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Essays on Management of fiscal resources in developing and emerging countries

Lavinia Teodora Mustea

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Ecole Doctorale des Sciences Economiques, Juridiques, Politiques et de Gestion

Centre d'Etudes et de Recherches sur le Développement International

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Essays on: Management of fiscal resources in developing and emerging countries

Décision publique et gestion des ressources budgétaires dans les pays en développement et émergents

Decizia publică şi managementul resurselor bugetare în ţările în dezvoltare şi emergente

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Par

Lavinia Teodora MUSTEA

sous la direction de M. Jean-Louis COMBES et M. Mihai Ioan MUTASCU

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Summary

Several years ago, a financial and economic crisis struck the world. Although originated in the United States, it quickly increased in intensity and reached all countries. In a context of financial contagion, governments (at national and supranational level) needed to react through measures designed to revive their economies. The aim of this PhD thesis is to highlight the importance of regional and/or country specific characteristics for the public decision making in order to stimulate economic growth, by analyzing the relationship between GDP and unemployment and the effects of fiscal stimuli programs.

The first part of the thesis is dedicated to analyzing the rule-of-thumb also known as Okun's Law at regional level in three emerging countries of Central and Eastern Europe. We find high values (in absolute values) for the Okun coefficient, compared with the results emphasized by the recent literature that mostly focuses on developed countries. First, we consider two emerging countries, selected for presenting a strong connection in terms of history, culture and economic activity, namely the Czech Republic and Slovakia. One interesting result is that Okun's Law appears not to be statistically significant in the regions in which average economic growth is low and average and long-term unemployment is high. Second, we analyze the same relationship in a newer member of the European Union, namely Romania. Here, Okun coefficients are not statistically significant in the most developed regions, namely with the highest average economic growth and with the lowest share of population at poverty risk. Consequently, our results suggest that Okun's Law is far from being not "universal"; as such, policymakers need to take into account the regional specificities in the design of their policies regarding growth and unemployment. In regions where Okun's coefficient is statistically significant, public authorities can make use of demand-side policies of Keynesian inspiration in order to reduce unemployment, while in regions where the coefficient is not significant policymakers need to turn their focus to supply-based policies.

In the second part of this thesis we approach the fiscal multiplier concept and its rebirth since the Great Recession, from the perspective of lessons to learn from developed countries. We begin by presenting the methods used to estimate multipliers and we survey the recent studies that assess fiscal multipliers. We begin by grouping the literature taking into account nonlinearities in the multipliers evaluation, such as: (i) the position in the economic cycle, (ii) the debt level, (iii) the monetary policy and (iv) the exchange rate regime. Subsequently, we present multipliers values by the level economic of development. Contrary to the wide number

of studies focusing on developed countries, only few studies assess multipliers in developing and emerging countries. In particular, this latter strand of studies suggests that fiscal multipliers might be lower in developing and emerging countries compared to developed countries. Capitalizing on this evidence, we provide an analysis that consists of estimating multipliers in selected European Union (EU) countries, by specifically accounting for a potential role of the Eurozone (namely, being a member country or not). More precisely, we assess fiscal multipliers in four groups of countries: (i) the "historical" EU countries, (ii) EU countries that are not expected to adopt the Euro, (iii) countries that recently joined the EU and are expected to join the Eurozone in the future, and (iv) Eurozone countries heavily affected by the crisis. In particular, we find that being in the Eurozone or expecting to join the Eurozone in the future generates expenditure multipliers in accordance with the Keynesian theory.

Finally, the third and last part of the thesis deals with evaluating fiscal multipliers in developing and emerging countries. On the one hand, we focus on the Mediterranean area, providing an appealing environment for the scope of our analysis due to the diversity of countries that compose it (in terms of cultures, traditions, religions) and to the heterogeneous response of these countries to the current crisis (countries that experienced negative growth rates coexist in the Mediterranean area with countries that managed to secure – at least for a period – positive growth rates). We reveal a positive and significant response of output on impact following a consumption (investment) shock in African (Asian) countries, a negative response after an investment shock in African countries or statistically not significant response for a consumption (investment) shock in Asian (small EU) countries. On the other hand, we analyze fiscal multipliers in eleven Central and Eastern European countries. We present results for pooled, country-specific and groups of countries (disentangled by the exchange rate regime, the level of economic development, the fiscal stance, and the openness degree). We reveal positive and significant multipliers for the whole group of countries, but output's response becomes not significant or even negative when estimated at country level or in separate groups of countries.

Keywords: fiscal policy, economic crisis, Okun's Law, fiscal multipliers, developing and emerging countries, panel VAR, panel cointegration.

Résumé

Il y a quelques années qu'une crise financière et économique a frappé le monde. Née aux Etats-Unis, elle a progressée rapidement et s'est propagée à tous les pays. Dans un contexte de contagion financière, les gouvernements (nationaux et supranationaux) ont dû réagir en adoptant des mesures visant à relancer l'économie. L'objectif de cette thèse est de mettre en évidence l'importance des caractéristiques spécifiques à la fois régionales et nationales dans la prise de décision publique visant à stimuler la croissance économique, notamment par l'analyse de la relation entre le PIB et le chômage et les effets des programmes de relance budgétaire.

La première partie de cette thèse est dédiée à l'analyse de la règle d'or connue comme la loi d'Okun, au niveau régional, dans trois pays émergents d'Europe Centrale et de l'Est. Nous obtenons des valeurs élevées (en valeur absolue) pour les coefficients d'Okun, en comparaison avec les résultats mis en évidence par la littérature récente qui se concentre principalement sur les pays développés. Premièrement, on considère deux pays émergents, sélectionné pour leur fort lien en termes d'histoire, de la culture et de l'activité économique, à savoir la République Tchèque et la Slovaquie. Un résultat intéressant est que la loi d'Okun semble ne pas être statistiquement significative dans les régions où la croissance moyenne économique est faible et où le chômage moyen et de long terme est élevé. Deuxièmement, nous analysons la même relation dans un nouvel état de l'Union européenne, à savoir la Roumanie. Ici, les coefficients d'Okun ne sont pas statistiquement significatifs dans les régions plus développées, plus spécifiquement où la croissance économique moyenne est élevée et la part de la population au risque de pauvreté est faible. Par conséquent, nos résultats suggèrent que la loi d'Okun est loin d'être « universelle » ; de surcroît, les décideurs de politique économique doivent prendre en compte les spécificités régionales dans la définition de leurs politiques de croissance et d'emploi. Dans les régions où le coefficient d'Okun est statistiquement significatif, les autorités publiques peuvent faire usage des politiques de demande d'inspiration keynésienne afin de réduire le chômage, tandis que dans les régions où les coefficients sont non-significatifs les décideurs doivent tourner leur attention vers les politiques d'offre.

Dans la deuxième partie de cette thèse nous approchons le concept de multiplicateur budgétaire et sa renaissance depuis la Grande Récession, dans la perspective des leçons à apprendre des pays développés. Nous commençons par présenter les méthodes utilisées pour estimer les multiplicateurs et nous survolons les études récentes évaluant les multiplicateurs budgétaires. Nous débutons par regrouper la littérature qui prend en compte les nonlinéarités dans l'évaluation des multiplicateurs, tels que: (i) le cycle économique, (ii) le niveau de la dette,

(iii) la politique monétaire et (iv) le régime de taux de change. Par la suite, nous présentons les valeurs des multiplicateurs en fonction du niveau de développement économique. Contrairement au nombre très important d'études se focalisant sur les pays développés, seuls quelques travaux évaluent les multiplicateurs dans les pays en développement et émergents. En partant de cette évidence, nous développons une analyse qui consiste à estimer des multiplicateurs dans une sélection de pays de l'Union Européenne (UE), en prenant en compte spécifiquement un rôle pontentiel pour la zone euro (à savoir, être ou pas membre). Plus précisément, nous calculons des multiplicateurs budgétaires dans quatre groupes de pays: (i) le groupe « historique » des pays de l'UE, (ii) des pays de l'UE qui ne sont pas censés adopter l'euro, (iii) des pays qui ont récemment adhéré à l'UE et qui devraient rejoindre la zone euro à l'avenir, et (iv) des pays de la zone euro fortement touchés par la crise. Les résultats montrent, entre autres, que l'appartenance à la zone euro ou la possible intégration à la zone euro à l'avenir génèrent des multiplicateurs de dépenses conformes à la théorie keynésienne.

Enfin, la troisième et dernière partie propose une évaluation des multiplicateurs budgétaires dans les pays en développement et émergents. D'une part, nous nous concentrons sur la région méditerranéenne, qui est très attrayante pour l'objectif de notre analyse en raison de la diversité des pays qui la composent (en termes de culture, tradition, religion) et compte tenu des réponses hétérogènes de ces pays à la crise actuelle (des pays qui connaissent des taux de croissance négatifs coexistent dans la région méditeranéenne avec des pays qui ont réussi à préserver – du moins pour une certaine période – des taux de croissance positifs). Nous trouvons une réponse positive et significative du PIB à l'impact suite à un choc de consommation (d'investissement) dans les pays africains (asiatique), une réponse négative après un choc d'investissement dans les pays africains ou une réponse statistiquement non significative suite à un choc de consommation (d'investissements) dans les pays asiatiques (dans les petits pays de l'UE). D'autre part, nous analysons les multiplicateurs budgétaires dans onze pays d'Europe Centrale et de l'Est. Nous présentons des résultats pour l'ensemble des pays, pour chaque pays et pour des groupes de pays (répartis selon le régime de change, le niveau de développement économique, la situation budgétaire et le taux d'ouverture). Nous mettons en évidence des multiplicateurs positifs et significatifs pour l'ensemble des pays, mais la réponse du PIB devient non significative, voire négative, lors de l'estimation pour chaque pays ou pour des groupes de pays.

Mots-clés: politique budgétaire, crise économique, Loi d'Okun, multiplicateurs budgétaires, pays en développement et émergentes, panel VAR, cointegration en panel.

Rezumat

Acum câțiva ani, o criză financiară şi economică a lovit economia mondială. Deşi originară din Statele Unite, criza a avut o creştere rapidă în intensitate şi s-a propagat în toate ţările. Într-un context de contagiune financiară, guvernele (la nivel naţional și supranaţional) au fost nevoite să reacţioneze, adoptând măsuri având ca scop revigorarea economiei. Scopul acestei teze de doctorat este de a evidenţia importanţa caracteristicilor specifice atât la nivel regional cât şi la nivel de ţară pentru luarea deciziilor publice care vizează stimularea creşterii economice, mai exact prin analizarea relaţiei dintre PIB şi şomaj şi a efectelor programelor de stimuli bugetari.

Prima parte a tezei este dedicată analizei regulii de aur cunoscuta sub numele de Legea lui Okun, la nivel regional, în trei ţări emergente din Europa Centrală şi de Est. Obţinem valori ridicate (în valoare absolută) pentru coeficienţii Okun, în comparaţie cu rezultatele subliniate de literatura recentă, care se concentrează în special pe ţările dezvoltate. În primul rând, analizăm două ţări emergente selectate pentru legătura puternică dintre ele în ceea ce priveşte istoria, cultura şi activitatea economică, şi anume, Republica Cehă şi Slovacia. Un rezultat interesant este că Legea lui Okun pare a nu fi semnificativă statistic în regiunile în care creşterea economică medie este scăzută şi şomajul mediu sau pe termen lung este ridicat. În al doilea rând, analizăm aceeaşi relaţie într-un stat relativ nou al Uniunii Europene, şi anume România. Aici, coeficienţii Okun nu sunt semnificativi din punct de vedere statistic în regiunile cele mai dezvoltate, mai exact, cu cea mai mare creştere economică medie şi cu cea mai mică pondere a populaţiei cu risc de sărăcie. Prin urmare, rezultate noastre sugerează că Legea lui Okun este departe de a fi "universală"; în consecinţă, factorii de decizie publică trebuie să ia în considerare specificul regional în definirea politicilor privind creşterea economică şi şomajul. În regiunile în care coeficientul Okun este semnificativ statistic, autorităţile publice pot folosi politici de cerere de inspiraţie keynesistă în vederea reducerii şomajului, în timp ce în regiunile în care coeficientul nu este semnificativ factorii de decizie trebuie să-şi îndrepte atenţia spre politici bazate pe ofertă.

În a doua parte a acestei teze abordăm conceptul de multiplicator bugetar și renaşterea acestuia odată cu începutul Marii Recesiuni, dintr-o perspectivă a lecţiilor ce pot fi învăţate din ţările dezvoltate. Începem prin a prezenta metodele utilizate pentru a estima multiplicatorii şi survolăm literatura recentă care calculează multiplicatori bugetari. Punctul de plecare constă in gruparea literaturii ținând cont de non-liniarităţi în evaluarea multiplicatorilor, cum ar fi: (i)

poziția în ciclul economic, (ii) nivelul datoriei, (iii) politica monetară și (iv) regimul cursului de schimb. Ulterior, vom prezenta valori ale multiplicatorilor în funcţie de nivelul de dezvoltare. Contrar numărului mare de studii care se focalizează pe ţările devoltate, doar un număr limitat de studii evaluează multiplicatorii în ţările în curs de dezvoltare şi emergente. În particular, această ultimă parte a literaturii sugerează că multiplicatorii bugetari sunt mai mici în ţările în curs de dezvoltare şi emergente comparativ cu valorile obținute pentru ţările dezvoltate. Bazându-ne pe aceste evidenţe, dezvoltăm o analiză ce constă în estimarea multiplicatorilor în anumite ţări ale Uniunii Europene (UE), în special ţinând cont de rolul zonei euro (a fi ţară membră sau nu). Mai precis, am estimat multiplicatori bugetari în patru grupuri de țări: (i) grupul „istoric" de ţări UE, (ii) țările UE care nu sunt de așteptat să adopte moneda euro, (iii), țări care au aderat recent la UE și se așteaptă să se alăture zonei euro în viitor, și (iv) țările din zona euro puternic afectate de criză. În special, rezultatele arată că apartența la zona euro sau posibila integrare in zona euro in viitor conduce la multiplicatori de cheltuieli în conformitate cu teoria keynesistă.

În cele din urmă, a treia şi ultima parte a tezei se focalizează pe calcularea multiplicatorilor bugetari în țările în curs de dezvoltare şi emergente. Pe de o parte, ne concentrăm pe zona mediteraneană, care asigură un mediu atractiv pentru scopul analizei noastre datorită diversităţii țărilor care o compun (în ceea ce priveşte cultura, tradiţia, religia) şi a răspunsurilor eterogene la criza actuală (țări care au cunoscut rate de creştere negative coexistă cu ţări care şi-au menținut – macar pentru o perioadă – rate de creştere pozitive). Descoperim un răspuns pozitiv și semnificativ al PIB-ului la impact, după un șoc de consum (investiții) în ţările din Africa (Asia), un răspuns negativ în urma unui şoc de investiţii în ţările din Africa sau un răspuns nesemnificativ statistic pentru un şoc de consum (investiţii) în ţările din Asia (țările mici din UE). Pe de altă parte, analizăm multiplicatori bugetari în unsprezece țări din Europa Centrală și de Est. Prezentăm estimări pentru toate ţările ca ansamblu, pentru fiecare țară în parte și pentru grupuri de țări (împărţite în funcţie de regimul de curs de schimb, nivelul de dezvoltare economică, situația bugetară, precum și gradul de deschidere). Evidențiem multiplicatori pozitivi și semnificativi pentru întregul grup de țări, dar răspunsul PIB-ului devine nesemnificativ sau chiar negativ, atunci când este estimat la nivel de țară sau în grupuri separate de țări.

Cuvinte-cheie: politică fiscală, criza economică, Legea lui Okun, multiplicatori bugetari, țări în curs de dezvoltare și emergente, panel VAR, cointegrare în panel.

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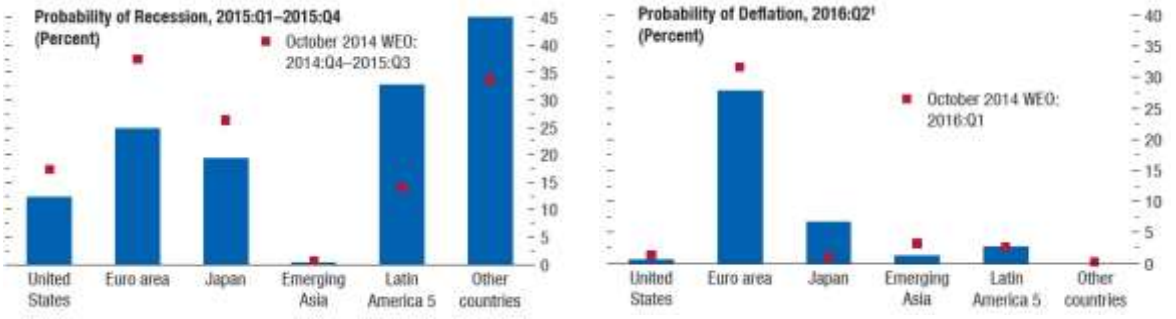
General Introduction

General introduction: The Great Recession, unemployment and fiscal stimulus

The world economies still fight the perpetuation of the crisis that started in 2007, generating considerable economic growth losses and major unemployment imbalances. For example, for the Euro Area, the ECB announced in January 2015 the Asset Purchase Program (APP) that pursues combined monthly purchases of 60 billion Euros until September 2016. Additionally, the Bank of Japan announced in October 2014 that the Quantitative and Qualitative Monetary Easing (QQE) will be expanded in order to achieve the price stability target of 2 percent change of the CPI, a goal established at the introduction of QQE in April 2013. Moreover, the recent decrease in oil prices will generate an increase in the global growth, but it is necessary to pay attention to the medium term growth prospects that can be affected by the uncertainty linked to the oil prices in the future, as reported in The G-20 Meeting (2015). The International Monetary Fund (IMF) Global Financial Stability Report discusses the fact that while the United States (US) seems to have passed the crisis and that the growth for 2015-2016 is projected to exceed 3 percent, in Japan and the Euro Area the economy is not there yet. The data from the third quarter of 2014 state that the Japanese economy fell into technical recession, while for the Euro Area the data indicate a lower growth than expected, and also deflation. As depicted in Figure 1, the IMF Global Projection Model predicts a decrease from the 2014 forecasts in the risk of recession in many major economies, and the fact that the deflation risk exists in principal for the Euro Area.

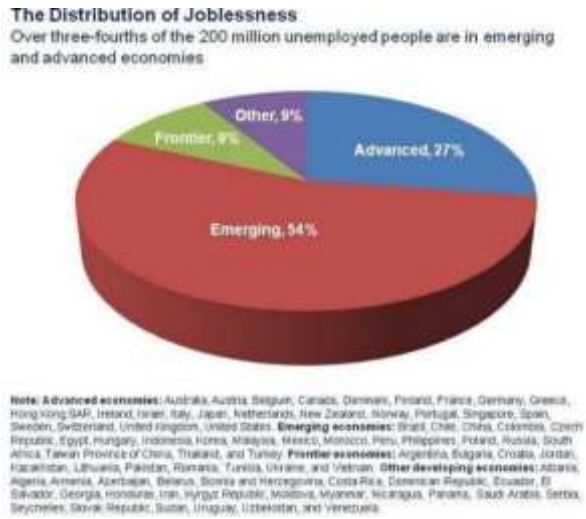
Figure 1. The probability of recession and deflation forecasts



Source: IMF (2015) *World Economic Outlook April*

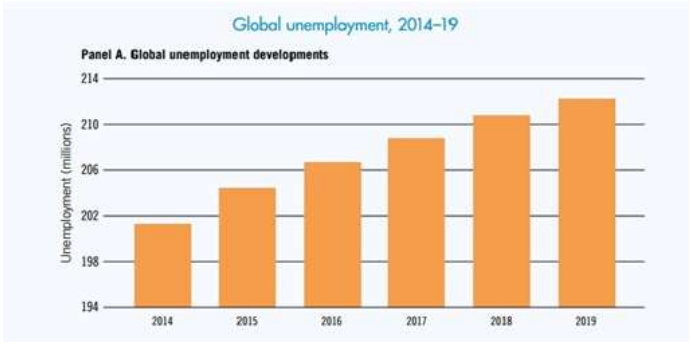
If we turn to the unemployment problem, in Europe almost one quarter of young people under 25 years are unemployed, while the unemployed people number reaches nearly 20 million (Lagarde, 2014). Figure 2 reveals the proportion of unemployed people between advanced and developing and emerging economies, while Figure 3 presents the forecast established by ILO (2015), namely an increase in unemployment in Europe.

