistically significant. Then, due to a 'general to specific econometric approach', they were dropped and a reduced model was estimated; nonetheless, final results maintained always same interpretational meaning.

- 3.2) Empirical strategy

The econometric model for both the exercises of this work can be summarize as follows:

(3.2)

$$y_{it} = \alpha y_{it-1} + \rho y_{it-2} + X'_{it}\beta + \delta ELE\_HIGHER_{it} + \omega ELE\_LOWER_{it} + \varphi_t + \mu_i + \epsilon_{it};$$

where the dependent variable is alternatively regional deficit/surplus over GDP and total regional per capita expenditures[97]. X_{it} is a vector of endogenous and exogenous socio-economic covariates (as defined previously for each model), while ELE_HIGHER_{it} and ELE_LOWER_{it} are the two dummies for election year (as defined before in this section) considered strictly exogenous. Concluding, φ_t and μ_i are respectively the time and regional fixed effects and ϵ_{it} the errors.

In the estimation of (3.2), the contemporaneous presence of lagged dependent

[97] In case of the first model ρy_{it-2} turned out to be not-significant and it has been left out from the final estimation.

variables, as well as endogenous covariates makes results obtained by means of standard techniques for panel, be unreliable[98]. A suitable estimation method to avoid such criticality builds on the GMM approach developed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998).

The GMM estimator is robust because it does not require information on the exact distribution of the error term and it is efficient in presence of autocorrelation and heteroskedasticity. Its main drawback is that it generates moment conditions copiously, then, the possibility of over-fitting biases, as well as assumptions needed for GMM no longer valid for all the over-identifying restrictions, cannot be ruled out a priori[99]. Therefore, following the suggestion in Drazen and Erslava (2010) and Cioffi *et al.* (2012), the most parsimonious specification is carried out and the number of instruments reduced to the minimum in every estimation[100]. However, differently from the authors, this aim is reached by 'collapsing' the entire Z matrix of instruments and considering only one lagged instruments for coefficients estimated in GMM style[101]. Using only the latter method brings about separate instruments still generated for each period; the number per period is capped though, so the instrument count is linear in T. The first less common approach combines instruments through addition, into smaller sets. Namely, the blocks of the standard matrix with one lagged instruments for $y_{i,t-1}$ is collapsed from:

$$(3.3)\quad Z_i = \begin{bmatrix} y_{i,1} & 0 & 0 & \\ 0 & y_{i,2} & 0 & \\ & 0 & y_{i,3} & \\ & 0 & \dots & \ddots \end{bmatrix}$$

[98] See the appendix for details.
[99] See Roodman (2009) for an useful discussion about GMM estimator's pitfalls.
[100] The covariates in both the models have been just-identified. One instrument (for each coefficient estimated in GMM style) has been allowed.
[101] These functions are available in *xtabond2* package of STATA.

to:

$$(3.4)\ Z_i = \begin{bmatrix} y_{i,1} \\ y_{i,2} \\ y_{i,3} \\ \vdots \end{bmatrix}$$

and the matrix for the instruments in level *a là* Arellano and Bover (1995) becomes:

$$(3.5)\ Z_i = \begin{bmatrix} \Delta y_{i,2} \\ \Delta y_{i,3} \\ \vdots \end{bmatrix}$$

which can be seen the result of squeezing the original matrix horizontally. According to Roodman (2006), the two approaches (lag limits and collapsed instrument matrix) can be combined together in order to decrement sharply the count of instruments.

In a striking example, by using the abovementioned techniques Roodman (2009) shows clearly how the problem of overfitting biases may lead to serious estimation problems, in particular in N small, T small contests[102] (as in this case).

Lastly, difference and system GMM are typically applied in one- and two-step

[102] Roodman (2009) reproduced the analysis carried out by Forbes (2000) on the linkage between inequality and growth where a panel data set of 138 observations for 45 countries over a 5 years period had been implemented. The author clearly showed how, by alternatively lagging and collapsing the instruments' matrix, the parameter of interest (*income Gini) "loses significance as the number of instruments falls"* (p.152).

variants. The two-step variants use a weighting matrix W_N^{OPT} that is the inverse of an estimate, *S*, of $E(Z'\Delta u \Delta u' Z)$. This 'optimal' weighting matrix makes two-step GMM estimator asymptotically efficient. However, the number of elements to be estimated in S is quadratic in the number of instruments, which in the present context can mean *quartic* in T [103]. Moreover, Hayashi (2000)[104] points out that the elements of the optimal matrix , as second moments of the vector of moments between instruments and errors, are fourth moments of the underlying distributions, which can be hard to estimate in small samples. Computed fourth moments are sensitive to the contours of the tails, which are likely to be poorly sampled. One common symptom of the difficulty of approximating such matrix with limited data is that the estimate can be singular[105].

In difference and system GMM, this issue tends to occur as *j* , number of instruments, approaches the number of individuals[106]. The alternative to the generalized inverse does exemplify how a high instrument count can lead two-steps GMM far from the theoretically efficient ideal. But it does not make two-step GMM inconsistent (the choice of weighting matrix does not influence consistency)[107].

Despite the usage of Windmeijer-robust standard errors can help in this cases, due to the high number of covariates in the first model, only the one-step version of the GMM estimator[108] is used together with robust standard errors. Moreover, Bond (2002) points out as *"simulation studies have suggested very modest efficiency gains from using the two-step version, even in the presence of considerable*

[103] Recalling that the standard number of linear moment restriction in an AR (1) context is equal to $m = (T-2)(T-1)/2$. See Arellano and Bond (1991).
[104] Hayashi (2000), in Roodman (2009).
[105] *Xtabond2* routinely shows a message of warning when it happens.
[106] A fact that has also contributed to the idea that N can be considered a threshold for the number of instruments for safe estimation.
[107] Then, as outlined by Roodman (2009) , p. 140: "*it is not obvious that j=N is a key threshold for reliability*."
[108] See the appendix for details.

heteroskedasticity "[109]. Two-step version GMM estimator with Windmeijer-robust standard errors is instead performed in case of the second model.

[109] Bond(2002), p.147. See even Arellano and Bond (1991) and Blundell and Bond (1998).

- 4) Results

In light of the literature revised in section 1, as well as of the considerations made in section 2 and 3 about *Ente regionale's* revenues and spending peculiarities, as an election year approaches a worsening in the regional deficit/surplus over GDP ratio may be expected. And this, due to a likely increase in the amount of expenses since withdrawals are thought as more rigid. All the estimation's results can be found in table 1 and 2 of the Appendix.

Both one-step difference Arellano and Bond (1991) and one-step system Arellano and Bover (1995), Blundel and Bond (1998) estimators have been carried out for the first specification, whilst 2 is estimated by means of a two-step system GMM.

The regressions which have been run present interesting regularities.

Starting from table 1, despite the two slightly different estimation methods (to wit, difference and system GMM), meaningful variations of the final results do not come out as the four dummies of interest maintain similar values.

The election effects on deficit, captured by ELE_LOWER and ELE_HIGHER, are deeply different from each other, corroborating the hypothesis of a sort of linkage between political cycles and rents' for politicians as strong incentives to tilt fiscal outputs. In particular it emerges that, in case of 'higher rents' regions, likewise Persson and Tabellini (2002), coefficients for election years in table 1 are not significant but both negative and equal respectively to -0.42 and -0.46. Then, they may be a weak proof of a deterioration of regional fiscal balance during the election rounds due to incumbents' opportunistic behaviours.