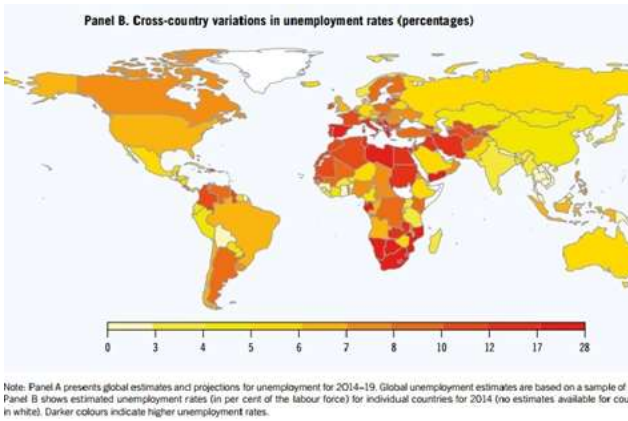
Figure 2. The distribution of joblessness



Source: Furceri, D. and P. Loungani (2014) "Growth: An essential Part of a Cure for Unemployment" *http://blog-imfdirect.imf.org/2014/11/19/growth-an-essential-part-of-a-cure-for-unemployment/*

Figure 3. Future trend in global unemployment





Source: International Labor Office (2015) World Employment and Social Outlook: Trends 2015

To this end, economists and academia still try to find answers to questions raised from the beginning of the recent crisis. Seven years have passed already and there is still place for lessons to be learned from the crisis effects. As stated by Blanchard (2015) "while the acute phase of "fiscal austerity'' has passed, many issues will remain for decades to come". Thus, in

order to find answers and the "good" path to deal with a crisis, the IMF started a series of conferences under the name "Rethinking Macro Policies". They began in 2011 with the first edition called "In the Wake of the Crisis", continued with the second edition in 2013 "What have we learned?" and the third in 2015 "Progress or Confusion?".

The Great Recession

Before approaching the recent crisis subject, it is necessary to shortly present the pre-crisis world situation. After the second oil price shock of the 1979, the global growth started to stagnate and so the 1980s and 1990s gain the name of the "Lost Decades" for developing countries where the median real growth per capita rate was almost zero. Turning to developed countries, the decades previous to the crises are known as the "Great Moderation". An interesting observation is made by Verick and Islam (2010), which argue that starting from 1979 until 2008 the world faced: "124 systemic banking crises, 208 currency crises, 63 sovereign debt crises, 42 twin crises, 10 triple crises, a global economic downturn every ten years and several price shocks." Another important period prior to the crisis is the global boom of 2002-2007, characterized by a period of high growth rates (especially in developing countries), high consumption (especially in developed countries) and high investments and exports (especially in developing countries). This increase in consumption and investment was not accompanied by a commensurate increase in wages (income), and we can easily affirm that the risks where underestimated in the "boom" period. For example, when the 2001 crisis started FED (The Federal Reserve) reduced the interest rate at 1 per cent and kept it at this point until the end of 2003. By so doing they stimulated the debt-financed consumption boom that influenced the global aggregate demand. In the boom years their policy was to maintain a loose monetary policy (not respecting the Taylor Rule).

Although the majority of economists were ready to call this boom period the beginning of a new era, namely the "platinum age", Bezemer (2009) in his paper reveals 11 economists that predicted a recession before 2008.

Table 1. Researchers that anticipated the crisis.

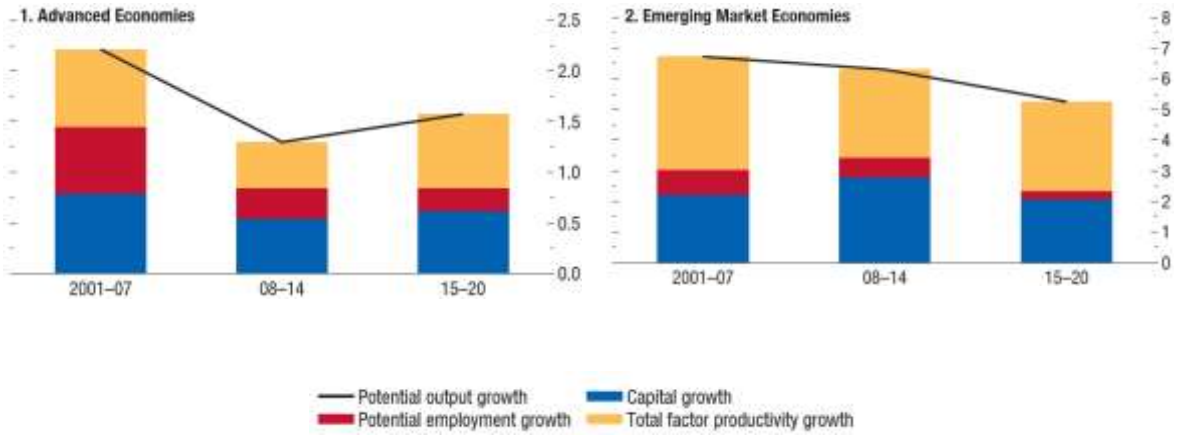
Researcher	Function	Date
Dean Baker, US	Co-director, Center for Economic and Policy Research	2006
Wynne Godley, US	Distinguished Scholar, Levy Economics Institute of Bard College	2006- and 2007
Fred Harrison, UK	Economic Commentator	2005
Michael Hudson, US	Professor, University of Missouri	2006
Eric Janszen, US	Investor and iTulip commentator	2006- and 2007
Stephen Keen, Australia	Associate Professor, University of Western Sydney	2006
Jakob Brochner Madsen and Jens Kjaer Sorensen, Denmark	Professor and Graduate Student, Copenhagen University	2006
Kurt Richenbacher, US	Private consultant and investment newsletter writer	2006
Nouriel Roubini, US	Professor, New York University	2005- and 2006
Peter Schiff, US	Stock broker, investment adviser and commentator	2006 and 2007
Robert Shiller, US	Professor, Yale University	2005

Source: adaptation of Bezemer (2009, p. 9) table.

The Great Recession, also called the "Second Great Contraction" (Reinhart and Rogoff, 2009), took governments, economists and people by surprise. According to Verick and Islam (2010), the four core factors of the crisis were: interest rates, global imbalances, perceptions of risk and regulation of the financial system. To be more precise, the crisis started as a crisis in the sub-prime mortgage market in the US. More exactly, it is the part of the market that assembles the people that have a higher risk of not being able to pay their loans. After 2000 due to the fact that interest rates were low, more people were tented to borrow money in order to buy a house, so the house prices began to rise. The problem appeared when the house prices started to decrease and the money borrowed exceeded the "new" value of their house. If the borrowers think that they are not able to repay the loan, than they might decide to renounce and just to give the house to the bank. The other part of the problem consists in the fact that the US legislation allowed banks to have higher leverage ratios, so the higher the leverage run by the bank, the stronger was the hit in their capital when the loss in assets value appeared. Banks needed to start selling assets and loans, so the cost of borrowing increased and determined investments to decrease. Thus, what started like a small decrease in US house prices generated into a world recession. The overwhelming consequence can be observed at global level, but the most affected countries were those which had a poor initial condition when the crisis struck in relation to the state of the economy, the labour market, fiscal space and institutional framework.

For a visual presentation on the state of the economy before, during and after the crisis, Figure 4 illustrates the potential output growth and its components. We can observe that in the pre-crisis period the emerging countries showed a stronger output growth than developed countries. The second period, namely the crisis period, is associated with a decrease in both type of economies, while in the next period the projections show a further decrease for emerging economies and a slight increase for advanced economies. One important aspect to retain is that the employment growth is on a continuous descending path, thus the unemployment still is and will be a problem. The unemployment is on an increasing path although some firms around the world adopted the "reducing the working hours" policy instead of reducing the number of employees during the crisis in order to keep their skilled workers, but also due to the fact that in most countries a worker with a permanent contract is protected by the legislation and/or collective bargaining agreements.

Figure 4. Potential output growth and its components

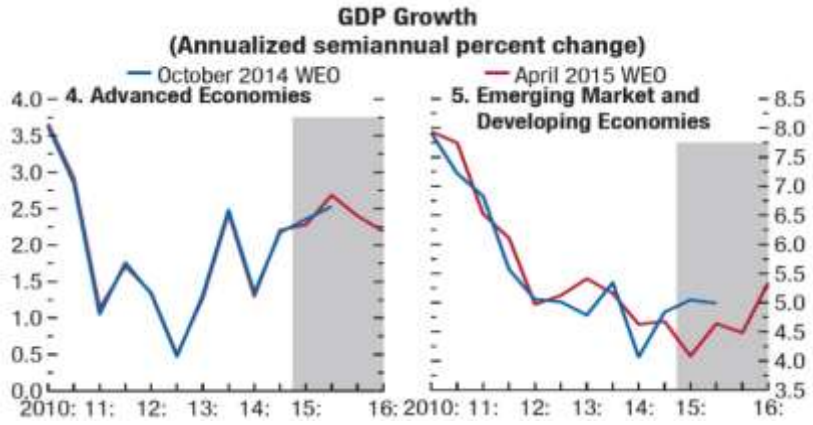


Source: IMF *World Economic Outlook* April 2015

Furthermore, Figure 5 depicts the GDP Growth around the world for advanced economies and for developing and emerging countries. We can observe that the global growth is still moderate and while for developed economies looks to be improving, for developing and emerging economies the growth is still lower and the forecast shows weaker expectations for increase. The forecasts for the 2015-2020 period supports a faint increase for advanced economies to 1.6 percent than the average of 1.3 percent for the crisis period (2008-2014). For developing and emerging countries the forecasts predict a decrease in GDP growth for the 2014-2020 period of 1.3 percent for the crisis average of 6.5 percent. The increase in the GDP growth should be the priority for each country. Thus, on the one hand, when referring to developed countries they should continue to support the demand in order to revive the investments, to

increase the spending on research and development, on education and policies to increase the labour supply incentives. On the other hand, the developing and emerging economies need to increase the infrastructure spending, must adopt policies to create better conditions for the business space and so to attract foreign direct investments and also to increase the spending on education and product market.

Figure 5. GDP growth 2010-2016



Source: IMF *World Economic Outlook* April 2015

According to the literature, two policy action trends may be used to fight the crisis, namely supply-, and, respectively, demand-based economic policies. In the following, we discuss these two policies. On the one hand, to analyze the supply side, we focus on the literature related to Okun's Law. Indeed, labour market-oriented policies can aid preventing the rise and persistence of unemployment (in addition to reducing inflationary pressures), but they need longer time until the results are perceptible (for example, improving the skills of human capital is a long process and results usually appear with a delay). There is a wide literature analyzing supply-based policies through studying the GDP-unemployment relationship, with the aim of establishing appropriate policy measures that may foster GDP through labour market reforms. For example, recent studies assessing the link between the labour market and the recent crisis include Cazes et al. (2009), ILO (2009a, b), IILS (2011) or Erhel and Levionnois (2013).

On the other hand, to investigate the demand side, we focus on the large fiscal stimuli that were put in place in order to fight the crisis, in an attempt to stimulate aggregate demand and to boost the output growth. Appendix A draws a survey of the impressively wide recent literature that aims at assessing the effects of fiscal stimuli, which usually consist of an increase in government consumption or investment, or tax cuts. All in all, as summarized by Blanchard

(2014), "*when demand improves, time to focus more on supply*" suggests that, in order to support the economy, both types of policies need to be put to use, but each at the right time.

Okun's Law

After the burst of the crisis, when the unemployment level started to increase rapidly and the GDP growth stagnated, academia turned its attention to the relation between unemployment and output growth, the rule of thumb also known in economics literature as Okun's Law. In his seminal paper of 1962, A. Okun stated that a 3 percent increase in output will reduce the unemployment by 1 percent (on US data). Moreover, he mentions that the 3 to 1 proportion holds up for both the growth-rate version and for the gaps version. Arthur Okun, besides being an economist, also devoted his work to explaining the macroeconomics concept to policy makers, thus being also a policy advisor. To sustain this affirmation are his 57 testimonials before the Congressional Committees (Lodewijks, 1989).

In time the Okun's Law gain popularity and was revisited continuously in its initial form, or by introducing new variables in the formula, or by applying a different technique. On the one hand, the majority of studies added new variables, such as Gordon (1984) that takes into consideration the changes in the capital and technology, Prachowny (1993) added workers weekly hours or capacity utilization, and Mayes and Virén (2009) took into account the adhesion to the EMU. On the other hand, other studies made use of different methodologies to analyze the relationship, namely Attfield and Silverstone (1998) used a VECM, Perman et al. (2015) conducted a meta-analysis to obtain Okun coefficient, or Melguizo-Chafer (2015) who made use of VAR and PVAR techniques.

If we are to consider the type of countries that are analyzed, the literature is focusing almost exclusively on developed countries, US being the most studied economy (Prachowny, 1993; Moosa, 1999; Ball et al. 2015). Among other developed countries that were analyzed we can mention UK (Attfield and Silverstone, 1998), G7 countries (Moosa, 1997) or OECD countries (Lee, 2000). At this point, we only found two papers that estimate Okun coefficients in developing and emerging countries, namely Hutengs and Stadtmann (2013) in five CEE countries in order to examine the youth unemployment problem, and Gabrisch and Buscher (2006) focusing on post-communist economies. When it comes to estimate Okun's Law at

regional level, to the best of our knowledge, all studies are focusing on developed countries, i.e. on US (Freeman, 2000), on Greece (Christopoulos, 2004), on France (Binet and Facchini, 2013) or Spain (Melguizo Chafer, 2015).

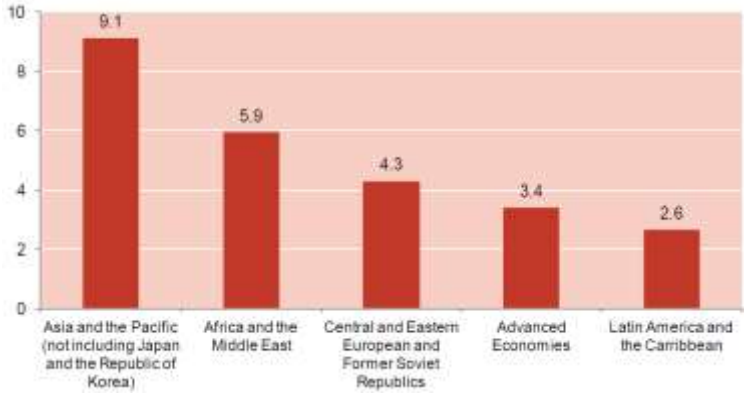
An interesting turning point was in 2010, when economists looked more in dept at the empirical relationship between GDP and unemployment claiming that due to the change in the economy the relationship should not be used in the future for forecasts (due to its historical stability in the US, the Okun Law forms the basis for most large-scale macroeconomic forecasting models, but it has evolved to a 2 to 1 proportion in forecast). Among the studies that discuss the end of Okun's Law we can mention the April 2010 WEO, stating that the law *broke down during the Great Recession*, Daly and Hobijn (2010) consider that *the relationship is disrupted by the surprise of 2009,* Gordon (2010) is more drastic and affirms that *the law is dead,* while Meyer and Tasci (2012) consider that *it's unstable* and Owyand and Vermann (2013) reveal that the relationship *changes during recoveries*.

Another stand of literature defenses the Okun Law and shows that after data revision the rule of thumb holds up. Daly et al. (2014) show that after the GDP data revision from the Great Recession the inconsistency in the relationship between unemployment and output dissipated, and in addition they present that the same discussions appeared after the 1973, 1991 and 2001 recession until the data were revised. Okun's Law is also backed by Ball et al. (2013a), Ball et al. (2013b), Ball et al. (2015)

Fiscal stimulus

In order to fight the crisis governments all over the world made use of fiscal policies measures to boost the demand, while central banks took the interest rate close to zero. Since the disposal income decreased, governments needed to take actions in order to replace private spending and investment with public spending and investment with the intention of sustaining the country economy. Thus, numerous countries implemented expansionary fiscal policies, namely fiscal stimulus packages. Figure 6 shows the stimulus around the world, while table 2 presents a short list of countries that announced stimulus packages and the size of their announced stimulus in order to aid the economy to exit the recession.

Figure 6. Global overview of fiscal stimulus as % of 2008 GDP



Source: IILS (2011)

Table 2. Announced stimulus packages

Country	Announced Stimulus Packages in $ (billions)	% of 2008 country GDP
Australia	47.04	5.75%
Austria	16.25	4.14
Belgium	4.93	1.03%
Canada	42.15	3.22%
China	585.26	13.30%
Czech Republic	3.91	2.04%
Egypt	2.72	1.67%
Finland	10.89	4.20%
France	36.18	1.34%
Georgia	2.28	19.92%
Germany	80.50	2.32%
India	38.39	3.53%
Israel	2.80	1.47%
Japan	297.52	5.32%
Lithuania	0.92	2.02%
Mexico	13.32	1.49%
Netherlands	8.35	1.02%
Norway	2.86	0.79%
Poland	10.64	2.49%
Portugal	3.03	1.31%
Russia	53.64	3.78%
Slovenia	1.20	2.32%
South Africa	9.90	4.03%
Spain	15.55	1.02%
Sweden	13.44	3.33%
Switzerland	1.97	0.39%
Turkey	37.95	6.09%
United Kingdom	29.16	1.39%
United States	787.00	5.52%

Source: adaptation of Zhang et al. (2010, p. 5) table and data from IILS (2011)

The structure of stimulus packages is different for each country, as shown for example by Saha and Weizsacker (2009) who analyze the composition of announced stimulus packages for 13 EU countries. They conclude that the spending categories of the package are so different due to the initial state of the economy. For instance, countries like France and Spain announced major spending on investment, while all Poland stimulus consists in investment. Austria and Sweden choose to direct a major part of the stimulus to permanent cut taxes and transfers, while United Kingdom (UK) and Netherlands to temporary cut taxes and transfers. The only country that has a more balanced structure of the stimulus package in terms of spending categories is Germany who tries to reach all categories: investment, permanent and temporary tax cuts and transfers, labour market measures and sector specific measures. The same variety in the composition of stimulus packages is found around the world, i.e. China spent a considerable part in rebuilding the region of Sichuan, while Brazil focused on the auto sector (ILLS, 2011). The distribution on years of the fiscal stimulus also differs among countries. For example, France announced a 0.7% of GDP stimulus for 2009, while Germany announced 1.5% of GDP and UK 1.4% of GDP. Other countries did not announced the allocation on years, just the period of stimulus, i.e. Japan for 2009-2010, while other countries propose the stimulus packages just for one year, i.e. Mexico, 1.49% of GDP in 2009.

With the purpose of identifying the best way to allocate the stimulus package, to find out what type of fiscal instrument is more appropriate for each economy and also to assess the stimulus impact on the economy output, economists, policy-makers and academia made use of the fiscal multiplier concept. The fiscal multiplier is a cornerstone of the Keynesian paradigm, and Keynes' (1936) analysis awarded the multiplier the central role that it still has today in macroeconomics. The simple way to define it is as the impact of an exogenous change in a fiscal variable (i.e. public spending ΔG) on output (ΔY), with respect to their respective baselines. Through the literature we can identify four major types of fiscal multipliers: impact multipliers, multipliers at a T horizon, peak multipliers and cumulative multipliers. The major part of the literature is assessing multipliers in developed countries (at country level or in panels like Euro area or OECD countries) and just a few studies are taking into account the developing and emerging economies. Table 3 presents studies that are estimating multiplier both in developing and developed countries (for a more complex review of the recent literature see Appendix A.).

Table 3. Recent studies assessing fiscal multipliers in developed and developing countries

Author	**Country**	**Economy**	**Fiscal Shock**	**Impact**	**One year**	**Long run**
lzetzki and Végh 2008	High income		Government spending	0.4	0.7	0.8
	Developing		Government spending	0.6	0.4	-0.11
Ilzetzki, Mendoza and Végh 2013	20 High income countries		Government spending	0.39*		0.66*
	24 Developing countries		Government spending	-0.03		-0.63
	20 High income countries		Government investment	0.39*		1.5
	24 Developing countries		Government investment	0.57*		1.6*
Petrović, Arsić and Nojković 2014	10 emerging CEEC		Expenditure multipliers	0.20*	0.48*	0.20*
		Fixed exchange rates	Expenditure multipliers	1.31*	1.58*	0
		Flexible exchange rates	Expenditure multipliers	0.03	0.11	0
		Expansion	Expenditure multipliers	0.10*	0.32*	-0.37*
		Downturn	Expenditure multipliers	1.15*	1.51*	-0.42*

Note: "*" defines statistically significant and the shock is a 1% increase in government spending, investment and expenditure.

A new stand of literature is focusing on the spillover effect. For example, Carmignani (2015) reveals the fact that a 1$ increase in US government expenditure generates an increase of output by approximately 7 cents in the full sample and about 24 cents in former transitions economies of Central and Eastern Europe. We can conclude that the literature that aims at assessing the effects of fiscal stimulus effects is on an increasing path in recent years.

Thesis presentation

As discussed above, two major effects of the recent crisis are the increase in world unemployment and the decrease in countries growth. The research conducted in this thesis tries to present potential solutions to these problems. When talking about this thesis originality, we

can mention the following: on the one hand, when referring to the unemployment we assess Okun coefficients in order to establish what type of policy is better suited to be applied. Two important features that significantly differentiate our analysis from that of the literature are related to the countries analyzed and to the use of regional data. As mentioned above, the majority of studies focus on developed countries and there is recent literature that use regional data, but only for developed countries, so to the best of our knowledge, this is the first analysis of Okun Law at regional level in emerging countries. On the other hand, when referring to growth, we assess fiscal multipliers. We mentioned above that the literature is generally focusing on samples composed of developed countries, or assesses multipliers at country level (also developed countries), or assesses multipliers in big samples of developed and developing countries. The originality of this analysis consists of studying specific areas in order to observe differences or similarities in the output response of the area with the purpose of establishing possible fiscal policy measures. It is well known that a country economy is influenced, to a greater or a minor extent, by its neighbours and by the area to which it belongs. Thus, we assess multipliers (i) in the European Union (EU) in order to observe differences if you are a developed or developing country, or if you are or not in the Euro area or if you intend or not to join it; (ii) after that we focus on the Mediterranean Area, that we consider as the world economy at a smaller scale due to the country typologies composing it and (iii) the Central and Eastern European (CEE) countries.

This thesis regroups 6 articles which analyze the fiscal policy in emerging and developing countries and also presents lessons from developed countries. This thesis is organized in three parts. The first part presents evidence of the Okun Law in 3 countries from Central and Eastern Europe, namely the Czech Republic, Slovakia and Romania at regional level. In the second part, the fiscal multiplier topic is approached and presented as lesson from developed countries, while the third part presents estimates of fiscal multipliers in developing countries.

The first part of this thesis aims at revising the GDP-unemployment relationship, also known as Okun's Law at regional level in three emerging countries of Central and Eastern Europe and contains two chapters.

Chapter 1 analyzes the above mentioned relationship in two emerging countries which have a strong connection in terms of history, culture and economic activity, namely the Czech Republic and Slovakia. In order to estimate the Okun equation we make use of detrending

techniques, which properly allow for estimating the long-run component of a time series, by taking into account the likely presence of a unit root and after that calculating the cyclical component of the variables. We present our results based on the most used filter in this literature, namely the Hodrick-Prescott (HP) detrending filter and after that, as robustness, we make use of the Quadratic Trend (QT) filter and the Baxter and King (1999) filter. We are using original output and unemployment regional annual data for the period 1995-2011 to provide the estimations of regional Okun's Law. In our subsequent analysis we make use of a set of regional variables, including domestic and foreign investment, R&D, or infrastructure public spending. Considering the alternative methods for estimating Okun's Law, three patterns arise: regions for which the Okun's Law is (i) always validated, (ii) never or weakly validated, and (iii) mixed results. Thus, we also present a systematic analysis of the major factors explaining why the unemployment-output relation is significant only in some regions. Moreover, we search for possible non-linearities in the significant estimated regional Okun coefficients across the two countries. By doing this we aim to develop the existing literature and to find explanations to the regional heterogeneity and to the magnitude of regional Okun coefficients. One interesting result is that the Okun Law appears to be not statistically significant in the regions in which the average economic growth is low and the average and long-term unemployment is the highest.

In chapter 2 we analyze the above mentioned relationship in a newer member state of the European Union, Romania. In order to estimate the Okun Law we apply the HP filter and the First Difference (FD) filter on regional annual data covering the period 1995-2010. Here we observe that although the negative relationship between the cyclical components of income and unemployment exist in all regions and at country level, the Okun coefficients are not statistically significant in the most developed regions. In the next step, we proceeded with an analysis of the driving factors of these heterogeneities. We looked at the average real income for the studied period, the real growth rate, the average unemployment rate, the average growth rate of foreign direct investment, the percentage of modernized roads, at demographic variables like stable population, workforce and variables like fertility, infant mortality and population at poverty risk. Our results suggest that the Okun coefficients are not statistically significant in the most developed regions, namely with highest average economic growth in the studied period and with the lowest share of the population at poverty risk.

The second part of this thesis approaches the fiscal multiplier concept and it's rebirth during the Great Recession, from the perspective of lessons to learn from developed countries.

Chapter 3 is a recent literature review of the fiscal multiplier topic. It starts with a short presentation of the fiscal multipliers and the types most used in the literature, then continues with the methods used to estimate multipliers in the literature (theoretical and empirical) and ends with a selection of recent studies that assess fiscal multipliers. First, the studies are group by taking into account the nonlinearities in the multipliers effects, to be more precise: the position in the economic cycle, the debt level, the monetary policy and the exchange rate regime. Second we present the recent literature on developed and developing countries. The main conclusion is that there is only a limited number of studies focusing on developing and emerging countries. Furthermore, the multipliers for developing countries are smaller than in developed countries and nonlinearities play an important role in the multiplier magnitude.

To better understand the difference between multipliers values in developed and developing countries, in Chapter 4 we focus on the European Union (EU) area. More precisely we want to see if the Eurozone plays a role or not in the EU and investigate if being a member or not, or being a developed or developing country (in this group we have the Czech Republic that according to the IMF classification is considered a developed country only from 2009, which is close to our time span end) influences the multipliers values. In order to find answers to these questions we created four groups of countries: the historical group, EU countries that are not expected to adopt the Euro, countries that have recently joined the EU and are expected to join the Eurozone in the future, and Eurozone countries heavily affected by the crisis. We draw upon the panel Vector AutoRegressive (PVAR) methodology and we use the Cholesky decomposition to transform the error term such as innovations to be orthogonal on quarterly data for the 1999:Q1 – 2012:Q4. Our variables (GDP, expenditures and taxes) are computed as growth rates. We then proceed at estimating impact, peak and cumulative fiscal multipliers, i.e. changes in output following changes in the fiscal policy and use as shock first, an increase in government expenditure, and second an increase in taxes. Our results reveal that being in the Eurozone or expecting to join the Eurozone in the future generates positive and significant expenditure multipliers, while the tax multipliers are not sensitive to being in the Eurozone or experiencing a crisis.

For extending the fiscal multiplier subject, the third part of the thesis focuses more on assessing fiscal multipliers in developing countries in two specific areas.

In chapter 5 we study the Mediterranean area, which we consider attractive due to the countries that compose it (three continents and islands). In order to compute fiscal multipliers we make use of the panel VAR methodology and use annual data from 1980 until 2010 for GDP, government consumption and government investment. As mentioned before, we take advantage of the diversity of each area and disentangle the countries in several groups, based on economic and geographic criteria. By doing so we obtained five groups of countries: group 1 "large-EMU" countries who adopted the euro in 1999 or 2001, group 2 "small-EMU" countries who joined the Eurozone only recently, group 3 which includes developing African countries, group 4 which considers developing Asian countries and finally group 5 composed of Former Republic of Yugoslavia countries for which we could find data. After obtaining the groups we compute impact, second year, third year, peak and cumulative multipliers for consumption and investment shocks. Our results for the entire Mediterranean area reveal a significant and positive output response both for government consumption and investment shock. Furthermore, we obtain positive and significant consumption (investment) multipliers in Africa (Asia) and negative and significant investment multiplier in Africa or not statistically significant consumption (investment) multipliers in Asia (small EU). In addition, we developed our analysis by computing fiscal multipliers first, by changing the ordering of the fiscal variables, second, by adding control variables like the current account, public debt and inflation and third, by changing the computation of the main variables, namely using the HP filter and not the growth rates.

Chapter 6 studies the response of output to a government spending shock in eleven Central and Eastern European countries by using quarterly data for the period 1999:Q1-2013:Q3. Due to the characteristics of this area (the countries are expected to follow a common dynamic path in the long-term but they may present different short-run dynamics) we draw upon a Panel Vector Error Correction model (PVECM) for computing the fiscal multipliers. By using this methodology we are able to compute pooled and country specific multipliers while controlling for the common long-run relationship between the eleven CEE countries. To define the spending shock we decompose the public spending into a structural (anticipated) and a residual (non-anticipated) component, and define discretionary spending shocks as the cyclically-adjusted component of government spending, which reflects unexpected fiscal policy changes. Our results show that impact and four-quarter cumulative spending multipliers are positive and significant for the whole group of countries, but the output response becomes not significant or even negative when estimating at country level. In addition, we disentangle the

CEE countries across several of their major characteristics, namely the exchange rate regime (ERR), the level of economic development, the fiscal stance and the openness degree.

Appendix

Table 1. Fiscal multipliers in recent literature

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
Dalsgaard, André, Richardson 2001 e	OECD interlink model		US		Government spending, country specific		1.1	1	0.5	0.2
	No monetary policy response				Government spending, global shock		1.5	1.3	0.7	0.3
	Nominal interest rate held constant		Japan		Government spending, country specific		1.7	1.1	0.4	0.2
					Government spending, global shock		2.6	1.9	0.6	0.3
			Euro Area		Government spending, country specific		1.2	0.9	0.5	0.2
					Government spending, global shock		1.9	1.5	0.7	0.4

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
Blanchard and Perotti 2002	Structural VAR	Quarterly 1960 :1 – 1997 :4	US		Government spending, deterministic trend	0.84	0.45	0.54	1.13	
					Government spending, stochastic trend	0.90	0.55	0.65	0.66	
					Taxes, deterministic trend	-069	-0.74	-0.72	-0.42	
					Taxes, stochastic trend	-0.70	-1.07	-1.32	-1.30	
HM Treasury 2003	European Commission's QUEST model		Germany		Taxes		0.2			
					Government spending		0.4			
			Spain		Taxes		-0.1			
					Government spending		0.5			
			France		Taxes		-0.1			

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
					Government spending		0.5			
			Ireland		Taxes		-0.1			
					Government spending		0.4			
			Italy		Taxes		-0.1			
					Government spending		0.5			
			Netherlands		Taxes		-0.1			
					Government spending		0.4			
			Portugal		Taxes		-0.0 to -0.1			
					Government spending		0.7			
			Sweden		Taxes		-0.3			
					Government spending		0.4			
			UK		Taxes		-0.2			

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
					Government spending		0.3			
Perotti 2005	VAR The two multipliers : the early and the late part of the sample: 1960-1979 1980-end Cumulative multipliers	Quarterly : 1960 :1 – 2001 :2	Australia		Government spending		-0.14 / 0.38		1.42 / 0.69	
					Taxes		1.50 / 0.55		1.69 / 0.85	
		Quarterly : 1961 :1 – 2001 :4	Canada		Government spending		0.98 / -0.32		0.58 / -1.10	
					Taxes		0.4 / -0.42		0.22 / -1.59	
		Quarterly : 1960 :1 – 1989 :4	Germany		Government spending		0.61 / 0.47		-0.08 / -1.10	
					Taxes		0.29 / -0.04		-0.05/ 0.59	
		1963 :1 – 2001 :2	UK		Government spending		0.48 / -0.28		-0.003 / -0.94	

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
					Taxes		-0.23 / 0.43		-0.21/ 0.70	
		1960 :1 – 2001 :4	US		Government spending		1.29 / 0.44		1.67 / 0.08	
					Taxes		-1.41 / 0.70		-23.87 / 1.55	
AL-Eyd and ray Barrell 2005	NiGEM model with one-year shock		France		Indirect tax		-0.26	-0.19		
					Corporate tax lump sum		-0.033	-0.158		
					Corporate tax rate		-0.153	-0.386		
	1% , 1year shock				Direct tax		-0.280	-0.158		
					Transfers		-0.19	-0.105		
			Germany		Indirect tax		-0.502	-0.161		
					Corporate tax lump sum		-0.129	-0.594		

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
					Corporate tax rate		-0.160	-0.660		
					Direct tax		-0.707	-0.195		
					Transfers		-0.491	-0.116		
			Italy		Indirect tax		-0.163	-0.210		
					Corporate tax lump sum		-0.033	-0.229		
					Corporate tax rate		-0.186	-0.404		
					Direct tax		-0.145	-0.180		
					Transfers		-0.110	-0.138		
			Spain		Indirect tax		-0.190	-0.087		
					Corporate tax lump sum		-0.028	-0.116		
					Corporate tax rate		-0.219	-0.232		
					Direct tax		-0.159	-0.074		
					Transfers		-0.20	-0.054		
			UK		Indirect tax		-0.303	-0.231		

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
					Corporate tax lump sum		-0.027	-0.205		
					Corporate tax rate		-0.085	-0.350		
					Direct tax		-0.150	-0.197		
					Transfers		-0.115	-0.152		
Mountford and Uhlig 2005	SVAR Impact multiplier They apply sign restriction	Quarterly : 1955 - 2000	SUA		Government spending	0.44	0.42	0.67	0.23	
					Tax cut	-0.19	-1.21	-2.79	-3.22	
Perotti 2006	VAR Cumulative multipliers	Quarterly : 1960 :1 – 2001 :2	Australia		Government spending		0.56*	0.86*	0.88*	
					Government investment		-0.29	0.02	0.5*	
		Quarterly : 1961 :1 – 2001 :4	Canada		Government spending		0.55*	0.74*	0.93*	
					Government investment		0.38	-0.24	-0.73*	

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
		Quarterly : 1960 :1 – 1989 :4	Germany		Government spending		0.77*	0.83*	0.91*	
					Government investment		5.07*	4.38*	3.84*	
		Quarterly : 1963 :1 – 2001 :2	UK		Government spending		0.64*	0.94*	0.99*	
					Government investment		0.01	-0.08	-0.06	
		Quarterly : 1960 :1 – 2001 :4	US		Government spending		1.37*	1.91*	2.16*	
					Government investment		1.17*	0.52	0.21	
Ilzetzki and Végh 2008	Panel VAR	Quarterly panel data on 27 developing and 22 high income countries	High income		Government spending	0.4	0.7	0.9	0.8	
			Developing		Government spending	0.6	0.4	0.1	-0.11	

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
IMF 2008	Regression analysis 2 alternative measures of fiscal impulse : elasticity /regression based	Annual panel data 1970-2007	Advanced		Taxes – elasticity		0.35		0.59	
					Taxes – regression based		0.01		0.40	
					Government spending – elasticity		-0.09		-0.26	
					Government spending – regression based		0.15		0.52	
			Emerging		Taxes – elasticity		0.23		0.23	
					Taxes – regression based		0.13		0.17	
					Government spending – elasticity		0.20		-0.18	

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
					Government spending – regression based		0.08		-0.23	
Romer and Bernstein 2009	Two quantitative macroeconomic models	ARRA estimations	USS		government spending	1.05	1.44	1.57	1.57	1.55
					Tax	0.00	-0.66	-0.99	-0.99	-0.98
Mountford and Uhlig 2009	SVAR Impact multiplier They do not apply sign restriction	Quarterly : 1955 - 2000	SUA		Government spending	0.65	0.27	-0.74	-1.19	
					Tax	-0.28	-0.93	-2.05	-3.41	
Cogan and others 2010 d	New Keynesian simulation exercise, based on the model in Smets and Wouter 2007	Quarterly : 2009 :1 to 2012 :4 Impact of the ARRA 17 fev 2009 on USs	US		government spending federal rate set to zero throughout 2009 and 2010	1.03	0.89	0.61	0.44	0.40

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
	Assumptions about the interest rate response				government spending federal rate set to zero throughout 2009	0.96	0.67	0.48	0.41	0.40
Auerbach-Gorodnichenko 2012a	Structural VAR	Quarterly data 1947 :1 – 2008-4	USA	Expansion	spending		0.0	-0.1		
				Recession	spending		1.4	1.8		
Auerbach-Gorodnichenko 2012b	Structural VAR	Semiannual data : Old members :1985 – 20110 ; ewer members: mid-1990s – 2010	OECD	Expansion	spending		-0.3	-0.3		
				Recession	spending		0.5	0.4		
Batini, Callegari and Melina 2012	Threshold VAR Cumulative fiscal multipliers	Quarterly Data : 1975 :1 – 2010 :2	US	Expansion	spending	0.95	0.3.	-0.49		
				Recession	spending	1.96	2.18	2.17		
				Expansion	Revenue	0.04	-0.15	-0.72		
				Recession	Revenue	0.03	-0.16	-0.65		

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
	1SD	Quarterly data : 1981 :1 – 2009 :4	Japan	Expansion	spending	0.71	1.40	1.09		
				Recession	spending	1.34	2.01	2.01		
				Expansion	Revenue	0.27	0.30	0.09		
				Recession	Revenue	0.31	0.21	-0.17		
		Quarterly data :1981 :1 – 2007 :4	Italy	Expansion	spending	0.25	0.41	0.46		
				Recession	spending	1.42	1.57	1.78		
				Expansion	Revenue	-0.07	-0.07	-0.10		
				Recession	Revenue	-0.12	-0.17	-0.17		
		Quarterly data : 1970 :1 – 2010 :4	France	Expansion	spending	1.39	1.55	1.88		
				Recession	spending	2.62	2.08	1.79		
				Expansion	Revenue	0.05	0.12	0.20		
				Recession	Revenue	-0.02	0.03	0.28		
		Quarterly data : 1985 :1 – 2009 :’	Euro Area	Expansion	spending	0.41	0.43	0.07		
				Recession	spending	2.06	2.56	2.49		
				Expansion	Revenue	0.10	0.20	0.06		
				Recession	Revenue	-0.18	-0.35	-0.35		

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
Anja Baum, Marcos Poplawsky-Ribeiro, Anke Weber Dec 2012	Threshold VAR The threshold variable= output gap Cumulative fiscal multipliers Obs : *no significant multiplier is found at the time the fiscal shock is implemented	Quarterly data : 1966 :1 – 2011 :2	Canada	Expansion – positive output gap	Positive spending shock		-0.9*	-0.7*		
				Expansion – negative output gap	Positive spending shock		-1.1*	-0.9*		
				Expansion – positive output gap	Negative revenue shock		-0.3	-0.2		
				Expansion – negative output gap	Negative revenue shock		0.1	0.1		
				Recession – positive output gap	Negative spending shock		0.9*	0.7*		
				Recession – negative output gap	Negative spending shock		1.1*	0.9*		
				Recession – positive output gap	Positive revenue shock		0.3	0.2		
				Recession – negative output gap	Positive revenue shock		-0.1	-0.1		