Moreover, it has been argued that variations in regional deficit/GDP ratios are likely to refer to increases in *Ente regionale's* levels of spending: such hypothesis seems to be confirmed by the second model's result whose ELE_HIGHER's coefficient is both

highly significant and positive.

Regarding to the sub-sample with higher value of EQI100 (i.e. 'lower rents'), in table 1 coefficients are instead positive and statistically significant. They indicate that the improvement (reduction of deficit) of regional deficit/surplus GDP ratio equal 0.93 on average, if estimation is performed only with one-step difference GMM, and 0.97 in case of system GMM. Firstly, these results are partly in line with coefficient's estimation of the second model in table 2 whose value is positive but not significant; that is, a 'getting worse' regional deficit/surplus over GDP ratio may not be expected. Furthermore, such a result should not be surprising. Recalling that the EQI100 index is not just a signal of greater perceived corruption in a territory, but also a sort of measure of quality of its institutions and enforcement, better regional deficit over GDP ratio in 'lower rents' sub sample may simply points to the fact that, as stressed by Shi and Svensson (2006), in explaining "*the size of political budget cycles […] institutional features matter.* The authors conclude their research stressing in fact that *"strong institutional constraints on politicians […] leave little room to public officials to expropriate public resources for private gains."*[110] Then the results remain still significant from this point of view as the evident difference between HIGHER_ELE and LOWER_ELE coefficients support the observation done by the two authors.

Moreover it has to be regarded that *Ente regionale's* share of government spending is around 22% of the total amount of public expenses. Then, in case of 'soft' budget manipulations, since the types of data implemented in the first model are nothing but regionalized aggregates of all the Italian government's deficit, the econometric specification may be not able to detect the expected negative variation from the

[110] Shi and Svensson (2006), p.1386.

mean[111], especially if other omitted variables drove the results. Future more precise studies about overall regional's institutions revenues (*Enti regionali* together with municipalities and provinces) may be helpful to explain this partial mismatch between models shown in table 1 and 2.

On the contrary, as shown by table 2, over the sample period increases in expenditures for 'high rents' regions were substantially greater than in the rest of the sample, both in absolute values and in significance. This more evident pattern has been probably better appreciated by the first model as well, as ELE_HIGHER turned out to be at least negative, as predicted.

Focusing the attention to table 2, it seems to confirm more clearly the hypothesis of this research. Signs of the coefficients of the electoral rounds' dummies, both for 'higher rents' and 'lower rents' regions, are perfectly in line with theory of fiscal cycle: an increase in spending would occur as elections come (then signs are positive). However, whilst the former estimation, equal to 0.179, turns out to be highly significant, the second one appears as not, despite the initial prediction of significant manipulations in spending for both 'lower' and 'higher' sub-samples.

[111] Brender and Drazen (2008) show how running extra deficits may not increase probability of re-election in equilibrium but instead reduce it. In particular, they find evidence of absence of deficit variations or little improvements during upcoming electoral periods in more advanced and mature economies and conclude that "*voters, especially in developed countries and established democracies, do not like deficits, particularly in election years"(p.2215)* Then, the afore-mentioned findings might better explain the behaviour of incumbents in 'lower rents' Italian regions, as non-significant higher spending (plus little evidence of enhancements) is detected. This observation can be validated recalling that differences in level of economic development among Northern, Centre (all part of the 'lower rents' set excluding Lazio) and Southern regions are a well-known issue in Italy. A striking argument about this problem can be to compare level of average income between the two sub-samples. In 1997 this value for 'lower rent' regions were around 15250 euros per capita[111], while it was equal to 9868 euros for the rest of the sample; the situation did not change over the sample timing as the two aforementioned average incomes were equal respectively to 19895 euros and 13818 euros with a difference in current terms of 6077 euros per capita. As indicated by Shi and Svensson (2006) clearly exists a positive correlation between level of economic growth and information level of the electorate (due to a greater diffusion of means of communication). Then, if the abovementioned difference in development can support Brender and Drazen (2008) hypothesis, better-informed voters in 'lower rents' regions would punish rather than reward such policies at the polls, even more so if it is perceived as electorally motivated.

Nonetheless, as ELE_LOWER's parameter comes out to be lower than that of the other sub-sample, and equal to 0.026, a greater amplitude of spending shows up where higher politicians' rents of being in power are likely to be more substantial; this was completely anticipated by the revised literature. An F-test is then performed in order to ascertain the positive difference between the two afore-mentioned coefficients being significantly different from zero; the test's result (reported in table 3) clearly confirms the hypothesis.

- 5) Conclusion

Evidence of existence of political budget cycles (or at least evidence of a higher level of spending before regional elections) at the Italian regional level of government is found by using the GMM estimator developed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). However, the abovementioned phenomenon does not arise throughout the considered sample. There seems to exist a correlation between greater spending and institutional features of a territory, ultimately pointing to different levels of rent extraction activity of an incumbent, as strongly advocated by the examined literature. Existence of economic and personal rents as incentives is in fact the core of moral hazard models *a là* Shi and Svensson (2006). It indeed represents a logical reason for politicians to manipulate the budget process in order to get consensus from the electorate. Furthermore, a feature of this model is that in equilibrium uninformed rational voters expect an increase in spending before an election period. Nevertheless they can only make inference on it, and the incumbent still runs deficit without influencing her or his probability of re-election directly. Information asymmetry is then a cornerstone in this model and, together with 'politicians' rents of being in power', brings up the magnitude of fiscal cycles (see section 1 for details) [112]. Consequently, section 1 has shown as, over the sample period, regions did not have a transparent budget process as defined by the literature, due to a lot of discretion to redact own balance sheets. This led to a lack of information about regional budgeting process, as pointed out by

[112] In this work, in order to take in account issue of uninformed voters, a quick overview of criticalities of the regional budgeting process has been presented. A further testable hypothesis may be to try to ascertain how much the amplitude of *Ente regionale's* spending can be related with different percentage of theoretically informed voters. Then, an index indicating diffusion of papers and internet wi-fi among regions' population may be helpful to accomplish in this task. However this goes far beyond the aims of this research and it is left to future studies.

several sources reported in this research. Therefore, thinking at a share of voters as likely uninformed about regional fiscal policies seems a quite logical assumption.

In addition, the afore-mentioned issue played probably a role in reducing the possibilities for the Italian central government to fully commit regions to better fiscal discipline by strictly controlling their financial needs (see section 1 and 2). As a consequence, incumbents' misbehaviours were likely to arise because of the marked information asymmetry among electorate, central government and *Enti regionali*. In particular these might have been rendered more evident by the upcoming electoral period, when strong economic and political incentives may trigger opportunistic decisions about fiscal policies to run.