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
		Quarterly data : 1970 :4 – 2010 :4	France	Expansion – positive output gap	Positive spending shock		-0.1*	-0.1*		
				Expansion – negative output gap	Positive spending shock		0.2*	0.1*		
				Expansion – positive output gap	Negative revenue shock		-0.5	-0.4		
				Expansion – negative output gap	Negative revenue shock		-0.7	-0.5		
				Recession – positive output gap	Negative spending shock		0.1*	0.1*		
				Recession – negative output gap	Negative spending shock		-0.2*	-0.1*		
				Recession – positive output gap	Positive revenue shock		0.5	0.4		
				Recession – negative output gap	Positive revenue shock		0.7	0.5		

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
		Quarterly data : 1975 :3 – 2009 :4	Germany	Expansion – positive output gap	Positive spending shock		0.2	0.1		
				Expansion – negative output gap	Positive spending shock		1.0	0.8		
				Expansion – positive output gap	Negative revenue shock		0.7	0.5		
				Expansion – negative output gap	Negative revenue shock		0.5	0.4		
				Recession – positive output gap	Negative spending shock		-0.4	-0.2		
				Recession – negative output gap	Negative spending shock		-1.3	-1.2		
				Recession – positive output gap	Positive revenue shock		-0.6	-0.4		
				Recession – negative output gap	Positive revenue shock		-0.4	-0.3		

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
		Quarterly data : 1970 :1 – 2011 :2	Japan	Expansion – positive output gap	Positive spending shock		1.4	1.9		
				Expansion – negative output gap	Positive spending shock		2.0	2.4		
				Expansion – positive output gap	Negative revenue shock		-0.5	-0.5		
				Expansion – negative output gap	Negative revenue shock		0.5	0.3		
				Recession – positive output gap	Negative spending shock		-1.5	-1.7		
				Recession – negative output gap	Negative spending shock		-2.0	-2.0		
				Recession – positive output gap	Positive revenue shock		0.4	0.5		
				Recession – negative output gap	Positive revenue shock		-0.7	-0.6		

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
		Quarterly data : 1970 :1 – 2011 :2	UK	Expansion – positive output gap	Positive spending shock		-0.00	-0.00		
				Expansion – negative output gap	Positive spending shock		0.2	0.1		
				Expansion – positive output gap	Negative revenue shock		0.4*	0.4*		
				Expansion – negative output gap	Negative revenue shock		-0.2*	-0.2*		
				Recession – positive output gap	Negative spending shock		0.00	0.00		
				Recession – negative output gap	Negative spending shock		-0.2	-0.1		
				Recession – positive output gap	Positive revenue shock		-0.4*	-0.3*		
				Recession – negative output gap	Positive revenue shock		0.2*	0.2*		

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
		Qurterly data : 1965 :2 – 2011 :2	US	Expansion – positive output gap	Positive spending shock		1.3	1.0		
				Expansion – negative output gap	Positive spending shock		1.7	1.2		
				Expansion – positive output gap	Negative revenue shock		-0.1*	-0.1*		
				Expansion – negative output gap	Negative revenue shock		0.1*	0.1*		
				Recession – positive output gap	Negative spending shock		-1.3	-1.0		
				Recession – negative output gap	Negative spending shock		-1.8	-1.3		
				Recession – positive output gap	Positive revenue shock		0.1*	0.1*		
				Recession – negative output gap	Positive revenue shock		-0.1*	-0.1*		

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
WEO 2012	Forecast model	2010-2011	28 advanced and emerging economies		Government spending	0.9 to 1.7				
Ilzetzki, Mendoza and Végh 2013	SVAR	1960:1-2007:4 quarterly	20 high income 24 developing	High income countries	Government spending	0.39*				
				Developing countries	Government spending	-0.03				
				High income countries	Government investment	0.39*				
				Developing countries	Government investment	0.57*				
				Fixed exchange rates	Government spending	0.15*				
				Flexible exchange rates	Government spending	-0.14*				
				closed economies	Government spending	0.6*				
				Open economies	Government spending	-0.08				
				Low debt	Government spending	-0.37				

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
				High debt	Government spending	-0.03				
M Owyang, V Ramery and S Zubairy 2013	extension of Ramey (2011) military news and Jorda's (2005) method	quarterly interpolated data: US:1980-2010 Canada:1921-2011	US		Military news shock			0.72		0.81
				High Unemployment	Military news shock			0.76		0.78
				Low Unemployment	Military news shock			0.72		0.88
			Canada		Military news shock			0.67		0.79
				High Unemployment	Military news shock			1.60		1.16
				Low Unemployment	Military news shock			0.44		0.46
Petrović, Arsić and Nojković (2014)	SVAR cumulative multipliers	1999-2012 quarterly	10 emerging CEEC		Expenditure multipliers	0.20*	0.48*			
				Fixed exchange rates	Expenditure multipliers	1.31*	1.58*			
				Flexible exchange rates	Expenditure multipliers	0.03	0.11			

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
				Expansion	Expenditure multipliers	0.10*	0.32*			
				Downturn	Expenditure multipliers	1.15*	1.51*			
C-Y Hong and J-F Li, 2015	Spillover imput-output model	2009-2013 Fiscal stimulus packages adopted by the government	Taiwan		Increase in government consumption	1.47*				
	cumulative multipliers				Increase in government investment	1.94*				
D Riera-Crichton, CA Vegh and G Vuletin, 2015	Single-equation approach of Jorda 2005	1986-2008 semiannual	29 OECD countries	Recession	Spending shock	0.73*		1.25*		
				Expansion	Spending shock	0.09*	Not significant			
	Cumulative fiscal multipliers			Increase in government spending	Spending shock	0.49*		2.28*		
				Decrease in government spending	Spending shock	Not significant				
				Recession - Increase in	Spending shock	0.68*		2.28*		

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
				government spending						
				Recession - Decrease in government spending	Spending shock	0.76*	Not significant			
				Expansion - Increase in government spending	Spending shock	1.13*				
				Expansion - Decrease in government spending	Spending shock	Not sidnificant				
				Extreme recession	Spending shock	1.21*		2.08*		
				Extreme expansion	Spending shock	Not significant				
				Extreme recession - Increase in government spending	Spending shock	0.92*		3.14*		

						Fiscal multipliers values				
Authors, year	Methodology	Data	Countries	Economy	Fiscal Shock	Impact	One year	Two years	Three years	Four years
				Extreme recession - Decrease in government spending	Spending shock	1.23*		1.60		
KP Arin, FA Koray and N Spagnolo 2015	a regime switching framework	Quarterly data: 1949 - 2006	US	Low growth	Defense spending shock	2.91				
				High growth	Defense spending shock	0.13				
				Low growth	Tax shock	-0.19				
				High growth	Tax shock	-0.66				
R Ambrisko, J Babecky, J Rysanek, V Valenta 2015	DSGE model	Quarterly data: 1996-2011	Czech Republic		Spending shock		0.6			
					Investment shock		0.5			

Note: The multipliers are the response of GDP to a positive government spending shock or/and positive tax shock; "*" (for the articles that mention the significance) shows that the multiplier is statistically significant, unless otherwise stated.

I Evidence on Okun's Law at regional level in three developing countries from Central and Eastern Europe

Chapter 1. Regional Evidence on Okun's Law in Czech Republic and Slovakia

Regional Evidence on Okun's Law in Czech Republic and Slovakia[1]

Abstract

We present regional evidence on Okun's Law using original data for two emerging countries, namely the Czech Republic and Slovakia. We unveil the presence of important regional heterogeneities, as in many Czech and Slovak regions Okun's Law is not significant. Among the drivers of these regional differences, we outline the level of unemployment and output, domestic and foreign investment, and R&D and infrastructure spending. Subsequently, we show that unemployment, output, and domestic investment are equally related to regional magnitude non-linearities, when it comes to Czech and Slovak regions in which Okun's Law is at work. We draw upon these rich results to discuss policies that could be implemented to avoid underemployment traps in Czech and Slovak regions.

Keywords: regional Okun's Law, emerging countries, Central and Eastern European Countries (CEEC)

JEL Codes: E24, E32, R11

[1] A version of this chapter was published as "Regional Evidence on Okun's Law in Czech Republic and Slovakia", *Economic Modelling*, vol. 42, pp. 57-65, 2014, and was written with R. Durech, A. Minea and L. Slusna.

1.1. Introduction

The dawn of the 1990's brought massive changes in Central and Eastern European Countries (CEEC). Politically, these changes marked the end of almost half a century of Cold War. Economically, CEEC entered a new era, characterized by progressive monetary and financial liberalization, free markets, free prices, and free trade. Many countries found themselves trapped in the tumult of increasing external competition, particularly since their industrial systems were characterized by obsolete techniques, over-designed production plants, and low labor productivity in a full employment context. Consequently, many such large loss-generating public plants were closed, causing massive unemployment in the second half of the 90s.[2]

These high unemployment levels draw the attention of policymakers. Indeed, according to the popular Okun's Law (Okun, 1962), there exists a strong relation between an increase in GDP above its potential, i.e. a positive output gap, and a decrease of unemployment below its trend. Thus, over the last two decades, an increasing strand of literature focused on exploring the robustness of Okun's Law on several grounds.[3]

First, regarding its significance and magnitude. In a very influential paper, Prachowny (1993) appends Okun's Law to include the effect of weekly hours and capacity utilization,[4] and shows that, although significant, the magnitude of the link between cyclical unemployment and the output gap is around -0.67, notably lower (in absolute value) than Okun's initial estimation of -3. Subsequent work continues this debate: using US quarterly data, Weber (1995) and Moosa (1999) emphasize Okun coefficients above 3 (in absolute value), while Attfield & Silverstone (1997) or Coen & Hickman (2006) outline Okun coefficients of lower magnitudes, namely of -2.25 and -1.90, respectively.

Second, Okun's coefficient was found to significantly differ across countries. Compared to their previous findings for the US, Attfield & Silverstone (1998) illustrate a lower (in absolute value) Okun coefficient of -1.45 for the UK, using a VECM augmented to account for cointegration in the presence of non-stationary output and unemployment series. Several authors, like Kaufman (1988) or Moosa (1997), present evidence on a small number of countries. For example, using data for G7 countries, Moosa (1997) concludes that all seven Okun coefficients are significant and have the expected negative sign, but their magnitude

[2] For example, unemployment in Slovakia in 1995 was 13.0%, while in Czech Republic in 1999 it equaled 9.4%.

[3] In particular, the current Great Recession revived the question of the pertinence of Okun's Law (for recent discussions, see Daly & Hobijn, 2010, Owyang & Sekhposyan, 2012, Ball, Leigh & Loungani, 2013, or Daly, Fernald, Jordà & Nechio, 2014).

[4] Alternatively, Evans (1989) and Mussard & Philippe (2009) emphasize the importance of time lags and money creation, respectively, in estimating Okun's Law.

differs across countries. Comparable conclusions arise from the analysis of Harris & Silverstone (2001) for Australia, Canada, Western Germany, Japan, the UK, and the US, as they find that Okun coefficients are negative and significant, while rather different in UK and Japan compared to the other countries (for an identical finding for Japan, see also Freeman, 2001). Moreover, many studies focus on a large set of countries, especially from the OECD area. Using annual data for 16 OECD countries, Lee (2000) not only confirms the significance of Okun's coefficient, but shows that its magnitude is subject to important country heterogeneities, ranging from -6.55 for Japan to -0.57 for Italy, based, for example, on the Hodrick-Prescott (HP) filter.[5]

Third, in addition to country heterogeneities, Okun's Law has been found to exhibit multiple non-linearities. Using US data, Moosa (1999) shows that Okun's coefficient is different in the short- compared to the long-run. Moreover, Harris & Silverstone (2001) and Cuaresma (2003) conclude that Okun's Law changes in business cycle upturns compared to downturns (or above compared to below the trend, see Holmes & Silverstone, 2006). In addition to the level of output, Virén (2001) and Fouquau (2008) find that Okun's Law is equally sensitive to the level of unemployment. Subsequent papers emphasize alternative mechanisms for threshold effects in Okun's Law, including the considered time period (Knotek, 2007, or Beaton, 2010), the level of effort in the labor market (Malley & Molana, 2008), changes in labor productivity (Huang & Lin, 2008), adhesion to the EMU (Mayes & Virén, 2009), or market regulations (Neely, 2010).

Finally, a more recent strand of literature focuses on the pertinence of Okun's Law at a sub-country, regional level.[6] Among the first studies, Freeman (2000) emphasizes differences between Okun's coefficients for pooled data (around -2) compared to US regions (between -3.57 and -1.84). Even more important disparities are outlined by Adanu (2005) for Canadian regions. On the one hand, in some regions the Okun coefficient is not significant. On the other hand, the magnitude of significant Okun coefficients ranges between -2.14 and -0.93, if we consider, for example, the HP filter.

In addition to the US and Canada, much of the regional analysis of Okun's Law has focused so far on European Countries. Early studies by Kangasharju & Pehkonen (2001) outline both significance and magnitude differences in the Okun coefficient for regions in Finland (see also Kangasharju, Tavera & Nijkamp, 2012). Two other studies analyze regions in Greece.

[5] See also the analysis of Moazzami & Dadgostar (2009) performed on 13 OECD countries, or the work of Gabrisch & Buscher (2006) focusing on post-communist economies.

[6] To some extent, cross-country OECD or E(M)U studies can be also seen as regional, provided countries are considered as regions of the OECD or E(M)U areas.

Apergis & Rezitis (2003) find little differences between Greek regions, except for two regions for which the estimated coefficients are quite large in absolute value (around -3). On the contrary, Christopoulos (2004) concludes that not only is the size of the Okun coefficient weaker, ranging between -1.70 and -0.32, but that Okun's Law is valid (at the 5% level) in only 5 out of the 13 Greek regions. In their analysis on Spanish regions, Villaverde & Maza (2007, 2009) emphasize results in favor of Okun's Law in most regions (between 11 and 15 out of 17 regions), of relatively low (absolute value) magnitude (between -1.55 and -0.32 for the regions, and equal to -0.91 for Spain as a whole). Finally, comparable results are illustrated by Binet & Facchini (2013) for France: Okun's coefficient is significant in only 14 out of 22 regions, and ranges between -1.81 and -0.91.

In this paper we take stock of this latter strand of literature and explore the potential existence of Okun's Law in regions within the Czech Republic and Slovakia. By so doing, we aim to develop the existing literature in several directions. First, compared to previous research, this is the first paper that presents evidence on the regional Okun's Law in more than one country. Indeed, there are several reasons for jointly considering the Czech Republic and Slovakia. Historically, the two countries were part of the former Czechoslovakia for the period 1918-1992, during which time they shared common traditions, culture, history, and so forth, in addition to a common government and economic policy. Nowadays, there is a strong tradition for the elected prime minister of one country to make the first official foreign visit to the other one. Also, the two countries often disregard their common border when it comes to important development projects (i.e. highways), and students from one country can study in the other one in their own language (the two languages are fairly close). Finally, each country is the other's first (after Germany) foreign partner in terms of trade.

Second, to the best of our knowledge, this is the first paper analyzing Okun's Law in emerging countries at a regional level, while previous contributions focused exclusively on developed countries. As such, we are using an original output and unemployment regional dataset to provide estimations of a regional Okun's Law, as well as a set of regional variables, including domestic and foreign investment, R&D, or infrastructure public spending, in our subsequent analysis. Thus, we illustrate output and unemployment dynamics over two decades for two emerging countries that were confronted with major political, institutional and economic transformations in the 1990's.

Third, after emphasizing regional estimates for Okun's Law in both the Czech Republic and Slovakia, we augment our study in two ways. On the one hand, we present a systematic analysis of economic drivers of Okun's Law, in other words, the major factors explaining that

the unemployment-output relation is significant only in some regions. On the other hand, we search for possible non-linearities in the significant estimated regional Okun coefficients across the two countries. Compared to previous studies in which relatively minor importance is given to explaining the underlying sources of regional heterogeneity, our analysis considers a wide range of variables that can affect not only the significance, but also the magnitude of regional Okun coefficients.

Our results are the following. First, we produce evidence on the presence of a negative relation between output and unemployment in the two emerging countries considered. Second, we highlight important regional disparities in both the Czech Republic and Slovakia, when it comes to the significance of Okun's Law. Third, we provide an extensive analysis regarding potential drivers of such regional heterogeneities. In particular, we find that cyclical unemployment is significantly related to changes in the output gap in Czech and Slovak regions with relatively high output, high domestic and foreign investment, high R&D, and a developed network of highways. On the contrary, regions with high and persistent long-term unemployment or large populations cannot benefit from positive output gaps to reduce unemployment. Fourth, we look for subsequent discrepancies across Czech and Slovak regions, by focusing exclusively on regions in which Okun's Law is at work. We unveil important non-linearities, mainly related to the level of unemployment, economic growth, and the growth rate of domestic investment. Finally, capitalizing on our results, we discuss policy measures designed to reduce unemployment regional disparities in the Czech Republic and Slovakia.

The rest of the paper is organized as follows. Section 2 presents the empirical strategy and the data, section 3 illustrates evidence on the regional Okun's Law in the Czech Republic and Slovakia, section 4 analyses the determinants of both the significance and the magnitude of Okun's coefficient, and section 5 discusses policy implications and concludes.

1.2. Empirical strategy and data

We first present the econometric specification and then discuss the data used in our study.

1.2.1. Econometric Strategy

Let us consider a general specification of Okun's Law linking the cyclical components of output and unemployment

$$y_t - \bar{y}_t = \alpha_0 + \alpha_1 (u_t - \bar{u}_t) + \varepsilon_t, \quad (1)$$

where y_t and u_t are, respectively, the (log of) real GDP and the unemployment rate, α_0 is a constant, and ε_t is the error term. Denoting by $\bar{y}_t$ the trend of GDP and by $\bar{u}_t$ the trend of unemployment, the terms $\left(y_t - \bar{y}_t\right)$ and $\left(u_t - \bar{u}_t\right)$ measure the cyclical components of output (the output gap) and unemployment (the unemployment gap), respectively.

One major difficulty for estimating the interest coefficient, α_1, is that the long-term components of output and unemployment, namely potential output $\bar{y}_t$ and the natural unemployment rate $\bar{u}_t$, are unobserved. However, the literature has by now emphasized numerous detrending techniques, which properly allow for estimating the long-run component of a time series, by taking into account the likely presence of a unit root.[7] To easily compare our results with the literature, we focus on the Hodrick-Prescott (HP) detrending filter for estimating $\bar{y}_t$ and $\bar{u}_t$.[8] Despite its popularity, the HP technique is the object of various criticism, particularly regarding the value of the key smoothing parameter, λ. In particular, although some consensus emerges for quarterly data, the literature is much divided when observed series present an annual frequency. Consequently, we append the value recommended by HP, namely 100, to account for the popular correction emphasized by Ravn & Uhlig (2002) and use the value $\lambda = 6.25$.

1.2.2. Data

At the most disaggregated level, our study is conducted on a balanced panel of 22 regions (14 from the Czech Republic and 8 from Slovakia), using original yearly data over the period 1995-2011.[9] We measure output y_t by real GDP, while unemployment u_t is captured through the registered unemployment rate, based on the methodology developed by the Ministries of Labor, Social Affairs and Family of the Czech Republic and Slovakia.

We begin by estimating the output and unemployment gaps using the HP filter on observed series y_t and u_t. For a proper estimation of Okun's Law by equation (1), both cyclical components $y_t - \bar{y}_t$ and $u_t - \bar{u}_t$ must be stationary. The literature emphasizes, mainly, two alternatives for investigating the presence of a unit root, namely unit root (for example,

[7] For an early excellent survey on detrending methods, see Canova (1998).

[8] The robustness section will provide results based on other detrending methods.

[9] The time length was selected based on data availability. In addition, assuming that data were available since 1990 (i.e. after the end of the Cold War), we would still use 1995 as the starting date of our sample, to allow several years for economies to stabilize after the massive shocks they experienced.

Augmented Dickey-Fuller) and stationarity (for example, Kwiatkovski-Phillips-Schmidt-Shin, KPSS, 1992) tests.[10] If we consider stationarity tests, according to Carrion-i-Silvestre & Sanso (2006) a major shortcoming relates to the estimation of the long-run variance; thus, we estimate it using the correction of Sul, Phillips & Choi (SPC, 2005).

Table 1. Stationarity tests for output and unemployment gap

Region	Output gap	Unemployment gap
Czech Republic		
Central Bohemia (CB)	0.056	0.054
Hradec Kralove (HK)	0.061	0.049
Karlovy Vary (KV)	0.062	0.047
Liberec (LI)	0.051	0.047
Moravia Silesia (MS)	0.066	0.058
Olomouc (OL)	0.063	0.054
Pardubice (PD)	0.057	0.049
Plzen (PZ)	0.065	0.050
Prague (PG)	0.060	0.059
South Bohemia (SB)	0.064	0.050
South Moravia (SM)	0.061	0.055
Usti (UT)	0.069	0.059
Vysocina (VY)	0.054	0.046
Zlin (ZL)	0.055	0.051
Slovakia		
Banska Bystrica (BB)	0.047	0.086
Bratislava (BA)	0.072	0.084
Kosice (KE)	0.060	0.099
Nitra (NR)	0.065	0.091
Presov (PO)	0.055	0.088
Trencin (TR)	0.058	0.081
Trnava (TV)	0.062	0.088
Zilina (ZI)	0.059	0.083

Note: KPSS stationarity tests are computed with a time trend. The maximum lag length was chosen based on the Schwert (1989) criterion. The critical values for the KPSS test are 0.119 (10%), 0.146 (5%), and 0.216 (1%).

Table 1 presents the KPSS stationarity test for output and unemployment gaps. Results show that the HP filter was successful in extracting a potential unit root, as all considered cyclical components of output and employment are stationary. In addition to regional unit root tests,[11] these results are backed up by (i) panel unit root tests—for example, the Im, Pesaran & Shin (IPS, 2003)[12] statistic (and its p-value) for cyclical output is -5.69 (0.00), while for cyclical unemployment is -5.19 (0.00), therefore rejecting the presence of a unit root in the panel—and

[10] The null hypothesis for unit root (stationarity) tests is that the series is non-stationary (stationary) against the alternative hypothesis of stationarity (non-stationarity); thus, the two tests can be seen as the reversal complement of each other.

[11] The results of the Elliott-Rothemberg-Stock (ERS, 1996) test are available upon request.

[12] As acknowledged by the literature, the IPS test is more appropriate for heterogeneous panels compared, for example, with the Levin, Lin & Chu (2002) statistic, which is more appropriate for homogeneous panels.

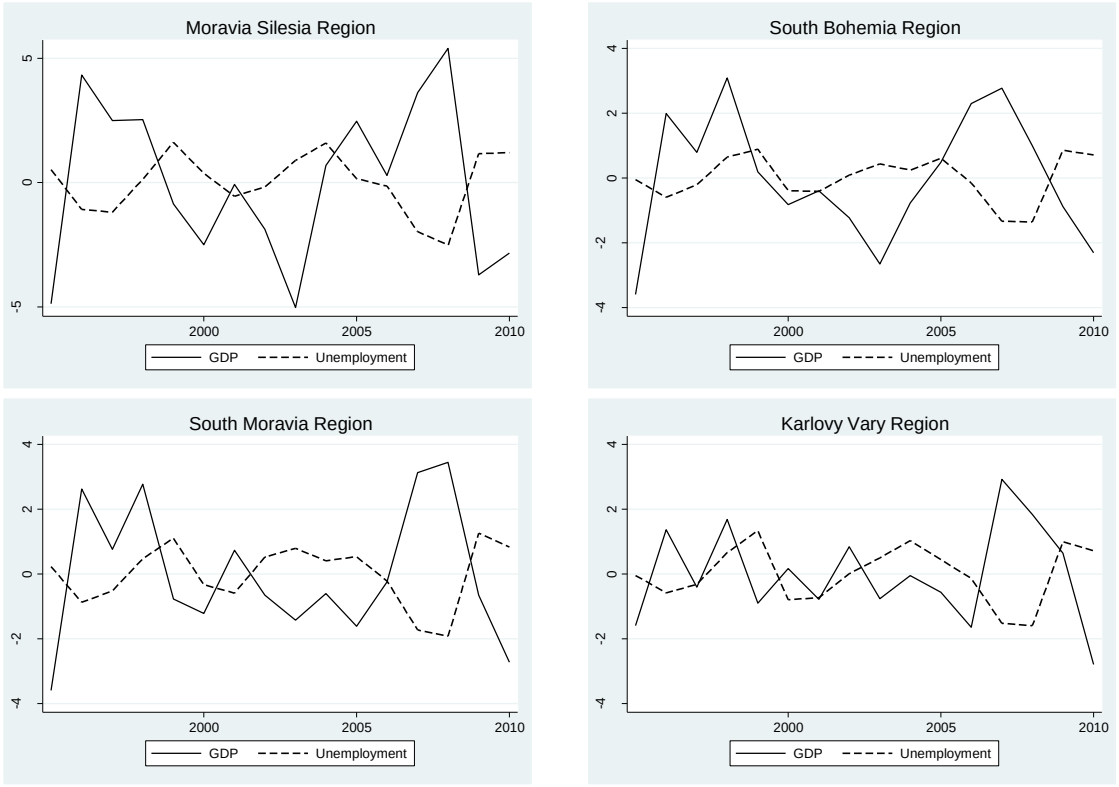
by (ii) panel stationarity tests—for example, the Hadri (2000) statistic (and its p-value) equals -2.68 (0.996) for cyclical output and -2.43 (0.993) for cyclical unemployment, therefore accepting the null hypothesis of stationary panels. Consequently, we employ the cyclical components of output and unemployment in the next section to search for eventual regional evidence on Okun's Law.

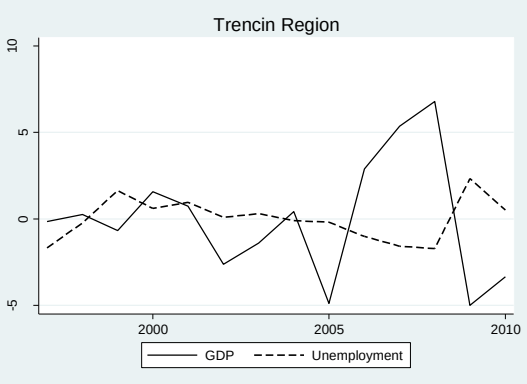
1.3. Results: Regional evidence on Okun's Law in the Czech Republic and Slovakia

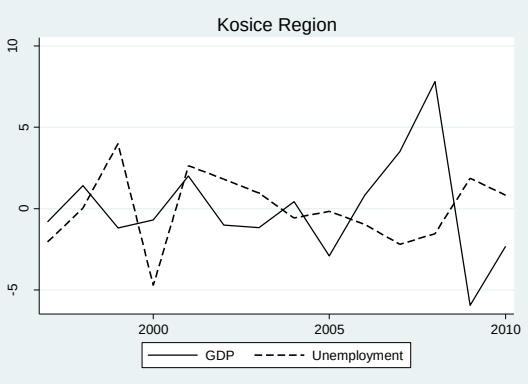
We proceed in two steps: first, we present a graphical illustration of the relationship between unemployment and output at the regional level and, second, we emphasize regional estimations of Okun's Law.

Figure 1 illustrates the cyclical components of unemployment and output based on HP computations. For parsimony, we present four examples for the Czech Republic (the first two lines) and two examples for Slovakia (the last line).

Figure 1. Regional output and unemployment cycles in the Czech Republic and Slovakia







As emphasized by Figure 1, the output gap has a much higher magnitude compared to the unemployment gap. This is consistent with the fact that both the Czech Republic and Slovakia are emerging economies experiencing a catching-up process (possibly relative to advanced EU countries) characterized by relatively higher economic growth rates. Figure 1 shows mixed evidence. On the one hand, there seems to be a strong inverse relation between the output gap and the unemployment gap in the regions on the left-hand side column, namely Moravia Silesia, South Moravia, and Trencin. On the other hand, in South Bohemia, Karlovy Vary, and Kosice, the negative correlation between the two series is not that clear-cut. Indeed, for the latter regions, the behavior of unemployment and output seems less consistent with Okun's Law, as the two series often cross at values fairly different from zero, namely a positive output gap is not always correlated with a negative unemployment gap (or vice versa). Capitalizing on these observations, we present in the following regional estimations.

Table 2. Okun's Law in the Czech Republic and Slovakia: regional evidence

Region	HP	QT	BK
Czech Republic			
Central Bohemia (CB)	-2.30** (.729)	-1.72** (.545)	-1.94 (1.00)
Hradec Kralove (HK)	-1.04** (.461)	-.904 (.479)	-1.20** (.407)
Karlovy Vary (KV)	-.535 (.408)	-1.10** (.329)	-.539 (.564)
Liberec (LI)	-1.51** (.476)	-1.14** (.470)	-1.21** (.515)
Moravia Silesia (MS)	-1.90** (.478)	-2.17** (.306)	-2.05** (.602)
Olomouc (OL)	-.919** (.408)	-.856** (.263)	-.980 (.505)
Pardubice (PD)	-1.45** (.451)	-1.64** (.394)	-1.29** (.523)
Plzen (PZ)	-1.53** (.609)	-2.17** (.446)	-1.25 (.877)

Prague (PG)	-3.00** (1.17)	-2.56** (.806)	-2.78 (1.41)
South Bohemia (SB)	-.724 (.623)	-1.37** (.551)	-.553 (.594)
South Moravia (SM)	-1.51** (.407)	-1.13** (.356)	-1.25** (.493)
Usti (UT)	-.619 (.478)	-1.57** (.312)	-.403 (.490)
Vysocina (VY)	-1.40** (.357)	-1.55** (.261)	-.947 (.597)
Zlin (ZL)	-1.22** (.510)	-1.41** (.467)	-1.15** (.396)
Slovakia			
Banska Bystrica (BB)	-1.32 (.722)	-.501 (.399)	-2.33** (.771)
Bratislava (BA)	-2.58** (.884)	-2.64** (.607)	-2.90** (1.07)
Kosice (KE)	-.471 (.397)	-.676** (.290)	-.226 (.384)
Nitra (NR)	-1.11** (.433)	-.872** (.217)	-1.34 (.661)
Presov (PO)	-.986 (.493)	-.750** (.291)	-1.29** (.542)
Trencin (TR)	-1.89** (.610)	-1.45** (.407)	-2.29** (.656)
Trnava (TV)	-2.16** (.929)	-2.20** (.580)	-1.44 (.945)
Zilina (ZI)	-1.72** (.500)	-1.06** (.297)	-2.70** (.570)

Note: HP stands for the Hodrick-Prescott filter. QT signals the use of a quadratic trend. BK stands for the Baxter-King filter. Standard errors robust to autocorrelation and heteroskedasticity are reported in brackets. ** shows significance at the 5% level.

Table 2 presents OLS estimations of regional Okun coefficients for each of the 22 Czech and Slovak regions. HP-based results depicted in the first column are consistent with Okun's Law, as all coefficients are negative, emphasizing an inverse relation between the unemployment gap and the output gap. Similar results occur if we perform panel pooled or fixed effects estimations on Czech and Slovak regions; for example, the Okun coefficient based on a panel regression with regional fixed effects equals -1.23 (with a standard error of 0.108). The (absolute magnitude) value of the Okun coefficient is even higher if we consider country data, namely -1.50 (0.265) for a panel regression with country fixed effects, -1.58 (0.464) for the Czech Republic, and -1.47 (0.343) for Slovakia. Altogether, these results confirm the presence of a negative link between cyclical unemployment and the output gap.[13]

[13] Note also the existence of some differences in the magnitude of the Okun coefficient between the Czech Republic and Slovakia. Indeed, although the difference between the two countries is rather weak if we compare regional-average coefficients, namely -1.3 for the Czech Republic versus -1.2 for Slovakia, it becomes more important if

However, results equally outline significant regional disparities. Regarding the Czech Republic, Okun's Law is statistically significant in 11 out of 14 regions, while in only 5 out of 8 regions for Slovakia. Moreover, when it comes to its magnitude, significant Okun coefficients lie between -3.00 for Prague and -2.58 for Bratislava, or between -0.92 for Olomouc and -1.11 for Nitra. Notice that these numbers are of higher (absolute value) magnitude than regional coefficients derived for developed countries (see Villaverde & Maza, 2009, for Spain, or Binet & Facchini, 2013, for France), confirming the strong link between unemployment and output in emerging countries, such as the Czech Republic and Slovakia.

Using the HP filter as a benchmark, in columns 2 and 3 we present robustness tests, which consider alternative detrending methods allowing for comparison with the related literature, namely a Quadratic Trend (QT, in column 2; see Adanu, 2005) and the Baxter & King (1999) filter (BK, in column 3; see Villaverde & Maza, 2009). The negative coefficients are yet again compatible with Okun's Law and of comparable amplitude with those based on the HP filter, namely between -2.56 (-2.64) for Prague (Bratislava) and -0.856 (-0.676) for Olomouc (Kosice) for QT, and between -2.05 (-2.90) for Moravia Silesia (Bratislava) and -1.15 (-1.29) for Zlin (Presov). However, compared to the HP filter, the use of a QT increases the number of significant coefficients to 13 in the Czech Republic and to 7 in Slovakia, while drawing upon the BK filter drops the number of significant regions to 6 for the Czech Republic and to 5 in Slovakia.[14]

Based on the three alternative detrending methods, we can identify three patterns when it comes to assessing the significance of the regional Okun's Law. In the first group there are several regions in which the coefficient is strongly significant (at the 5% level), irrespective of the method used. Regarding the Czech Republic, such regions are South Moravia or Moravia Silesia, while for Slovakia we can identify Bratislava and Trencin. Regarding the second group, in several regions the unemployment and output cycles do not seem to be significantly correlated, as the estimated coefficient is not significant in at least 2 out of 3 cases. This is the case for Karlovy Vary, Usti, and South Bohemia for the Czech Republic, and for Banska Bystrica and Kosice for Slovakia. Finally, in the last group we identified regions with mixed results, namely, in which significant and non-significant Okun coefficients coexist, depending

we focus only on significant regional coefficients, as their averages are -1.6 for the Czech Republic and -1.9 for Slovakia. The more vigorous (in absolute value) Okun coefficient in Slovakia might be attributable, for example, to a better integration with trade partners (mostly EU countries), fostered by the convergence process prior to the adoption of the Euro in 2009.

[14] Moreover, to control for the fact that, as with most of the CEECs, the Czech Republic and Slovakia experienced changes in the dynamics of their population after the end of the Cold War, we used real per capita GDP as a measure of output. We report that HP-based results are unchanged when it comes to the sign and significance of Okun's coefficient in all Czech and Slovak regions (results are available upon request).

on the econometric method used. For example, for the Czech Republic, Central Bohemia and Vysocina would be associated with the first and second group, while for Slovakia, Trnava and Presov would be closer to the first and second groups, respectively. Building on these findings, in the next section we aim to emphasize potential factors that could drive such important regional differences.

1.4. Discussion: a closer look at driving factors of regional disparities

The goal of this section is to explore two issues. In the first subsection we investigate what might differentiate regions in which Okun's Law holds from regions in which it does not. In the second subsection we focus exclusively on the regions in which the relation between the cyclical components of unemployment and output is significant and search for potential variables that might significantly influence its magnitude.

1.4.1 What explanations exist for a significant regional Okun's Law?

Let us first focus on our main variables, namely unemployment and GDP. Regarding unemployment in Slovakia, the regions where Okun's Law is not significant are associated with high unemployment, as well as high long-term unemployment. Average unemployment for Banska Bystrica, Kosice, and Presov equals 19.2%, compared to 8.83% in Bratislava, Zilina, and Trnava, while for long-term unemployment the numbers are 11.2% and 3.52%, respectively. Turning to the Czech Republic, average unemployment and average long-term unemployment together for Karlovy Vary and Usti is 10.8% and 4.04%, well above the values for Central Bohemia and Prague, namely 4.40% and 0.87%. Consequently, an identical initial explanation arises for both countries: demand-based policies are found to be inefficient in reducing unemployment in Czech and Slovak regions characterized by high and persistent unemployment.[15] Given the beginning date of our sample, namely 1995, we can suspect that this long-term unemployment is mainly related to the end of the Cold War and the transition to a market economy in the 1990's, which was typically associated with deindustrialization and massive job destruction. In particular, the skills of the unemployed rapidly became obsolete with respect to the requests of the new types of industries. Therefore, these regions should draw upon supply-based policies designed to reduce labor market rigidities, allowing, for example, for the long-term unemployed to acquire new skills through requalification.

[15] Our results confirm previous findings for Greece (Christopoulos, 2004) and for the OECD (Sogner & Stiassny, 2002).

We now turn to GDP. Regarding the Czech Republic, the regions Karlovy Vary, Usti, and Vysocina are below the average GDP per capita, in contrast with Prague, South Moravia, and Central Bohemia, which are (decreasingly) ranked 1, 2, and 4, respectively. The same holds in Slovakia, as, according to their average GDP per capita, Bratislava and Trnava are the two richest regions, while Banska Bystrica and Presov are the two poorest. Thus, it seems that demand-based policies may create important unemployment regional disparities in both the Czech Republic and Slovakia, with the formation of "clubs," namely, rich regions with low and decreasing unemployment, which coexist with poor regions with high and persistent (long-term) unemployment. To better emphasize the potential existence of such underdevelopment traps, we can augment our analysis using GDP growth rates. For Slovakia, the regions of Bratislava and Zilina present the two highest growth rates, in contrast with Banska Bystrica and Presov which exert the two lowest growth rates. For the Czech Republic, Karlovy Vary and Usti are associated with the lowest average growth rates (3.8% and 4.7%, respectively), below the average of 5.5% for the Czech Republic and well below the most rapidly growing regions, namely Prague (7.7%), Central Bohemia (6.8%), and South Moravia (6.3%). Since average growth rates are computed over the period 1995-2011, these important differences in magnitude over such a long period support the idea of the formation of significant regional disparities involving regional development paths at different speeds (absence of regional convergence).

Capitalizing on the evidence for unemployment and GDP, we consider, in the following, additional explanatory variables for the regional Okun's Law. Let us first focus on domestic and external investment. An interesting feature for both countries is that domestic and foreign investment seem to be highly complementary. Indeed, for the Czech Republic, the lowest and highest volumes of per capita gross fixed capital formation (GFCF) and foreign direct investment (FDI) are registered in Karlovy Vary and in (except Prague) South Moravia and Central Bohemia, respectively. Similarly, Banska Bystrica and Presov, and Bratislava and Trnava, present, respectively, the lowest and highest per capita GFCF and FDI volumes for Slovakia. The fact that domestic and foreign investment often go hand in hand, signifying that one type of investment can hardly substitute the other, yet again supports the potential danger of regional underdevelopment traps in Czech and Slovak regions.

Second, we discuss innovation, measured alternatively by two variables. On the one hand, the largest volume of R&D investment in the Czech Republic occurs in (except Prague) Central Bohemia, South Moravia, and Moravia Silesia, and the smallest in Karlovy Vary, Vysocina, and Usti. The same pattern appears for R&D growth rates, as the former (latter) three regions are all above (below) the average. For Slovakia, R&D investment volumes are roughly

10-20 times (2-4 times) higher in Bratislava (Trnava) compared to the lowest amounts of R&D investment, which is registered in Presov and Banska Bystrica. These high magnitudes still hold when we compare the average growth rate of R&D for Bratislava (11.1%) and Trnava (9.95%) with that of Presov (4.39%). On the other hand, we consider the number of students, as a proxy for human capital, which itself can foster innovation. If the highest number of students over the period 2007-2011 occurs as expected in Bratislava, note that the region of Presov has among the lowest number of students. The figures for the Czech Republic for the same period are even more conclusive: the top four regions regarding the number of students are Prague, Moravia Silesia, South Moravia, and Central Bohemia, while Karlovy Vary, Vysocina, Usti, and South Bohemia are all below the average. Thus, evidence for innovation, proxied alternatively by R&D investment or the number of students as a measure of human capital, confirms the patterns established for previous variables.