Besides, Italian regions greatly differ among each other for what are considered by the literature good proxies for politicians' rents of being in power. Namely: perceived corruption and quality of public institutions such as enforcement, healthcare and schooling (see section 1 and 3). As it has previously been stressed, the greater the personal gains from remaining in charge for a politician, the larger the equilibrium amplitude of a political budget cycle in Shi and Svensson's (2006) moral hazard model. Results are partly in line with the theory as the estimates for 'high rents' and 'lower rents' regions differ substantially to each other indicating looser pre-electoral spending for the former set. However, no significant evidence supporting the initial hypothesis of fiscal cycles in the latter sub-sample is found (see section 4), leaving open for this group the question whether this phenomenon exists or not.

-Appendix

Dependent variable		Surplus/deficit over GDP		Surplus/deficit over GDP
Regression		Model n.1		Model n.1
Method		One-step difference GMM		One-step system GMM
N. of regions		21		21
N. of observations		210		210
N. of instruments		15		19
L.deficit		0.68***		0.72***
		(0.15)		-0.15
Lnincome		-17.37		-12.51*
		(11.80)		(6.44)
Trade		-25.82***		-19.85***
		(7.08)		(6.01)
Depratio		37.59		44.06
		(55.30)		(35.07)
HIGHER_RENTS		-0.42		-0.46
		(0.26)		(0.29)
LOWER_RENTS		0.93**		0.97**
		(0.32)		(0.35)
Arellano-Bond AR(2)		0.359		0.389
Hansen test		Exactly identified		0.22

Table 1) Notes: estimations with Xtabond2 package of STATA. Year dummies not reported. One-step difference and system GMM estimators with robust standard errors. Second-lag instruments only.

Matrix of instruments ‘collapsed’. Standard errors in parenthesis. *: significant at 10%; **: significant at 5%; ***: significant at 1%. One-tailed tests.

Dependent variable		Total spending per capita
Regression		Model n.1
Method		Two-step system GMM
N. of regions		21
N.observation		210
N. of instruments		10
L.deficit		0.41***
		(0.13)
L2.deficit		0.12***
		(0.03)
Transfers		0.25*
		0.14
Income		0.00003*
		(0.00001)
HIGHER_RENTS		0.17**
		(0.07)
LOWER_RENTS		0.02
		(0.04)
Arellano-Bond AR(2)		0.322
Hansen test		0.785

Table 2) Notes: estimations with Xtabond2 package of STATA. Two-step system GMM estimator with

Windmeijer-robust standard errors. Second-lag instruments only. Matrix of instruments 'collapsed'. Standard errors in parenthesis. *: significant at 10%; **: significant at 5%; ***: significant at 1%. One-tailed tests.

Test for the hypothesis HIGHER_RENTS - LOWER_RENTS = 0
F(1, 20) = 5.09; P-value = 0.03

Table 3) Notes: estimation with Xtabond2 package of STATA.

-1) Explanatory variables of formula (3.1):

$$\frac{DEF_i}{GDP_i} = -\frac{RDLh_i}{GDP_i} - \frac{RDLf_i}{GDP_i} + \frac{Ch_i}{GDP_i} + \frac{ILF_i}{GDP_i} + \frac{DS_i}{GDP_i} - \frac{Ig_i}{GDP_i} + \frac{NX_i}{GDP_i}\ ; i = region$$

$\frac{DEF_i}{GDP_i}$: Regional deficit/surplus over (regional) GDP.

$\frac{RDLh_i}{GDP_i}$: Regional gross disposable income of the households.

Source: ISTAT, *Reddito disponibile delle famiglie*, www.istat.it.

$\frac{RDLf_i}{GDP_i}$: Regional gross disposable income of the firms.

Source: ISTAT, *Conti economici regionali*, *Conti economici istituzionali*, www.istat.it.

$\frac{Ch_i}{GDP_i}$: Consumption of the households.

Source: ISTAT, *Conti economici regionali*, www.istat.it.

$\frac{ILF_i}{GDP_i}$: Gross fixed investments.

Source: ISTAT, *Conti economici regionali*, www.istat.it.

$\frac{DS_i}{GDP_i}$: Change in inventories.

Source: ISTAT, *Conti economici regionali,* www.istat.it.

$\frac{Ig_i}{GDP_i}$: Public investments.

Source: *Ministero dello sviluppo, Conti pubblici territoriali (beni ed opere immobiliari, beni mobile macchine),* www.dps.tesoro.it.

$\frac{NX_i}{GDP_i}$: Net exports/trade balance.

Source: Istat, *Conti economici regionali,* www.istat.it; IRPET database (available under request).

-2) Explanatory variables of the models

DEFICIT : Regional deficit/surplus over (regional) GDP, $\frac{DEF_i}{GDP_i}$

ELE_HIGHER : date of election of the *Governatore* in 'higher rents' regions.

Source: www.cattaneo.org.

ELE_LOWER : date of election of the *Governatore* in 'lower rents' regions.

Source: www.cattaneo.org.

LNINCOME : natural log of regional per capita income.

Source: ISTAT, *Conti economici regionali, www.istat.it.*

TRADE : regional trade balance.

Source: ISTAT, *Conti economici regionali, www.istat.it;* IRPET (database available under request)

DEPRATIO : dependency ratio defined as $\frac{Occupati\ totali\ (media\ annua)}{Popolazione\ totale\ media}$.

Source: ISTAT, *Conti economici regionali, www.istat.it.*

OUTPUTGAP: Italian output gap.

Source: International Monetary Fund database, www.econstats.com.

PERCAPITAEXP : Ente regionale's total expenditures (in current chain-linked euros with reference year 2005) over total regional population.

Source: *Conti pubblici territoriali*, www.dps.tesoro.it; ISTAT, *Conti economici regionali*,www.istat.it.

TRANSFERS : Total transfers towards *Ente regionale* (in current chain-linked euros with reference year 2005) over total regional population.

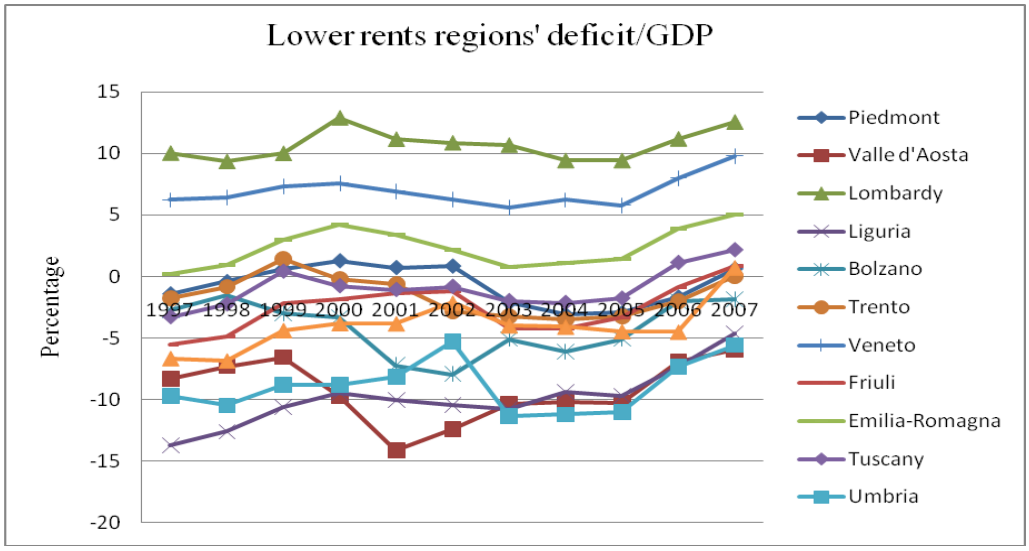
Source: *Conti pubblici territoriali*, www.dps.tesoro.it; ISTAT, *Conti economici regionali*, www.istat.it.

INCOME : regional per capita income (in current chain-linked euros with reference year 2005).

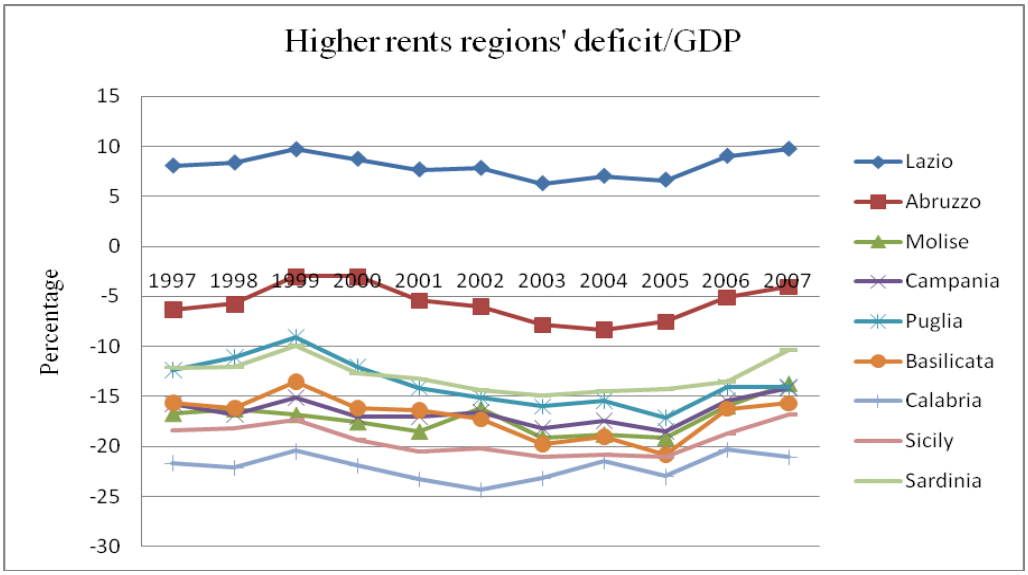
Source: ISTAT, *Conti economici regionali, www.istat.it.*

-3) Graphs of the dependent variables

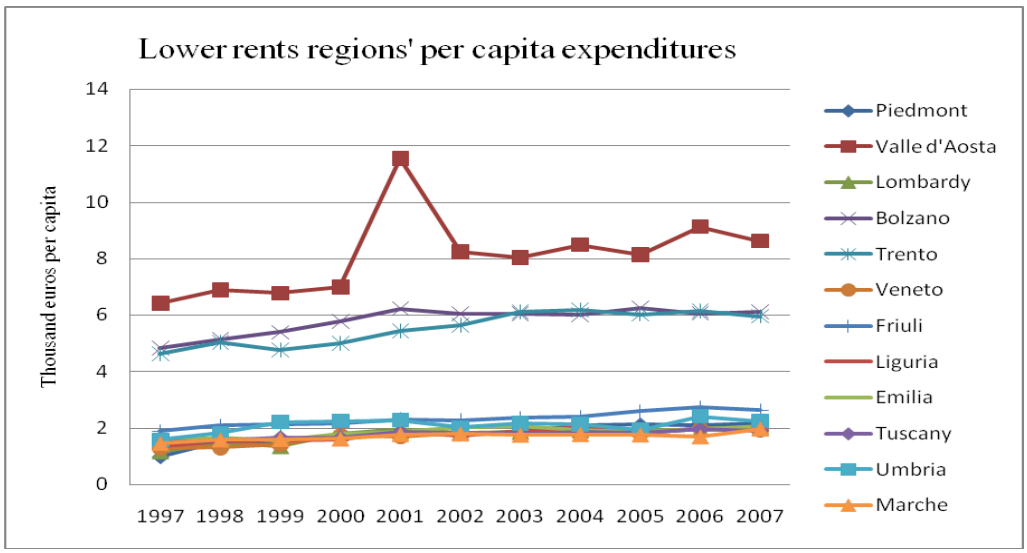
3.1



3.2

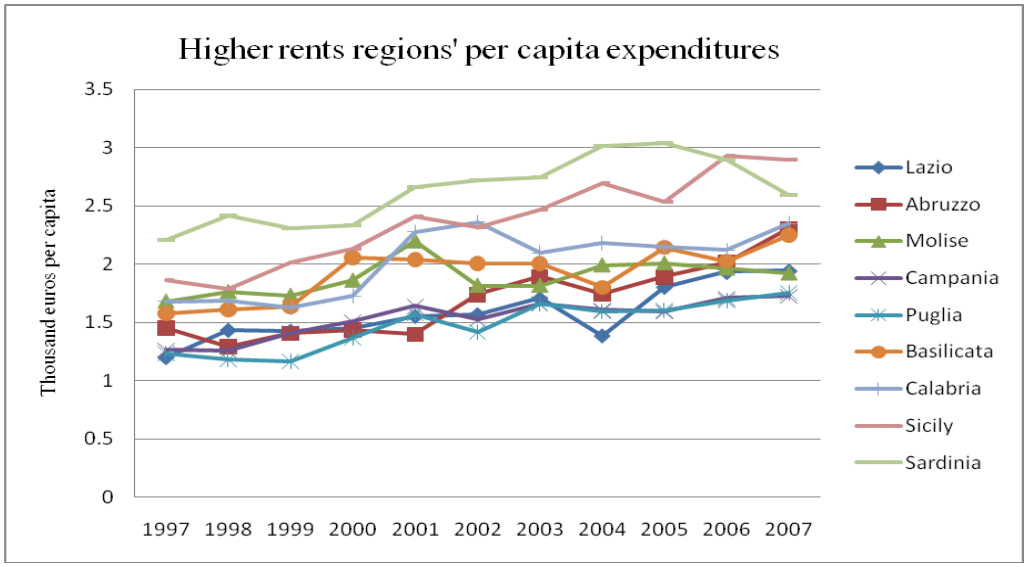


3.3



Elaborated by implementing the *Conti pubblici territoriali's dataset (*current chain-linked euros with reference year 2005).

3.4



Elaborated by implementing the *Conti pubblici territoriali's dataset (*current chain-linked euros with reference year 2005).

- 4) Econometric theory

Specific techniques for panel data are now widely used to estimate dynamic econometric models as only such type of data provides information about phenomena and dynamics over time and on individuals. Indeed cross-section data usually provide very little details about past time periods to conjecture on dynamic relationships. On the other hand, aggregate time series data do not permit to control for the microeconomic characteristics associated with each level, leading to biases and poor estimations of the parameters of interest.

This section begins by showing how standard estimators commonly implemented in panel data turn out to be inconsistent in the case of dynamic specifications. The focus is then turned on the Arellano-Bond GMM estimator widely used in such context. Finally, the Arellano-Bover (1995)/Blundell-Bond (1998) estimator is presented in the concluding component of this part[113].