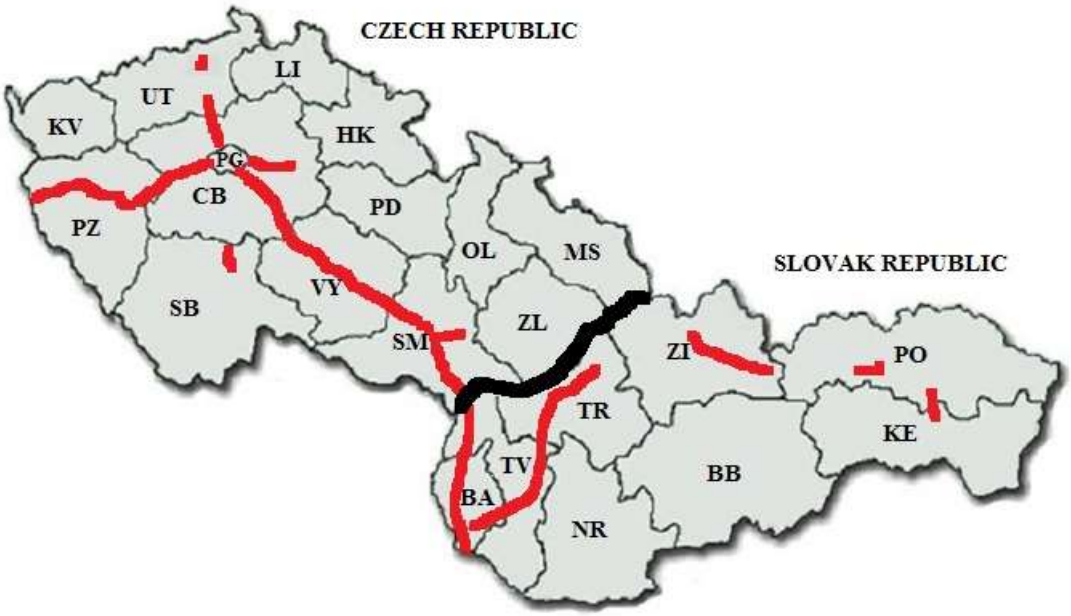
Finally, we explore to what extent demographic and geographic variables may explain differences in the significance of Okun's Law. In the former group of variables, for Slovakia, the most populated regions are Presov and Kosice, while Bratislava and Trnava are among the least populated regions; in addition, Banska Bystrica and Presov are the lowest two regions when it comes to population density.[16] For the Czech Republic, the regions with the highest average net migration are Central Bohemia, Prague, and South Moravia, while Karlovy Vary and Vysocina have virtually no net migration.

To capture geographic variables, we searched for data on highways, since, particularly for developing and emerging countries, they can be a strong vector of economic development. Figure 2 displays the network of highways in Czech Republic and Slovakia.[17]

[16] Note also that the largest Slovak regions are Banska Bystrica and Presov (together they represent 38% of the total land area of Slovakia).

[17] We looked for maps for the beginning and the end of our sample. However, the lack of available data forced us to use the map for 2005—as close as we could get to the middle year of our sample, 2003.

Figure 2. The network of highways in the Czech Republic and Slovakia in 2005



Visually, the map confirms the three areas along which the Okun's Law was found to be significant. First, around the capital Prague, namely for the regions Prague and Central Bohemia, there is an important concentration of highways. Second, along the highway linking the two capital cities Prague and Bratislava, namely for the regions South Moravia and Bratislava. Third, along the highway connecting Bratislava to Trencin, namely for the regions Bratislava, Trnava, and Trencin. For example, regarding the Czech Republic, out of the 546 km of highways in 2005, 298 km are located in Central Bohemia (174) and South Moravia (124), while for Slovakia the three regions with the longest highways are Bratislava (101), Trnava (67), and Trencin (67), for a national highway network of 317 km in 2005.[18] Strongly related to the presence of high-quality transport infrastructure, the automobile industry is equally developed in these regions. For example, regarding Slovakia, Volkswagen is implanted in the region of Bratislava, Peugeot-Citroen in Trnava, and Kia Motors in Zilina. Similarly, regarding the Czech Republic, Skoda is implanted in Central Bohemia, while Moravia Silesia and South Moravia are traditionally highly industrialized regions.[19] Conversely, Okun's Law is not

[18] Note that our conclusions still hold if we consider other national rapid roads, i.e. 1st roads, in addition to highways. For example, among the regions with the lowest density of highways and 1st roads in 2005 in the Czech Republic we find South Bohemia and Karlovy Vary, while Prague (corrected for the surface covered by historical buildings) and the Moravian Silesian region contain the highest density of highways and 1st roads. Regarding Slovakia, there is a major gap between the density of the last three ranked regions, namely Kosice, Banska Bystrica, and Presov (the average value is around 6.4 km of such roads per 100 km2 of surface), and the first three regions, namely Bratislava, Trnava, and Trencin (the average is around 9.5 per 100 km2 of surface).

[19] For example, the industrial tradition of the Moravian Silesian region goes back (at least) to 1763 (discovery of coal in the region) and currently Moravia Silesia is among the most industrialized regions in all of Central Europe.

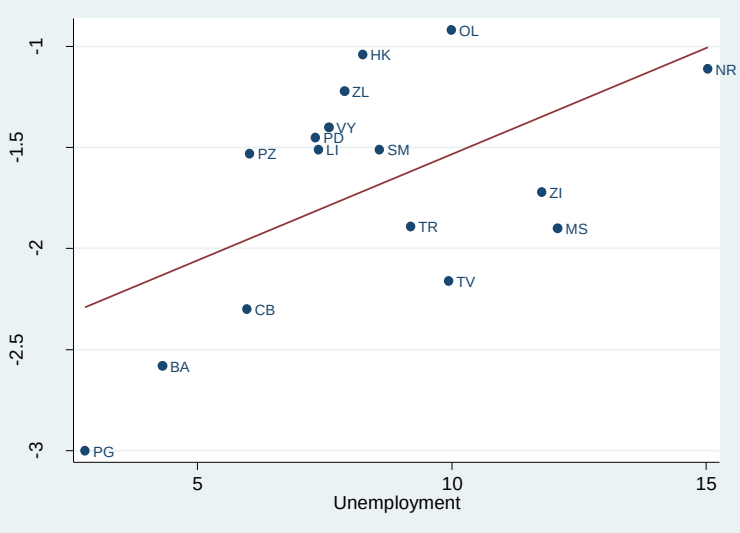
significant in northern regions of the Czech Republic (especially Karlovy Vary and Usti) and in eastern regions of Slovakia (Banska Bystrica, Kosice and Presov).

This preceding analysis suggests that, in addition to common historical and cultural traditions between the Czech Republic and Slovakia, there exists a regional pattern of where Okun's Law holds, namely in border regions between the Czech Republic and Slovakia (Czech Republic: South Moravia, Zlin, and Moravia Silesia; Slovakia: Trnava, Trencin, and Zilina). Consequently, the following analysis considers all regions pooled, i.e. irrespective of the country to which they belong.

1.4.2. Are there regional non-linearities in the regional Okun's Law?

In complement to the previous analysis, we focus in this subsection exclusively on the regions in which the Okun coefficient is significant. Precisely, we aim to look at whether, when significant, the relation between unemployment and output is related to non-linearities among Czech and Slovak regions. To this end, we consider several variables that may generate such nonlinear effects. Let us first focus on the influence of average unemployment on Okun coefficients.

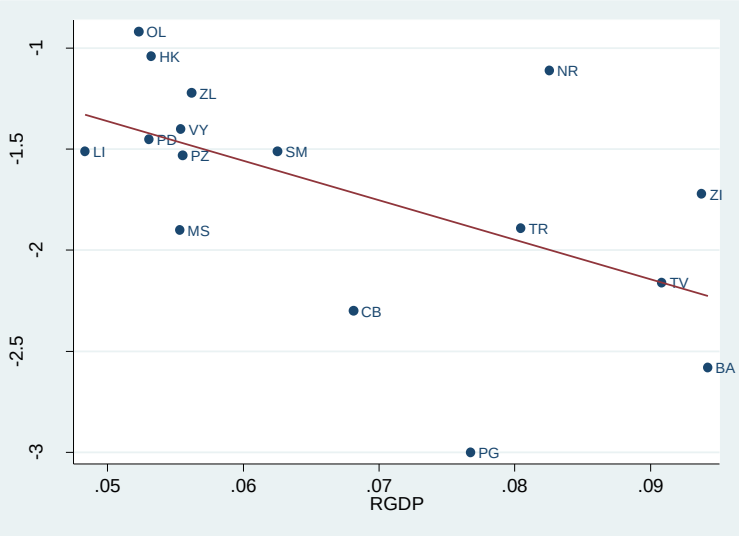
Figure 3.a. The magnitude of regional Okun coefficients: the role of unemployment



Previously focused on mining and heavy industry, the region has undergone a significant restructuring process, leading to the development of new industries, including automotive and related supply chains. Important firms include Moravia Steel (ranked 7th in the Czech Republic according to net sales in 2011), OKD (coal and coke production, ranked 6th in the Czech Republic according to the number of employees in 2011), or the famous automotive company Tatra. In particular, note that the high magnitude (in absolute value) of the Okun coefficient for Moravia Silesia is in line with the work of Blackley (1991), emphasizing high Okun coefficients in large manufacturing sectors.

As emphasized by Figure 3.a, there exists an increasing relation between average (1995-2011) unemployment and Okun coefficients. In addition, since the slope is significant (the p-value associated with the slope equals 2.7%), our analysis reveals that the relation between unemployment and output is significantly different depending on the level of average unemployment. For example, the Okun coefficient is 2-3 times stronger in Central Bohemia or Bratislava compared to its value in Olomouc or Hradec Kralove. Thus, in addition to the result from the previous subsection, according to which the level of unemployment matters when it comes to the significance of the Okun coefficient, we find that the level of unemployment is equally related to significant magnitude non-linearities across Czech and Slovak regions for which Okun's Law is at work.

Figure 3.b. The magnitude of regional Okun coefficients: the role of economic growth

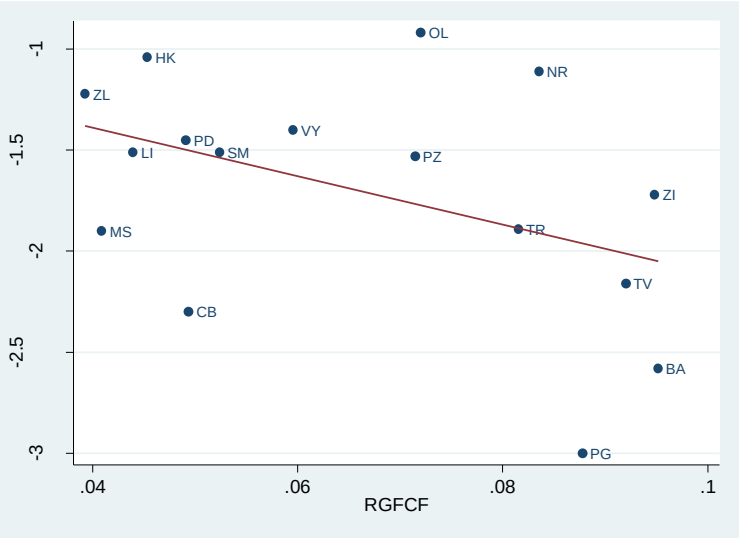


Second, we look for a potential role of economic growth. According to Figure 3.b., there exists a decreasing and significant (the p-value associated with the slope equals 2.5%) link between the size of the Okun coefficient and the 1995-2011 average economic growth (RGDP). Specifically, in regions such as Bratislava, Central Bohemia, Prague, or Trnava, Okun coefficients are above 2 (in absolute value), but only around 1 in Hradec Kralove, Olomouc, or Zlin. Consequently, there exist significant regional disparities in the reaction of unemployment to output-based policies among Czech and Slovak regions with rapid, versus moderate, economic growth paths.[20]

[20] A positive link between output and the absolute size of the Okun coefficient is similarly reported by Adanu (2005) for Canada.

Third, let us look more in detail at important economic growth drivers, namely research and development (R&D), foreign direct investment (FDI), and the gross fixed capital formation (GFCF). Despite presenting the expected negative sign, the correlations between Okun coefficients and the growth rates of both R&D and FDI are not significant.[21] On the contrary, as illustrated by Figure 3.c., the higher the growth rate of the gross fixed capital formation (RGFCF), the higher the Okun coefficient (in absolute value). Even though the significance of the relation is relatively weaker (the p-value associated to the slope equals 9.4%), GFCF appears, in addition to unemployment and the growth rate of GDP, as a potential key determinant of the magnitude of the relation between unemployment and output.

Figure 3.c. The magnitude of regional Okun coefficients: the role of the GFCF



Finally, we explored other potential sources of heterogeneities among Okun's coefficients in Czech and Slovak regions. We report that population dynamics (measured by the growth rate of migrants), the evolution of human capital (measured by the growth rate of students), or the change in wages were not found to be significant drivers of regional heterogeneities in the relation between unemployment and output in Czech and Slovak regions.

[21] An unpublished appendix provides a graphical illustration. The lack of a significant relation between R&D growth and Okun coefficients can be related to the time needed for R&D investment to generate sizable effects at the macroeconomic level (and all the more in emerging or developing countries, as is the case for our analysis). Besides, there is currently a debate over the sign of the effect of R&D growth on the Okun coefficient; for example, Villaverde & Maza (2009) find a positive relation, contrary to the not significant slope we find. However, R&D and FDI growth rates explain regional differences when it comes to the significance of Okun's Law (see also the previous subsection). For example, in regions with high FDI growth rates, such as Moravia Silesia or South Moravia, Okun's coefficient is significant, while not significant in regions with low FDI growth rates (Karlovy Vary or Usti).

1.5. Conclusion

We presented in this paper evidence on the regional Okun's Law in the Czech Republic and Slovakia. Compared to the few previous contributions that focused exclusively on developed countries, our paper is, to the best of our knowledge, the first attempt to present such regional evidence in two emerging countries, selected for their historical, cultural, and economic closeness.

Using annual data for the period 1995-2011, we emphasized important heterogeneities among Czech and Slovak regions regarding the significance of the Okun coefficient. Considering alternative methods for estimating Okun's Law, three patterns arise: regions for which the Okun's Law is (i) always validated, (ii) never or weakly validated, and (iii) mixed results. The existence of these disparities calls for more detailed analysis of the underlying mechanisms explaining such regional differences. On the one hand, we searched for determinants that might explain what drives regional disparities in the relation between unemployment and output. According to our findings, the Okun's Law appears not to be statistically significant in Czech and Slovak regions in which average and long-term unemployment is high and average economic growth is relatively lower. These results are to be related to the deindustrialization process that followed the end of the Cold War, generating high and persistent unemployment due to obsolete skills. Furthermore, these findings raise serious regional development concerns, as regions with high unemployment may be caught in an underemployment trap, in addition to the underdevelopment trap due to the presence of relatively lower economic growth rates over such a long period. In addition, the regions where the Okun coefficient is not significant are jointly characterized by low domestic (GFCF) and foreign (FDI) investment, which equally raise the danger of regional underdevelopment traps in the Czech Republic and Slovakia. Unfortunately, the same holds when considering other potential sources of economic development, like R&D spending, population, the number of students, or the network of highways. On the other hand, we found that the level of unemployment, economic growth, or the growth rate of the GFCF are related to significant non-linearities among Czech and Slovak regions for which the Okun's Law is statistically significant.

Altogether, these results have important policy implications. First, it appears that demand-side policies are inappropriate in many Czech and Slovak regions for dealing with unemployment. In such regions, policymakers should draw upon supply-based policies, including supporting the unemployed in acquiring new skills through requalification,

subsidizing the formation of human capital (for example, through increasing the number of students), or subsidizing the development of R&D activities is poor regions with high unemployment.[22] In addition, from a more demand-side perspective, since domestic and foreign investment seem to go hand in hand in Czech and Slovak regions, policymakers concerned with reducing unemployment should provide facilities for attracting FDI in such affected regions.[23] One way to do so is to focus on large public investment plans in regional infrastructure (such as highways or other rapid roads).[24] Failing to do so might result in persistent unemployment rates, and even regional underemployment traps, in Czech and Slovak regions associated with different convergence speeds compared to other EU/CEEC regions. From this perspective, EU funds designed for fostering convergence across the area can play the role of a key vector in accompanying the Czech and Slovak transition (and convergence to the advanced EU countries) process, by driving regional development and reducing regional unemployment.

[22] Supply-based policies are likewise defended by Apergis & Rezitis (2003) and Apergis (2005) for Greece, or Villaverde & Maza (2009) for Spain.

[23] One successful example is the Moravian Silesian region in the Czech Republic: despite high unemployment rates following the restructuring process in industry, the region attracted domestic and foreign investment (in particular by building industrial parks) that generated sizable macroeconomic effects in reducing unemployment.

[24] The role of local infrastructure for reducing regional unemployment is similarly outlined by Christopoulos (2004) for Greece or Binet & Facchini (2013) for France.

Chapter 2. Economic growth and unemployment in Romania: a regional analysis of Okun's Law

Economic growth and unemployment in Romania: A regional analysis of Okun's Law[1]

Abstract

We analyze the regional Okun's Law in Romania, the second largest emerging country in the European Union. We are unveiling significant regional heterogeneities of the Okun coefficient. The regions in which Okun's Law is not significant have high growth rates, but the unemployment rates are around the median. These results illustrate the importance of the regional dimension in setting growth and employment policies. In most Romanian regions, demand policies would still be effective in reducing unemployment. However, in some areas, government should focus on supply policies. Finally, an employment policy might prove virtuous to regain economic growth.

Keywords: Regional Okun Law, emerging countries, Romania

JEL Codes: E24, E32, R11

[1] Aversion of this chapter will be published as "Croissance économique et chômage en Roumanie: Une analyse régionale de la loi d'Okun" in *Canadian Journal of Development Studies*, and was written with A. Minea and I. Tomuleasa.

2.1. Introduction

In the context of the end of the Cold War, the events of December 1989 marked an abrupt change in the political regime in Romania, and with it major economic and institutional changes. The country has embarked on a transition period, intended to lead to monetary, financial and commercial liberalization, and generalization of the market economy.

However, this transition was associated with significant imbalances from the early years. In fact, faced with the reality of the external competition, many Romanian public companies, oversized in capital and with low labour productivity, faced strong decreases in their activity or even closure. In this context, the first decade of transition was characterized by a steady increase in the unemployment rate, from full pre-1990 employment at two figures in the late 1990s (about 11.5% in 1999).

Then, the 2000s marked a turnaround in the economic situation, fuelled by the context of intensifying discussions on integration of Romania into international structures, particularly in the European Union (EU). Thus, the average real growth rate of GDP over the period 2003-2007 was above 6.5%, peaking at around 8% in 2008, just before the start of the recent financial and economic crisis.

This article aims to analyze the relationship between income (GDP) and unemployment, through the estimation of Okun's Law. Proposed by Okun (1962), this relationship shows a strong empirical decreasing link between the GDP growth rate (real) and the unemployment rate. In a Keynesian perspective, Okun's Law allows to observe whether demand policies, designated to promote economic growth, reduce unemployment in the labour market. In a more neoclassical vision, Okun's Law measures the ability of supply policies to improve the functioning of the labour market, in order to generate economic growth.

If the study of Okun's Law was the subject of many contributions (see next section), it is only recently that its analysis was extended to the inclusion of a regional dimension (see Freeman, 2000, Adanu, 2005, for a discussion on the US and Canadian regions). However, unlike these works that are concentrating around the developed countries, the focus in this article is on an emerging country, Romania. This choice is motivated by several reasons. First, it is the second largest (in terms of population) emerging Central and Eastern Europe country among the 13 countries that joined the European Union since 2004.[2] Then, Romania has two statutes, both emerging country and EU member. The EU membership is important for the

[2] The population of Romania in 2011 was around 21 million inhabitants, the seventh most populated and the ninth largest (surface) country of the European Union.

quality of statistical data, particularly for unemployment measures.[3] Finally, the authors have a great knowledge of Romanian regional characteristics in the three major regions (Moldova at north and northeast, Transylvania at north and north-west and South Wallachia), allowing strengthening the interpretations based on econometric estimations.