The overview is completed by reporting useful specifications tests typical for such estimators.

- 4.1) An autoregressive panel data model

The initial focus of this work is on the case where there are no exogenous variables: an autoregressive AR(1) model.

[113] As stressed by Roodman (2006), p.1, the Arellano-Bond (1991) and Arellano-Bover (1995)/Blundell-Bond (1998) are both dynamic panel estimators designed for situations with: "*1) "small T, large N" panels; 2) a linear functional relationship; 3) a single left-hand-side variable that is dynamic, depending on its own past realizations; 4) independent variables that are not strictly exogenous, meaning correlated with past and possibly current realizations of the error; 5) fixed individual effects; and 6) heteroskedasticity and autocorrelation within individuals but not across them.*"

Let us consider the following specification:

$$(1)\quad y_{it} = \alpha y_{i,t-1} + (\mu_i + u_{i,t}); \qquad |\alpha| < 1; \quad i = 1, 2, \ldots, N; \quad t = 2, 3, \ldots, T$$

where $y_{i,t}$ is an observation on the individual *i* for the period *t*, $y_{i,t-1}$ is the value of the same variable but from the previous period, μ_i is an unobserved individual-specific time-invariant effect which allows for heterogeneity in the means across different individuals, and $u_{i,t}$ is the error term. It is unavoidable to underline that the current time period is denoted by small T, large N context and by following Arellano and Bond (1991), $u_{i,t}$ is specified to have finite moments. Besides, it is $E(u_{i,t}) = E(u_{i,t}, u_{i,t-s}) = 0$ for $t \neq s$ implying the assumption that the errors are serially uncorrelated but not necessarily independent over time. Moreover, μ_i are stochastic and therefore correlated with the lagged dependent variable.

With these assumptions it can be shown that the explanatory variable $y_{i,t-1}$ is correlated with the error term $(\mu_i + u_{i,t})$ via the individual effect[114]. The lagged variable is given by the equation:

$$(2)\quad y_{i,t-1} = \alpha y_{i,t-2} + (\mu_i + u_{i,t-1}).$$

Consequently $y_{i,t-1}$ turns out to be correlated with μ_i and the estimation methods routinely applied in case of panel data sets all become inconsistent.

When the Ordinary Least Squares (OLS) estimator is taken into consideration, it first needs to be stated that it tends to overestimate the true value of the parameter of interest. The unfortunate fact remains that it is not possible to eliminate this correlation neither by increasing the number of individuals nor by extending the

[114] Cameron and Trivedi (2005), p.764.

number of time periods[115].

Similarly, in case of Random Effects, a basic assumption is that the individual effects are independent from the regressors of the model which is clearly not plausible in this context.

The Within Groups estimator requires $T \to \infty$ to be consistent since the regressor $(y_{i,t-1} - \bar{y_i})$ is still correlated with $(u_{i,t} - \bar{u_i})$. Indeed the transformed lagged variable is

$$(3) \quad y_{i,t-1} - 1/T - 1\,(y_{i1} + \cdots + y_{it} + \cdots y_{i,T-1})$$

while the error is given by

$$(4) \quad u_{i,t} - 1/T - 1\,(u_{i,2} + \cdots + u_{i,t-1} + \cdots + u_{i,T}).$$

The components $-y_{i,t}/T - 1$ and $u_{i,t}$ are correlated because of (1) and an identical problem is present when $y_{i,t-1}$ and $-u_{i,t-1}/T - 1$ are taken into consideration. Thus, the OLS estimation of the Within model leads to biased results. In order to achieve consistency, a very small $\bar{u_i}$ is required[116] implying that *T* needs to increase towards infinity[117]. *"Standard results for omitted variables bias indicate that, at least in large samples, the Within Group estimator is biased downwards"*[118].

Considering our specification (1), we can estimate α with a fixed effect procedure as follows[119]:

[115] See Bond (2002).
[116] Further explanation about this issue can be found in Nickell (1981).
[117] Whilst it does not vanish as the number of the individual in our sample increases.
[118] Bond (2002) , p.144.
[119] Hsiao (2003), p.71.

$$(5.1)\quad \widehat{\alpha_{FE}} = \sum_{i=1}^{N}\sum_{t=1}^{T}(y_{it} - \bar{y}_i)(y_{i,t-1} - \bar{y}_{i,-1}) / (\frac{1}{NT})\sum_{i=1}^{N}\sum_{t=1}^{T}(y_{i,-1} - \bar{y}_{i,-1})^2$$

$$(5.2)\quad =$$
$$\alpha + \left(\frac{1}{NT}\right)\sum_{i=1}^{N}\sum_{t=1}^{T}(y_{i,t-1} - \bar{y}_{i,-1})(u_{i,t} - \bar{u}_i) / \left(\frac{1}{NT}\right)\sum_{i=1}^{N}\sum_{t=1}^{T}(y_{i,t-1} - \bar{y}_{i,-1})^2$$

where $\bar{y}_i = \sum_{t=1}^{T} y_{i,t}/T$, $\bar{y}_{i,-1}$=$\sum_{t=1}^{T} y_{i,t-1}/T$, and $\bar{u}_i = \sum_{t=1}^{T} u_{it}/T$.

Hsiao (2003) shows that when N tends to infinity, the nominator in (5.2) is equal to:

$$(6)\quad -\sigma_u^2/T^2 . \{[(T-1) - T\alpha + \alpha^T]/(1-\alpha)^2\}$$

Therefore, if both T and N tend to infinity, the fraction in (5.2) converges to zero leading to the implication that the fixed-effects estimator is consistent for α. However a major setback related to this methodology is the fact that in many applications long time series of data are not available. By showing evidence from Monte Carlo experiments, Verbeek (2012) clearly ascertains that the bias related to cases where the samples have finite small *T* can hardly be ignored[120].

In order to solve the inconsistency problem it is possible to first refer to Anderson and Hsiao's (1981) differentiation of model (1) to obtain:

$$(7)\quad \Delta y_{i,t} = \alpha \Delta y_{i,t-1} + \Delta u_{i,t};\ \ |\alpha| < 1;\ \ i = 1,2,\dots,N;\ \ t = 3,4,\dots,T$$

First of all it is important to outline that OLS is still inconsistent in light of the correlation between $y_{i,t-1}$ and $u_{i,t-1}$ in $\Delta u_{i,t}$. However, since our errors are assumed to be serially uncorrelated, consistent estimates of the parameters can be

[120] See Verbeek (2012), p.397.

obtained via the usage of the 2SLS method. Specifically, in this context it can easily be noted that $y_{i,t-2}$ is both correlated with $\Delta y_{i,t-1}$ and orthogonal to $\Delta u_{i,t}$. That is, the two period lagged dependent variable is a good instrument for ($y_{i,t-1} - y_{i,t-2}$) and the only additional assumption required is the availability of at least three observation periods. In case where one is dealing with four years of data, $\Delta y_{i,t-2}$ is also usable[121].

"More efficient estimation is possible by using additional lags of the dependent variable as instrument"[122] especially adding exogenous variables to the model and implementing the first-differenced instrument[123].

Furthermore, Arellano and Bover (1995) point to the fact that it is possible to find evidence from Monte Carlo simulations proving that the Anderson-Hsiao estimator suffers from large standard errors and bias in cases where α is close to unity.

As an alternative, another class of estimator comes in the form of the GMM framework.

According to Arellano and Bond (1991), the relevant set of instruments is defined as:

$$(8)\ Z_i = \begin{bmatrix} y_{i,1} & 0 & \cdots & 0 \\ 0 & y_{i,1}, y_{i,2} & \cdots & 0 \\ \vdots & \vdots & \cdots & \vdots \\ 0 & 0 & \cdots & y_{i,1} \cdots y_{i,T-2} \end{bmatrix}$$

where each row represents the instruments for periods t=3,4,..,T and thus, the matrix of all instruments turns out to be equal to Z = $[Z_1', \ldots, Z_N']'$. The asymptotically

[121] As noted by Bond (2002), another assumption on the initial conditions is required: $y_{i,1}$ needs to be predetermined .

[122] Cameron and Trivedi (2005), p.765

[123] Arellano (1989), p.337:"*With an autoregressive exogenous variable, the estimator that uses differenced instruments has a singularity point and very large variances over a significant range of parameter values. On the contrary, the estimator that uses instruments in levels has no singularities and much smaller variances."*

efficient GMM estimator is based on the moment conditions:

(9.1) $E[Z_i'\Delta u_i]=0$ for i = 1,2,..,N

and following Baltagi (2008) and Verbeek (2012), from (7) one can re-formulate the constraints in the following fashion:

(9.2) $E\left[Z'_i\left(\Delta y_i - \alpha\Delta y_{i,-1}\right)\right]$.

In order to obtain the asymptotically efficient GMM estimator, the criterion

$$(10)\ \left(\frac{1}{N}\sum_{i=1}^{N} Z_i'\left(\Delta y_i - \alpha\Delta y_{i,-1}\right)\right)' W_N \left(\frac{1}{N}\sum_{i=1}^{N} Z_i'\left(\Delta y_i - \alpha\Delta y_{i,-1}\right)\right)$$

with W_N symmetric positive weighting matrix is thus minimized for α. The result, referred to as 'difference GMM', is consistent as long as W_N is positive definite[124]. If no restrictions are imposed on the covariance matrix of the errors it is possible to calculate the weighting matrix by exploiting consistent estimates of the first-differenced residuals. These are previously obtained from a first-step consistent estimator (where for instance $W_N = I$)[125]. Hence, the resulting optimal weighting matrix is given by

$$(11)\ \widehat{W_N^{OPT}} = \left(\frac{1}{N}\sum_{i=1}^{N} Z_i'\Delta\widehat{u_i}\,\Delta\widehat{u_i}'Z_i\right)^{-1}$$

and the resultant estimator, known as two-step GMM, is

[124] It means in general that $Re(x'Ax) > 0, \forall x \in \mathbb{C}^n \; with \; x \neq 0;$ namely, the real part of $x'Ax$ is strictly greater than zero for every vector $x \in \mathbb{C}^n$.

[125] See Verbeek (2012), p.400.

$$(12)\ \widehat{\alpha_{GMM}} = \left(\left(\sum_{i=1}^{N} \Delta y'_{i,-1} Z_i\ \right) W_N \left(\sum_{i=1}^{N} Z'_i \Delta y_{i,-1}\right)\right)^{-1} \left(\left(\sum_{i=1}^{N} \Delta y'_{i,-1} Z_i\right) W_N \left(\sum_{i=1}^{N} Z'_i \Delta y_i\right)\right).$$

Even though the only assumption made about the errors was no serial correlation, *"it is also possible (and potentially advisable in small samples) to impose the absence of autocorrelation in* $u_{i,t}$*, combined with a homoskedasticity assumption"*[126]. Therefore an asymptotically equivalent GMM estimator can be obtained without involving unknown parameters in the weighting matrix but substituting $\widehat{W_N^{OPT}}$ with

$$(13)\ W_{1N} = \left[\frac{1}{N}\sum_{i=1}^{N}(Z'_i H Z_i)\right]^{-1}.$$

In this formula *H* is a square matrix with main diagonal of 2's, -1's on the first off-diagonals and zeros elsewhere and no estimation of residuals is required; in such a case one refers to the one-step GMM estimator. However, simulations done by Arellano and Bond (1991) have found a very limited efficiency gain using the two-step version, even in case of considerable heteroskedasticity. Furthermore, Bond and Windmeijer (2002) point out that the dependence of $\widehat{W_N^{OPT}}$ on estimated residuals undermines the usual asymptotic distribution of the estimator. It brings about standard errors that are much too small, or asymptotic t-ratio much too big. Windmeijer (2000) provides a finite sample correction for the asymptotic variance of the two-step estimator.

With fixed T and N$\rightarrow \infty$ the GMM estimator is asymptotically normal and consistent even though, as T grows a proliferation of available instruments occurs[127].

[126] Ibidem.

[127] However in this case would be more attractive to implement a fixed effect estimator.

- 4.2) Multivariate Arellano-Bond dynamic models

The GMM estimator described in the previous section can be straightforwardly implemented even in case the model has the following form:

$$(14)\ y_{i,t} = \alpha y_{i,t-1} + \beta' x_{i,t} + (\mu_i + u_{i,t});\ |\alpha| < 1;\quad i = 1,2,\dots,N;\ \ t = 2,3,\dots,T.$$

where $x_{i,t}$ is a *K* x 1 vector of current and lagged explanatory variables, and $u_{i,t}$ are kept serially uncorrelated. Bond (2002) clearly shows how the sets of moment conditions can vary depending upon the hypothesis associated with the new regressors, specifically the assumptions made about the correlation with each component of $(\mu_i + u_{i,t})$.

Additionally, the assumption is made that the explanatory variables are being correlated with the heterogeneity μ_i; the latter assumption forces the usage of first-differencing the model in order to get rid of μ_i.

In a case where the variables at hand are endogenous "*in the sense that* $x_{i,t}$ *is correlated with* $u_{i,t}$ *and earlier shocks, but* $x_{i,t}$ *is uncorrelated with* $u_{i,t+1}$ *and subsequent shocks*"[128], it is possible to treat $x_{i,t}$ analogously to $y_{i,t}$: this time $(y_{i,1}, \dots, y_{i,t-2})$ will be replaced by $(y_{i,1}, \dots, y_{i,T-2}, x'_{i,1}, \dots, x'_{i,t-2})$. Computation procedure is in this case analogous to the autoregressive model previously analyzed.

If $x_{i,t}$ is considered to be exogenous in the sense that all past, present and future realizations are uncorrelated with $u_{i,t}$, the complete time series $x_i = (x'_{i,1}, x'_{i,2}, \dots, x'_{i,T})'$ are now available instruments for each first-differenced equation of the regression; therefore the $(y_{i,1}, \dots, y_{i,t-2})$ set of instruments will be substituted by

[128] Bond (2002), p.152.

$(y_{i,1}, \dots, y_{i,t-2,}\ x'_i)$.