The econometric analysis performed for the 1995-2010 period reveals the following results. First, if in all Romanian regions our results are consistent with Okun's Law (the Okun coefficient is always negative), there are significant regional heterogeneities, concerning the significance of the Okun coefficient. Following the robustness analysis of this result through the use of several econometric methods, we find that the Okun Law is not significant in two regions, Bucharest-Ilfov and West. Second, among the regions where it is significant, the magnitude of the Okun coefficient varies greatly from one region to another. For example, if we consider the different methods used, it is sized (in absolute value) between 1.63 (South-West) and 2.75 (South-Muntenia). Finally, the areas where the Okun coefficient is not significant differ in terms of highest average rate of economic growth during the period and by favourable demographic conditions. However, since Okun's Law is significant in the regions most affected by unemployment, public authorities could rely on policies that encourage demand to potentially reduce it.

The rest of the paper is organized as follows. Section two provides a review of the literature on Okun's Law. Section three presents the econometric model and data. Section four presents our results. Finally, section five concludes and discusses policy implications.

2.2. Literature review

Despite the recent fifty year celebration (see Ball, Leigh and Loungani, 2013), Okun's Law has not lost its interest. Instead, she returned to the scene since the beginning of the recent financial crisis and the sharp rise in unemployment that followed (see, for example, Daly and Hobijn, 2010). However, its popularity is probably comparable to the controversies surrounding it. Indeed, Okun's Law is far from being "universal and unique", as can be seen through (at least) three dimensions.

First, the literature has often referred to the heterogeneity of Okun's Law over the studied period (see, for example, Knotek, 2007, and Beaton, 2010) or the perspective adopted (Moosa, 1999 and Huang and Yeh, 2013, illustrate different coefficients Okun on the short term

[3] The section devoted to data presentation analyzes in detail these issues.

vs. long term). Furthermore, in agreement with several studies that identified different Okun coefficients during expansion or recession (see, for example, Cuaresma, 2003 or Holmes and Silverstone, 2006), more recent works are analyzing the Great Depression in the vision. So, using US quarterly data over the period 1949-2011, Owyang and Sekhposyan (2012) find a strong instability of the Okun Law from a historical perspective.

Then, Okun's Law seems to vary with the levels of economic development. On one hand, the Okun coefficient is often significant in developed countries, although with rather large magnitude differences. For example, in an influential article, Prachowny (1993) shows that the Okun coefficient in the US, estimated by Okun (1962) to around 3 (in absolute value), is only around 0.7 when it is controlled by the number of weekly hours worked and by the degree of utilization of production capacity. However, recent work restore in (large) part the amplitude of the coefficient: Attfield and Silverstone (1997) and Coen and Hickman (2006) reveal an Okun coefficient close to 2 (in absolute value) in the United States. In addition, several authors, including Moosa (1997), Lee (2000), Freeman (2001), Harris and Silverstone (2001), Sögner and Stiassny (2002) or Perman and Tavera (2005), identify significant heterogeneity in developed countries. For example, according to Freeman (2001), the Okun coefficient is less than 1.5 in absolute value in Germany, Italy and the United Kingdom, near or greater than 2 in Canada, the United States and France and even around 4 in Japan[4]. On the other hand, though rarer, works on emerging countries reveal that Okun's Law is less significant compared to developed countries. In their panel analysis on 27 European in transition countries, Izyumov and Vahaly (2002) find that the Okun coefficient is not significant (at the 5% level) over the period 1991-1994, but it becomes significant over the 1995-2000 period. However, these results hide significant heterogeneities between these countries. Focusing on eight Central and Eastern European countries that joined the EU in 2004, Gabrisch and Buscher (2004) show that the Okun coefficient is significant (at the 5% level) only in the Czech Republic over the period 1994:2-2004:4, or also in Lithuania and Slovenia over a shorter period (1998:1-2004:4).[5] These results confirm that, as is the case for the period, Okun's Law seems heavily influenced by the level of economic development of countries.

[4] Among the various factors that influence Okun's Law in developed countries are the conditions on the labor market, namely the level of unemployment (Virén, 2001), the stress on the labor market (Malley and Molana 2008), and labour productivity (Huang and Lin, 2008), or monetary conditions, such as the creation of money (Mussard and Philippe, 2009) or membership in the European Monetary Union (Mayes and Virén, 2009). In addition, Hutengs and Stadtmann (2013) conclude that the age of the cohort influences the Okun coefficient in both the developed EU countries (EU-15) and five emerging countries of Central and Eastern Europe.

[5] The presence of not significant Okun coefficients in emerging and developing countries in other parts of the world is confirmed, among others, by Lal et al. (2010) or Hanusch (2012), in Asian countries.

Finally, a very recent literature explores Okun's Law at regional level. On the North American continent, Freeman (2000) found significant differences between the Okun coefficient in American regions (between 1.84 and 3.57 in absolute value), while for Canadian regions Adanu (2005) highlights, in addition to amplitude heterogeneities (between 0.93 and 2.14 in absolute value), regions in which the Okun coefficient is not significant. In Europe, Kangasharju and Pehkonen (2001) and Kangasharju, Tavera and Nijkamp (2012) highlight differences of significance and magnitude of the Okun coefficient in Finland. In Greece, the works of Apergis and Rezitis (2003) and Christopoulos (2004) arrive at rather different conclusions: the regional Okun coefficients would be higher (in absolute value) for the first, but less significant according to the second article. Two other contributions are interested in Spanish and French regions. According to Villaverde and Maza (2009), the Okun coefficient is significant in 11, and, depending on the method used, up to 15 of the 17 regions studied, but of low amplitude (between 0.32 and 1.55 in absolute value). In contrast, in France, Binet and Facchini (2013) show that the Okun coefficient is higher (between 0.88 and 1.95 in absolute value), but significant only in 14 of the 22 considered regions. Finally, according to Ďurech et al. (2014), Okun's Law is only significant in 16 out of 22 Czechs and Slovaks regions. Overall, if regional analysis appears to be increasing in developed countries, we can easily observe their rarity in developing and emerging economies. In order to precisely appreciate the importance of the development level for the significance and magnitude of Okun's Law suggested by the literature, we focus in the following on an emerging country, namely Romania.

2.3. The econometric model and data

2.3.1. The econometric model

Consider writing a series that depends on time x_t as the sum of a trend component x_t^T and a cyclic component $x_t^C = x_t - x_t^T$. By performing the same decomposition for income (y_t) and unemployment (u_t), we can estimate Okun's Law deviation from trend as a relationship between the cyclical components of income and unemployment.

$$y_t^C = \alpha + \beta u_t^C + \varepsilon_t \quad (1)$$

Where α and ε_t are the constant and the error term, respectively, and β is the coefficient of interest. According to Okun's Law, the coefficient β should be statistically significant and negative.

Before estimating the model (1), the question of calculating the variables $y_t^C = y_t - y_t^T$ and $u_t^C = u_t - u_t^T$ appears. In contrast to the series y_t and u_t the trend components of income (y_t^T) and unemployment (u_t^T) are not directly observable. However, the literature offers a large number of methods to estimate them. In this article, we focus on the econometric techniques that take into account the possible presence of a unit root in the observed series (y_t and u_t).

Among the methods used to extract the stochastic trend, the most common are the filters. If many filters have been proposed, we have chosen in this article, in particular to facilitate the comparison of our results with previous studies, to use the filter Hodrick and Prescott (HP 1997). The HP filter consists in estimating the trend of a series as a result of the minimization of the following objective function:

$$\min_{\{x_t^T\}} \left\{ \sum_{t=1}^{T} \left(x_t^C\right)^2 + \mu \sum_{t=2}^{T-1} \left[\left(x_{t+1}^T - x_t^T\right) - \left(x_t^T - x_{t-1}^T\right) \right]^2 \right\} \quad \text{(2a)}$$

The value of the smoothing parameter μ plays a central role. With respect to Hodrick and Prescott suggestion, which is to use the value $\mu = 100$ for annual data, we rely on the results of the spectral analysis performed by Ravn and Uhlig (2002), and adopt the value $\mu = 6.25$.

In addition to the HP filter, we propose, as robustness, another method for calculating the cyclical components of income and unemployment, namely the first difference (FD) to account for the presence of a unit root. In this case, the trend is just equal to the delayed value of a period of the series (modelled as a random walk, in logs):

$$\begin{aligned} x_t^T &= x_{t-1} \\ x_t^C &= x_t - x_t^T \end{aligned} \quad \text{(2b)}$$

The two methods described by equation (2a) and (2b) respectively will be used later to identify different cyclical components and potentially different relationships between the cycle of income and the unemployment cycle.

2.3.2. The data

Compared to the analyses related to the Okun's Law in developed countries, our work is focusing on an emerging country, Romania, and requires a more detailed discussion of the data used.

To provide the regional estimates of Okun's Law, our study focuses on regional data on the eight Romanian regions as defined by the European NUTS 2 classification, corresponding to regions where the population is between 0.8 and 3 million.[6] In the absence of regional quarterly data for both GDP and unemployment, we use data on annual frequency, covering the period 1995-2010. The selection of the temporal dimension was made on several criteria, namely (i) the availability of data, (ii) taking into account that the GDP calculation is harmonized with the ESA 95 methodology from the year 1995 and (iii) considering a stabilization period of five years following the political changes at the end of 1989, particularly in relation to measures on unemployment.

First, measuring income y_t by real GDP (at constant 1995 prices), obtained from regional series of nominal GDP, adjusted for price effects using the national GDP deflator, in the absence of data for GDP deflator for each region (source: Romanian National Institute of Statistics).

On the other hand, we measured unemployment u_t by the percentage of unemployed people in the workforce (source: Romanian NIS), in agreement with the methodology of the International Labour Organization (ILO). Several factors must be taken into account with respect to unemployment statistics in Romania. First, recent studies (Albu et al., 2012) estimate the size of the informal sector at around 20% of Romania's GDP in the 2010s, and the people involved in the informal sector to around 3 million people, about a sixth of the Romanian workforce. The importance of the informal sector, especially compared to developed countries, could lead to an overestimation of unemployment in the Romanian regions. Second, on the contrary, some Romanian specificities could lead to an underestimation of unemployment. In particular, if we still refer to the year 2010, according to Albu et al. (2012), the weight of the employed population working in agriculture is about 30%, well above other developed European countries (France, 3%) and emerging (Poland, 13%) countries. In addition, productivity in the Romanian agricultural sector is only 21% of the national average, well below other agricultural European countries (France, 70%). Although this population itself does not

[6] The only regions where the population is not between these limits are Central and South-Muntenia (around 3.5 million inhabitants each).

count in unemployment statistics, the degree in which it can be considered as employed is debatable (and especially given the often erratic nature of agricultural work). Finally, Romania has experienced a sharp decline in the total population of about 23 million (1989) to around 21 million inhabitants (2010), two thirds explained by strong international migration. Since this migration is to a large majority of unskilled workers, it could lead to an underestimation of the unemployment rate (assuming it is easier to find a job being skilled). However, the fact that this migration is not necessarily declared, makes it difficult for statistical measurement and generates an ambiguous effect on the size of the active population and the number of unemployed people and therefore on the unemployment rate.

If these elements may influence measurements of unemployment in Romania, it is clear that there exists some compensation between their effects.[7] Furthermore, compared to most emerging and developing countries, unemployment measures in Romania are probably more reliable, protected with respect to ideological bias (such as, for example, in China) or institutional (since the 1990s, the integration process of Romania to the EU has made the Romanian NIS more independent and closer to the standards of the European Union).

2.4. Okun's Law in the Romanian regions

2.4.1. Stationarity tests

We focus in this section on the stationary cyclical components of unemployment and income. To do this, we focus initially on the HP method. Using (2a), we extract the trend components of income and unemployment, and then calculate the income and unemployment cycles as the gap - relative for income, absolute for unemployment – of the observed series to the estimated trend.

We capture the series properties by using econometric stationarity tests. We present in Table 1 the statistics of the stationarity test Kwiatkovski, Phillips, Schmidt and Shin (KPSS, 1992). According to the first column, the cyclical component of income is stationary, because all test values lead to the acceptance of the null hypothesis (at the three common significance thresholds). These results remain robust when performing the stationarity test by adding a time trend (see column two). Similarly, the last two columns, offering KPSS test statistics for the cyclical component of unemployment without (column three) and with (column four) time trend, lead to the acceptance of the null hypothesis of stationarity. In total, it is concluded that

[7] For example, in their estimates of the NAIRU at national level, Albu et al. (2012) use the same unemployment data.

the cycles obtained by the extraction of a stochastic trend using the HP method are stationary,[8] and can be used to estimate Okun's Law.

Table 1. Stationarity tests by region for the cyclical components of income and unemployment

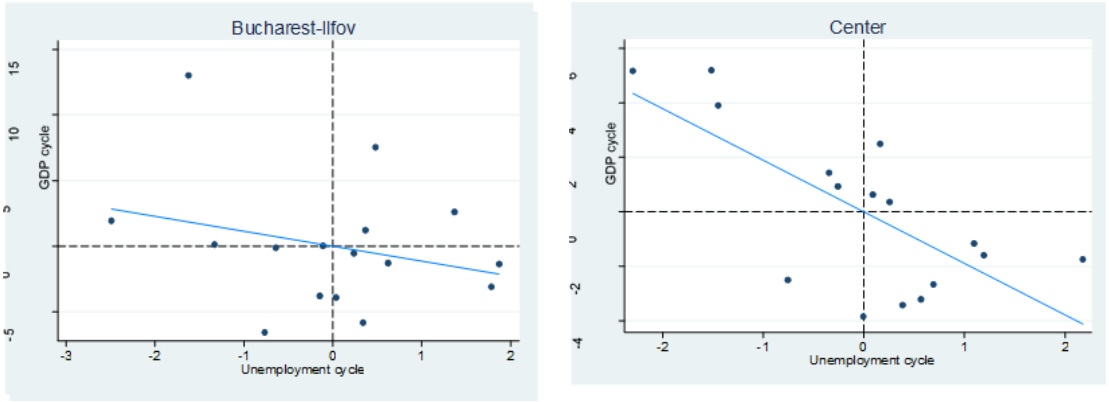
KPSS test	*Income cycle (HP filter)*		*Unemployment cycle (HP filter)*	
Region	constant	time trend	constant	Time trend
Bucharest-Ilfov	0.0663	0.0578	0.0735	0.0609
Center	0.0773	0.0674	0.0725	0.0614
North-East	0.0798	0.0730	0.0758	0.0652
North-West	0.0883	0.0788	0.0793	0.0718
South-East	0.0755	0.0756	0.0782	0.0654
South-Muntenia	0.0912	0.0900	0.0640	0.0662
South-West	0.0788	0.0732	0.0796	0.0679
West	0.0772	0.0762	0.0720	0.0657

Note: The KPSS stationarity test statistics are calculated with a constant and with a constant and a time trend. The critical values of the KPSS test with a constant are: 0.347 (10%), 0.463 (5%) and 0.739 (1%), and with a constant and a time trend 0.119 (10%), 0.146 (5%) and 0.216 (1%). The optimum lag has been selected using the Schwert criterion (1989).

2.4.2. A graphic illustration

Before presenting the results of the econometric estimates, Figure 1 provides a graphical representation of the relationship between the cyclical components of income and unemployment, calculated with HP method.

Figure 1. Unemployment and GDP cycles in Romanian regions



[8] The series stationarity is also supported by panel stationarity tests or panel unit root test (results available on request).

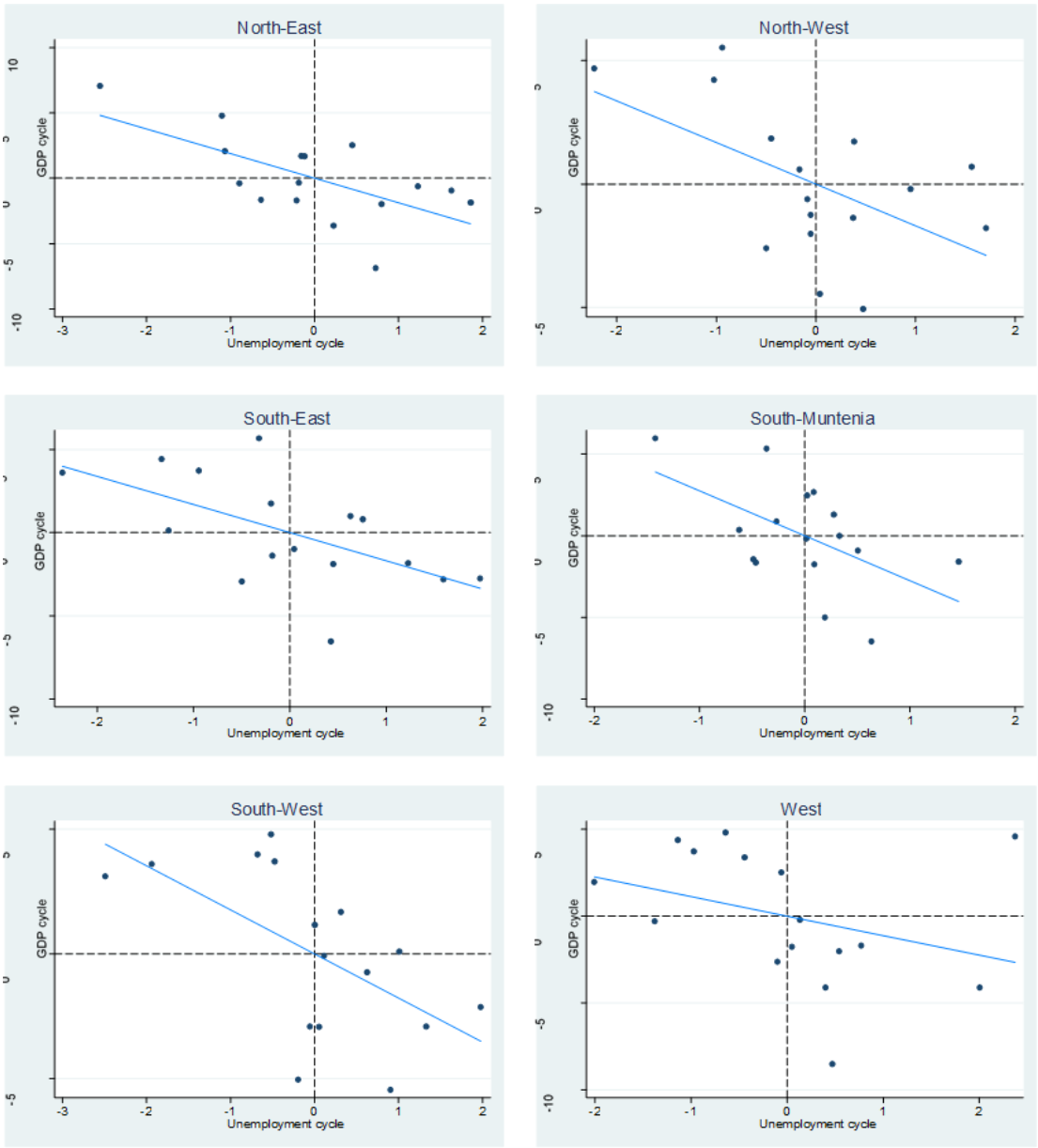


Figure 1 reveals several interesting results. First, comparing the figures on the y and the x-axis shows that the amplitude of the income cycle is significantly larger than the cycle of unemployment, regardless of the region. Romania is an emerging country on a catch-up path (possibly towards the developed countries of the European Union), the presence of high growth rates could explain the importance of income cycles. Then, on average, the data seems to confirm that the Okun's Law is an equilibrium relationship, since the adjustment line passes very close to the origin in all regions. Finally, in agreement with Okun's Law, the relationship between unemployment and GDP cycles is decreasing, although the slope of this relationship seems less pronounced for Bucharest-Ilfov and West regions. Starting from this simple

observations, which insinuates regional heterogeneities of the Okun's Law, we propose in the following an econometric analysis.