If there is absence of simultaneous correlation between $x_{i,t}$ and the error term $u_{i,t}$ but " $x_{i,t}$ *may still be correlated with* $u_{i,t-1}$ *and earlier shocks*"[129] , the explanatory variables are defined as predetermined: in such a case $x_{i,t-1}$ is used as a further instrument and they become $(y_{i,1}, \dots, y_{i,T-2}, x'_{i,1}, \dots, x'_{i,t-2}, x'_{i,t-1})$.

The Arellano-Bond estimator for the (k+1) x 1 coefficient vector γ is in both cases (exogenous and predetermined covariates) is given by:

$$(15)\ \widehat{\gamma_{GMM}} = (\bar{X}'ZW_NZ'\bar{X})^{-1}(\bar{X}'ZW_NZ'\Delta y)$$

where $\bar{X}$ is a stacked (T-2)N x (k+1) matrix of $\bar{x}^*_{i,t} = x^*_{i,t} - x^*_{i,t}$, where $x^*_{i,t}$=$(y_{i,t-1}, x'_{i,t})$. Z depends upon the aforementioned hypothesis for the instruments, and W_N on choosing one or two-step estimator variation.

If the explanatory variables $x_{i,t}$ are considered to be uncorrelated with μ_i, other additional moment conditions exploiting this lack in the level equations now become available. According to Arellano and Bond (1991) if the attention is turned to the case of predetermined explanatory variables $x_{i,t}$, one will obtain these non-redundant moment conditions:

(16.1) $E[(\mu_i + u_{i,t})x_{i,t}] = 0$; for $i = 1,2,\dots,N$; $t = 2,3,\dots T$;

(16.2) $E[\ (\mu_i + u_{i,2})\ x_{i,1}] = 0$; for $i = 1,2,\dots,N$;

and the Z matrix needs to be adjusted accordingly. The optimal matrix of instruments

[129] See the previous note.

Z_i^+ now includes two blocks of matrices: Z_i as previously defined for the case of predetermined variables plus a Z_i^a which is itself diagonal block with $[x'_{i,1}\, x'_{i,2}]$ in the first block and $x'_{i,s}$, with s = 3,…T, in the others:

$$(17)\quad Z_i^+ = \begin{bmatrix} Z_i & & & 0 \\ & [x'_{i,1}x'_{i,2}] & & \\ & & x'_{i,3} & \\ & & & \ddots \\ 0 & & & x'_{i,T} \end{bmatrix}$$

The Arellano-Bond estimator is then given by:

$$(18)\quad \hat{\gamma}_{GMM} = (X'^{+}Z^{+}W_N X'^{+})^{-1} X'^{+}Z^{+}W_N Z'^{+}\Delta y^{+}$$

In this case the [(T-2)+(T-1)] x 1 vector $u_i^+ = (\Delta u'_i v'_i)'$ is present where obviously $v_{i,t} = (\mu_i + u_{i,t})$ and we define $v' = (v_1'^{+}, \dots, v_N'^{+})' = y^{+} - X^{+}\alpha$. The optimal weighting matrix for the two-step estimator is modified as follow:

$$(19)\quad \widehat{W_N^{OPT}} = \left(\frac{1}{N}\sum_{i=1}^{N} Z_i'^{+}\hat{u}_i^{+}\hat{u}_i'^{+}Z_i^{+}\right)^{-1}$$

If instead the case in which $x_{i,t}$ are considered to be strictly exogenous, it turns out that the observations for all periods become valid instruments in the level equations. However, given the restrictions already exploited in first-differences, only the following T extra moment conditions will be available:

$$(20)\quad E\left(\frac{1}{T}\sum_{s=1}^{T} u_{i,s}x_{i,t}\right) = 0 \text{ for t=1,…,T.}$$

A problem with the original Arellano-Bond estimator is that lagged levels are poor instruments for first-differences when the variables are close to a random walk[130]. Arellano and Bover (1995) describe how, if the original equation in levels is added to the system, other instruments can be brought to increase efficiency. The crucial assumption needed is that these differences are uncorrelated with the unobserved country effects. In case there is lack of willingness to assume that $x_{i,t}$ is being uncorrelated with the individual effects it is still possible to add other instrument variables if the following assumptions hold:

$$(21.1)\ E(x_{i,t}\mu_i) = E(x_{i,s}\mu_i)$$

$$(21.2)\ E(x_{i,t}u_{i,s}) = 0$$

with all *t* and *s*. We consider predetermined variables with constant correlation with μ_i: it yields the result that the last assumption will hold only in case $t \leq s$. By eliminating the redundant conditions, other constraints are:

$$(22)\ E[(\mu_i + u_{i,t})\Delta x_{i,t}] = 0;\ t = 2,3\ldots,T\ ,$$

and the matrix of instruments needs to be redefined to get the estimator of the parameters of interest[131], usually indicated as the system GMM estimator. Then, the typical instrument set in level for a predetermined variable is:

[130] See some evidence from Monte Carlo experiments in Blundell and Bond (1998).
[131] Cfr. Arellano and Bover (1995) cap.4 for further details.

$$(23)\ Z_{i,level} = \begin{bmatrix} \Delta x_{i,2} & & \\ & \ddots & \\ & & \Delta x_{i,T} \end{bmatrix}.$$

Finally, Blundell and Bond (1998) further develops the Arellano-Bover findings[132] by clarifying when extra-conditions exploited for equations in level are valid instruments and particularly helpful.

The authors consider an autoregressive panel data model with no exogenous regressors,

$$(24)\ y_{i,t} = \partial y_{i,t-1} + \mu_i + u_{i,t}$$

with $E(\mu_i) = 0, E(u_{i,t}) = 0$ and $E(\mu_i u_{i,t}) = 0$ for i=1, 2, …, N and t = 1, 2, …T.

Blundell and Bond (1998) then, focus on the case where T = 3 and thus only one orthogonality condition, given by $E(y_{i,1}\Delta u_{i,3})$ = 0, is exploitable: in such a case ∂ is just-identified and roughly speaking, it reduces the case to a two-stages estimator in a GMM framework. The first-stage IV regression is obtained by running $\Delta y_{i,2}$ on $y_{i,1}$. This regression can result from (24) evaluated at t = 2 by subtracting $y_{i,1}$ from both sides of this equation, to wit:

$$(25)\ \Delta y_{i,2} = (\partial - 1)y_{i,1} + \mu_i + u_{i,2}\ .$$

Since it is expect $E(y_{i,1}\mu_i) > 0$, it follows that $(\partial - 1)$ will be biased upwards, with

[132] Sometimes we referred to the Arellano-Bover (1995)/Blundell-Bond estimator. See for instance Roodman (2006), Baltagi (2008).

$$(26)\ plim(\hat{\partial} - 1) = (\partial - 1)\frac{c}{c + (\sigma_\mu^2 + \sigma_u^2)}$$

where $c = (1 - \delta)/(1 + \delta)$. The bias term effectively scales the estimated coefficient on the instrumental variable $y_{i,1}$ towards zero. Blundell and Bond (1998) also find that the *F*-statistic of the first-stage IV regression converges to χ_1^2 with non-centrality parameter:

$$(27)\ \tau = \frac{(\sigma_u^2 c)^2}{\sigma_\mu^2 + \sigma_u^2 c} \to 0 \text{ as } \partial \to 1.$$

That is: as $\tau \to 0$, the instrumental variable estimator is low performing. "*Hence, Blundell and Bond attribute the bias and the poor precision of the first-difference GMM estimator to the problem of weak instruments*[133] *and characterize this by its concentration parameter* τ*"*[134]. Namely, the instruments for the equation in first differences are likely to be weak when the individual series have near unit root characteristics[135].

Blundell and Bond (1998) show that an additional stationarity mean restriction on the initial conditions of (25) allows the use of system GMM's instruments for equations in levels, in addition to lagged levels of $y_{i,t}$ as instruments for equations in first differences. Explicitly, it is required that

$$(28)\ E\left[\left(y_{i,1} - \left(\frac{\mu_i}{1-\alpha}\right)\right)\mu_i\right] = 0$$

[133] If using instrumental variables (IV) "*the partial correlation among instruments and the endogenous variable is low, then instruments are weak"*. (Staiger and Stock 1997, p. 557)
[134] Baltagi (2008), p.148.
[135] Bond (2002), p. 154.

so that "*the initial conditions do not deviate systematically from the value* $\left(\frac{\mu_i}{1-\alpha}\right)$"[136], a long-run mean towards the time series converges[137]. It brings about that $E(\Delta y_{i,2}\mu_i) = 0$ for all *i*, which in turn, given the soft assumption $E(\Delta u_{i,t}\mu_i) = 0$ for $i = 1, 2, \ldots, N$ and $t = 3, 4, \ldots, T$, implies the additional *T*-2 linear moment conditions:

$$(29)\ E\left(\Delta y_{i,t-1}(\mu_i + u_{i,t})\right) = 0 \quad \text{for } i = 1, 2, \ldots, N \text{ and } t=3, 4, \ldots, T.$$

In case of an autoregressive-distributed lag model, system GMM estimator can be applied straightforwardly if the mean stationarity assumption holds for the other covariates as well[138].

- 4.3) Specification tests

According to Arellano and Bond (1991) a model which is already first-differenced is considered:

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[136] *Ivi* (2002), p.153.

[137] According to Roodman (2009) an AR(1) with fixed effects is set: $y_{i,t} = \alpha y_{i,t-1} + \varepsilon_{i,t}$ with $\varepsilon_{i,t} = \mu_i + u_{i,t}$, $E(\mu_i) = E(u_{i,t}) = E(\mu_i u_{i,t}) = 0$. "*Entities in this system can evolve much like GDP per worker in the Solow growth model, converging towards mean stationarity"(p.143)*. The FIxed effect provides a constant ' boost' to the variable in each period, *"like investment does for the capital stock*". But, assuming $|\alpha|<1$, the enhancement is set off by reversion towards the mean. The series thus converges to steady-state defined by $E(y_{i,t}|\mu_i) = E(y_{i,t+1}) \Rightarrow y_{i,t} = \alpha y_{i,t} + \mu_i \Rightarrow y_{i,t} = \frac{\mu_i}{1-\alpha}$. Then, fixed effect and coefficient determine the long run mean of the series.

[138] System GMM estimator is shown to have *"dramatic efficiency gains over the basic first-difference GMM as* $\delta \rightarrow 1$*"* (Baltagi 2008), especially in case of short *T* and persistent series (difference GMM gains reliability as *T* get longer). Striking examples can be found in Blundell and Bond (1998), Bond (2002).

(23) $y = X\alpha + u$

where *y* and *u* are (n x 1) vectors, *X* is a (n x k) matrix with 'n' equal to $\sum_i (T-2)$, α is (k x 1) vector. In addition, the assumption for all the regressors to be correlated with the heterogeneity μ_i is made.

Making the usual assumption of serially uncorrelated errors brings about that $E(u_{i,t}u_{i,t-1})$ is different from zero whilst $E(u_{i,t}u_{i,t-2})$ = 0[139]. In order to identify or not the presence of second order serial correlation, the authors consider the average covariances $\phi_i = u'_{i,-2}u_{i\cdot}$ which are ascertained as being independent random variables with zero mean under the null hypothesis of no second order correlation. A one degree of freedom test statistic to verify whether $E(\phi_i) = 0$ is:

(24) $m_2 = \frac{\hat{u}'_{-2}\hat{u}_{\cdot}}{\hat{u}^{\frac{1}{2}}} \tilde{a}\, N(0,1)$,

where $\hat{u}$ at the denominator is given by:

(25) $\hat{u} =$
$\sum_{i=1}^{N} u'_{i,-2v}\hat{u}_{i\cdot}u'_{i\cdot}\hat{u}_{i,-2} - 2\hat{u}'_{-2}X_*(X'ZW_{1N}Z'X)^{-1}X'ZW_{1N}(\sum_{i=1}^{N} Z'_i\,\hat{u}_i\hat{u}'_{i\cdot}\hat{u}_{i,-2}) +$
$\hat{u}'_{-2}X_*av\hat{a}r(\hat{a})X'_*\hat{v}_{-2}$

.

In order to get a defined m_2 a minimum requirement is $T_i \geq 5$.

Moreover it is possible to test the moment conditions by performing a Hansen-Sargan test of over-identifying restrictions with test-statistic given by:

[139] The consistency of the GMM heavily depends upon the validity of the latter relation.

$$(26)\ s = \hat{u}' Z (\sum_{i=1}^{N} Z_i' \hat{u}_i \ \ \hat{u}_i' Z_i)^{-1} Z' \hat{u} \tilde{a} \chi^2_{p-k}\ .$$

The residuals are obtained from a two-step estimator of α and *p* is the number of columns of a general Z[140] provided $p > k.$

However, if the errors are i.i.d. over time and on individuals, the *s* statistic calculated using residuals $\tilde{u}$ from a one-step estimator, coincides exactly with the Sargan statistic with the additional characteristic of it still having a chi-square distribution. The related formula is:

$$(27)\ s_1 = \frac{1}{\hat{\sigma}^2} \tilde{u}' Z (\sum_{i=1}^{N} Z_i' H_i Z_i)^{-1} Z' \tilde{u}\ .$$

However, as stressed in Roodman (2006), *"if non-sphericity is suspected in the errors, as in robust one step GMM, the Sargan statistic […] is inconsistent"*[141] and the two-step estimator is theoretically superior[142].

A further possibility is to test a subset instruments validity using the so called 'difference-in-Sargan' test, also known as a C statistic. Indeed, if such an estimation is performed with and without a subset of instruments[143], the C statistic resulting from the difference between the two Sargan-Hansen tests, is itself asymptotically $\chi 2$ under the hypothesis of joint validity of the all set. The number of degrees of freedom will be equal to that of instruments in the subset[144].

A final point: the Sargan/Hansen test should not be relied upon too faithfully as the

[140] Z does not need to be the optimal one but it needs to have a sufficient number of column.
[141] Roodman (2006), p.13.
[142] When the user requests the Sargan test for 'robust' one-step GMM regressions xtabond2 performs the second GMM step in order to obtain and report a consistent Hansen statistic.
[143] The regression without the subsets of instruments is called 'unrestricted' since it has fewer moment conditions.
[144] The difference-in-Sargan test is feasible only if the unrestricted regression has enough instruments to be identified.

number of implemented instruments grows significantly. Indeed, intuitively, a high number of restrictions brings about a lower likelihood for these to be satisfied.

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