2.4.3. The results of the econometric estimates

We expose in Table 2 the Okun Law estimates in the eight Romanian regions. Prior to focus on the main results, note that the change in the unemployment explains between a quarter and half the change in income as shown by the R2 adjusted for regions where the Okun coefficient is significant. In addition, to take account of the possible presence of heteroscedasticity and serial autocorrelation, the standard deviations are estimated by the method Newey-West.[9]

Table 2. The Okun's Law in the Romanian regions

	Estimation method			
Region	Hodrick-Prescott (HP)	R2 adjusted	First Difference (FD)	R2 adjusted
Bucharest-Ilfov	-1.14 (1.19)	.0101	-1.66 (1.18)	.0912
Center	-1.89[a] (.347)	.4603	-1.77[a] (.397)	.3624
North-East	-1.88[a] (.218)	.3732	-2.01[a] (.317)	.3505
North-West	-1.70[a] (.510)	.2352	-1.77[a] (.410)	.2284
South-East	-1.69[a] (.172)	.3051	-1.71[a] (.321)	.2514
South-Muntenia	-2.75[a] (.657)	.2413	-2.65[a] (.599)	.1261
South-West	-1.77[a] (.208)	.3133	-1.63[a] (.311)	.2313
West	-1.12 (.871)	.0483	-1.16 (.915)	.0397

Note: [a] shows significance at the 5% level. The standard deviations estimated by the Newey-West method for correcting for heteroscedasticity and serial autocorrelation are shown in parentheses.

[9] In particular, the standard deviations are estimated for a delay equal to three, but we can confirm that the use of one or two delays generates only minor variations in their values (results available on request).

The results shown in the first column (HP filter), show an inverse relationship between the cycles of income and unemployment, reconcilable with Okun's Law in all Romanian regions (all coefficients are negative). These results were confirmed by an analysis of entire Romania for example, the Okun coefficient is equal to -1.64 when one considers all the regions. These results support the presence of a negative relationship between the cyclical components of income and unemployment in Romania.

However, a closer analysis reveals significant regional heterogeneities. If we focus on the first column, we first observe that the Okun's Law is statistically significant (at the 5% level) only in six of the eight Romanian regions. Next, among the regions where the relationship between income and unemployment is significant, there are significant differences in amplitude. For example, the Okun coefficient is 1.69 (in absolute value) in South-East, while it is equal to 2.75 (in absolute value) in the South-Muntenia region. Finally, it should be noted the importance of the Okun coefficient in Romania - an emerging country - compared to developed countries.[10] On the one hand, at national level, the Okun coefficient in Romania is 1.64 (in absolute value), i.e. well above its recent estimated value in Spain (0.96 in absolute value, see Villaverde and Maza, 2009) or in France (0.21 in absolute value, see Binet and Facchini, 2013). On the other hand, from a regional perspective, the Okun coefficient in Romania is at least equal to 1.69 (in absolute value, for example in the South-East) and up to 2.75 in South Muntenia, then at most it is equal to 1.55 in Spain (Villaverde and Maza, 2009) and 1.95 in France (Binet and Facchini, 2013). These differences are still noticeable if one refers to the regional significant coefficients average (1.94 in absolute value), or if we also compare the results of previous studies with those of the third column of Table 2.

Indeed, given the sensitivity of the cyclical component of the method used (see, for example, Canova, 1998), we propose in third column of Table 2 estimates of Okun's Law concerning the cyclical components calculated by the model (2b), namely the First Difference (FD).[11] First, the results are again consistent with Okun's Law, since all coefficients are negative. Second, in terms of significance, the results are consistent between the two methods considered: with respect to the HP method, the number of regions where the Okun coefficient is significant is still in number of six. Finally, the Okun coefficients remain remarkably high in absolute values when using the FD method (column 3), namely between 1.63 (South-West) and

[10] The particular strength of Okun's Law in emerging countries is also defended by Ďurech et al. (2014) for the Czech Republic and Slovakia.

[11] Prior to the econometric analysis, we explored the stationarity of income and unemployment cycles obtained with the FD method. Like the HP method, tests confirm the stationarity of the series (results available on request).

2.65 (South- Muntenia) illustrating yet again the enormous magnitude of the Okun Law in this emerging country.[12]

2.4.4. Regional heterogeneities and underlying factors

Consistent with the results shown in Table 2, we can identify two groups of regions. On the one hand, the areas in which there is a significant relationship between the cyclical components of income and unemployment, regardless of the econometric method used. Such is the case for most Romanian regions, namely Centre, North-East, North-West, South-East, South-Muntenia and South-West. On the other hand, the regions in which the relationship between the two variables has a very weak significance. This is particularly the case in Bucharest-Ilfov and West regions .Thereafter, we will try to identify factors explaining these heterogeneities in the relationship between the income cycle and unemployment cycle in Romanian regions.

First of all, let's focus on income. To do this, the Romanian regions are arranged in ascending order according to the average of real income for the studied period. We notice that the areas where Okun's Law is not significant are those with the highest income, namely West and Bucharest-Ilfov. Then we realize the same exercise, but this time with real growth rate over the period. Once more, both regions present the highest average real growth rate, i.e. 4.1% in West and 6.8% in Bucharest-Ilfov (respectively +1.5 and +4.2 percentage points above the median of the regions), and are also the ones for which the Okun coefficient is not significant. Therefore, we can say that the Okun coefficient does not appear to be significant in the richest Romanian regions (i.e. with the higher levels and average growth rate of income).

Next, we turn our attention to the unemployment. By analyzing the average unemployment rate over the period, no clear relationship can be observed, as regions Bucharest-Ilfov and West are ranked 4th and 6th respectively (in descending order). However, this means that Okun's Law works both when unemployment is low (the North-Western and South-Muntenia regions, with average unemployment rate of 6.21% and 3.61%) or high (the North-East and South-West regions, with average unemployment rate of 9.74% and 8.88%).

Finally, we look at several economic development variables. If both the average growth rate of foreign direct investment and the percentage of modernized roads (as a measure of public

[12] In an earlier version of this article, we followed the literature (see, for example, Freeman, 2000 or Villaverde and Maza, 2009) and have also used a third method to calculate income and unemployment cycles, assuming Quadratic trend (QT). The estimates confirm the high significance of the Okun's Law in the Romanian regions, and reveal Okun coefficients (significant at 5%) even higher in absolute value, i.e. between 2.47 (West) and 6.31 (South-Muntenia) and equal to 2.95 (and significant at 5%) for the entire Romania (the other results are available on request).

investment) reveal little information, if not a high concentration around Bucharest-Ilfov, the demographic variables provide several insights. Thus, Okun's Law is not significant in the regions of Bucharest-Ilfov and West, which are the least populated based on the average of the stable population, or only the 6th and 8th if we take into account the workforce over the period studied. In addition, these regions are also last regarding the fertility (average 1997-2010) and infant mortality (average over the whole period). Finally, the last two Romanian regions from the point of view of the share of the population at poverty risk are (average 2007-2010) West (15%) and Bucharest-Ilfov (around 5%), far behind most regions exposed, namely South-West and North-East (beyond 30% of the total population). Overall, these variables allow to better understand the crucial importance of economic development to explain regional heterogeneity in the relationship between economic growth and unemployment in the Romanian regions and will act as support for the discussion related to the economic policy implications.

2.5. Conclusion and policy implications

A growing literature is interested nowadays to the Okun's Law in a regional perspective. Unlike the work focusing on developed countries, we exploit in this paper recent data for analysis on an emerging country, namely Romania. In addition to being the second largest country in Central and Eastern Europe which has joined the European Union since 2004, Romania benefits of more reliable unemployment regional data that many developing or emerging countries, justifying such an analysis.

Our econometric evaluation covering the period 1995-2010 allowed us to highlight the following results. First, if a negative relationship between the cycle of income and the unemployment cycle exist, its significance depends on the considered region. Second, if we focus exclusively on Romanian regions where the Okun coefficient is significant, there are significant deviations in amplitude from one region to another. Third, these results prove robust to the use of other econometric methods for calculating the cyclical components of income and unemployment by using stochastic trend extraction. Finally, with respect to recent work on regional Okun's Law in developed countries, our study reveals remarkably high Okun coefficients (in absolute value), comparable to those found by Ďurech et al. (2014) in the Czech Republic and Slovakia. In some cases, these coefficients can approach the value estimated by Okun (1962) of around 3 (in absolute value). One possible explanation is the emerging nature of the Romanian economy, standing on a convergence path (probably towards the rich countries of the European Union) characterized by high growth rates.

This particular strength of the Okun coefficient emboldens us to research possible economic development variables to explain its significance. If the Okun coefficient is not significant in the regions with the highest average economic growth over the period, the average level of unemployment appears to have no clear influence on its significance. Moreover, we find no significant relationship between revenue cycle and cycle of unemployment in regions whose population, fertility and child mortality are lowest, and with a smaller share of the population at poverty risk.

Given these results, we can make several policy recommendations. First, Okun's Law is clearly not "universally winner", and it is essential for the Romanian public authorities to take into account regional differences in the composition of their policies in matters of growth and employment. On the one hand, in regions where the unemployment-income relation is not significant, the public authorities cannot make use of demand policies of Keynesian inspiration to reduce unemployment. Indeed, these regions have high growth rates, making ineffective policies which aim to stimulate the economic growth. Instead, measures aiming to make more flexible the regional labour market, as a better match for the unemployed to job offers or encouragement of population movements (eg, at least officially, the Western region is the last in terms of average arrival of new populations over the period) can prove to be more effective. On the other hand, in most Romanian regions the Okun's Law is significant. From a demand perspective, this means that the government could, potentially, reduce unemployment through macroeconomic policies of Keynesian inspiration. Our estimates reveal an interesting specificity in Romania, namely the significance of Okun's Law in both regions with low and high unemployment rate (average for the period).[13] In particular for regions in the latter group (ie North-East, South-West and South-East), which have the lowest average economic growth rate, the demand policies aiming to support the growth contribute , according to our results, with (statistically) significant unemployment decreases.[14]

Finally, the magnitude of the (significant) Okun coefficients in Romania, especially compared to developed countries, emphasizes the crucial importance of the Romanian labour market in terms of economic growth. In most Romanian regions, reforms to reduce unemployment could increase consequently the economic growth. According to our estimates,

[13] For comparison, Ďurech et al. (2014) found that Okun's Law is not significant in the Czech and Slovak regions characterized by high average unemployment rates.

[14] An explanation of the significance of the Okun's Law in high unemployment areas is related to the massive process of emigration of the population of these poor regions (particularly the North-East and South-West) to, especially, Spain and Italy. The remaining population often has a higher relative level of qualification, making it responsive to any request policies.

the impact would be, regardless of the econometric method used, greater than in developed countries. Even more, in the current environment, where economic growth remains stagnant, to look more closely to the labour market to reduce unemployment could be a way to retrieve a virtuous economic growth.

II Fiscal multipliers. Lessons from developed countries

Chapter 3. An analysis of fiscal multipliers: what lessons for developing and emerging countries?

An analysis of fiscal multipliers: what lessons for developing and emerging countries?[1]

Abstract

In response to the recent financial crisis, many governments adopted fiscal stabilization policies, whose multiplier effects generated considerable interest in academia and among policy makers. After a brief review of the foundations of fiscal multipliers, the paper presents the methods used to measure multipliers and the results, which are sensitive to the position in the economic cycle, the state of public finances, monetary policy and characteristics of economies. Based on these analyses related to developed countries, we draw lessons for developing and emerging economies.

Keywords: fiscal multipliers, fiscal policy, developing and emerging countries.

JEL Codes: E62, E63

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3.1. Introduction

A crucial moment in the analysis of the effects of fiscal policy was the publication of the article of Robert Barro (1974), formalizing the "Ricardian Equivalence" according to which, by adjusting their behaviour to changes in fiscal policy, by increasing their savings and anticipating that an increased public spending will lead to a future increase in their taxes, agents make its effect neutral. However, the recent crisis appears to have rediscovered the virtues of fiscal policy since many economies have launched massive fiscal stimuli, in the context of significant liquidity constraints that render inoperative the functioning of Ricardian equivalence. For example, the French Government adopted in 2009 the "Grand emprunt", a recovery plan of 35 billion Euros to finance public investment and, therefore, in addition to its stabilizing impact to increase the growth potential trail. The European Economic Recovery Plan (2008) implied a fiscal effort estimated at about 2% of European Union GDP cumulatively for the period 2009-2010, while The American Recovery and Reinvestment Act (2009) foresaw an increase in public spending of about 5% of US GDP for the period 2009-2011 (Cimadomo and Bénassy-Quéré, 2012).

These policies placed on the central stage the issue of fiscal multipliers,[2] especially as Blanchard and Leigh (2013) have recently shown that the IMF has consistently underestimated the importance of the multipliers derived from current fiscal austerity programs. Whereas the European Commission based its forecasts on the multiplier of 0.5, they are, in fact, greater than 1. The literature today does not seek so much to defend the theory of unconditional effectiveness of a Keynesian relaunch. Many economists are even willing to admit that average multipliers could be modest. In exchange, they would become important in particular times, as for example, the under-utilization of production factors.

Cornerstone of Keynesian paradigm, fiscal multipliers determine the impact of an exogenous change in a fiscal variable, such as changes in public expenditure (ΔG) on changes in income (ΔY). Multipliers associated with other fiscal instruments can also be considered (Coenen et al., 2012).[3] A feature is of major importance when it comes to defining them: the

[2] An interesting similarity may be drawn between the emergence of Keynesian doctrine in the twilight of the Great Depression, and its re-emerge in popularity after the Great Recession that began in 2008, as if the crisis (major) made economists and policy makers more Keynesian or, more likely, as if the major crises increased the value of the multiplier.

[3] According to Hegeland (1954) the origin of the multiplier theory comes from the Economic Table of Quesnay (1758), in which the variables are reported in both the current period t and in the next period $t+1$, which estimates a multiplier. More recently, Snowdon and Vane (2005) suggest that the multiplier concept was developed in the 1930s jointly by Kahn, Keynes and Giblin, and mentioned in a work published by Kahn (1931). But it was the analysis of Keynes (1936) that awarded the multiplier the central role it (still) plays in macroeconomics.

time horizon considered. Spilimbergo, Symansky and Schindler (2009) and Gechert and Will (2012) distinguish: (i) the impact multiplier, defined as the immediate response of income to the fiscal impulse $k_t = \frac{\Delta Y_t}{\Delta G_t}$, (ii) the multiplier at the horizon T, namely $k_T = \frac{\Delta Y_{t+T}}{\Delta G_t}$, (iii) the peak multiplier, equal to the largest value of the multiplier over a given period $k_M = \max_T \frac{\Delta Y_{t+T}}{\Delta G_t}$, and (iv) the cumulative multiplier, measured as the response of the cumulative changes in the income over the cumulative changes in public spending over a given period $k_t = \frac{\sum_{j=0}^{T} \Delta Y_{t+j}}{\sum_{j=0}^{T} \Delta G_{t+j}}$.

The theoretical literature that aims at highlighting fiscal multipliers is rich and significantly evolved through time. Initially, fiscal multipliers were demand-side driven, in the spirit of the static ISLM model (see Hicks, 1937), and of its dynamic version (see Blanchard, 1981). As a general characteristic, these setups are able to produce positive fiscal multipliers higher than one, a property conserved by aggregated supply-aggregated demand models in the short-run, while, as it is largely known, the long-run equilibrium displays. The conclusions of these models differ greatly from those of neoclassical and real business cycle models leading in general to conclude that fiscal policy is harmful or, at best, neutral. However, in these models, a positive shock to government spending can have positive effects on the economy through, in particular, the labour supply. An agent facing a permanent increase in public spending sees the present value of its tax increase, which may lead it to reduce its demand for leisure and thus to work more (Baxter and King, 1993). If, in contrast the increase in spending is temporary, the wealth effect is attenuated.[4]

Developed as a response to several shortcomings of the RBC models (and in particular flexible prices), New Keynesian DSGE models consider sticky prices, in addition to more developed micro-foundations (see An and Schorfheide, 2007, for a recent survey). When the Ricardian Equivalence is conserved, multipliers, while positive, are less than 1 and depend on factors such as the reaction function of the monetary authorities and, specifically, the reaction of the real interest rate (Gechert and Will, 2012). When some mechanisms are taken into

[4] Taking into account the nature of the taxes complicates the mechanism if additional public spending is financed by distortionary taxes, incentives to work decreases. However, if taxes are raised late, an intertemporal substitution effect can lead to the opposite result and increase at least temporarily labor supply (Burnside et al., 2004).

account, such as the existence of distortionary taxes or risk premiums on interest rates in contexts of high public debt, these models can generate negative values for multipliers, and therefore expansive effects (anti-Keynesian) of budgetary contractions (Briotti, 2005). However, in the event of non-Ricardian agents (Cwik and Wieland, 2011; Gali et al., 2007) or for sufficiently low nominal interest rates (close to 0), the DSGE model can also generate positive multipliers (Woodford, 2011; Freedman et al., 2010). In addition, although the ISLM and DSGE models are generally considered incompatible because they are producing divergent multipliers (greater than 1 in the first case and less than 1 in the second case), Bénassy (2007) shows the possible existence[5] of higher than unity multiplier in a DSGE framework of a non Ricardian economy with sticky prices.

When it comes to ranking multipliers, DSGE models conclude that spending multipliers are higher than the tax multiplier. For the former, the descending order according to the magnitude of the effect is: the public investment multiplier, public consumption, transfers to households with liquidity constraints. Regarding the latter, the worst effect on GDP would come from an increase in income tax and corporate income tax, followed by consumption taxes and property taxes.

The rest of the article will focus on the econometric literature. Part 1 develops the different methods used to estimate fiscal multipliers, part 2 presents recent estimates of multipliers. The conclusion deduces lessons for developing and emerging countries.

3.2. Empirical methods used to measure fiscal multipliers

The key mechanism underlying the fiscal multipliers in the Keynesian theory is based on the value of the marginal propensity to consume. Therefore, the first evaluations of multipliers attempted to estimate econometrically the consumer behaviour in response to fiscal shocks. Such models explore the response of consumption to changes in income, and therefore provide a direct, but only partial equilibrium effect of fiscal multipliers. The subsequent literature provided several major empirical techniques used to estimate fiscal multipliers, namely (i) large scale macroeconometric models, (ii) the narrative approach, (iii) Vector AutoRegressive models, and (iv) other, more recent, econometric methods.

[5] According to Linnemann (2006), assumptions on household's utility function (complementarity between consumption and labor supply, or between the public and private consumption) or the inclusion of productive public spending could also lead to multipliers above 1.

3.2.1 Large scale macroeconometric models (MACRO)

An impressive effort to estimate fiscal multipliers is related to the development of general equilibrium structural (large scale) macroeconometric models (MACRO). As emphasized by Gechert and Will (2012), MACRO models are based on the methodology of the Cowles Commission. They consist in estimating macroeconomic consumption and investment functions in a setup that combines Keynesian reactions in the short run with Neoclassical features in the long run. These models were intensively used in the 1960s and 1970s in a logic of economic analysis and policy forecasting (see Modigliani, 1971, or Klein and Young, 1980). But they have suffered a loss of interest in the academic world (Chinn, 2013), mainly due to the Lucas critique (1976), namely the criticism of the assumption of non –invariance of parameters estimated to regime changes in economic policy and the criticism of Sims (1980) on identification restrictions that are few theoretically based. However, these models continue to be used, among other things by the FED (Federal Reserve System) in the United States (Stein and Song 2002; Fair, 1993).

3.2.2 Vector AutoRegressive models (VAR)

To back-up his critique on the incapacity of MACRO models to identify exogenous shocks, Sims (1980) introduced a new methodology, namely Vector AutoRegression (VAR) models. These are statistical models that capture the linear interdependencies among multiple time series measuring impulse-responses of fiscal shocks. The Structural VAR (SVAR) models draw upon economic-based information to achieve the identification of shocks (it can be assumed that public spending is a predetermined variable and that state revenues do not react immediately to changes in the economic environment: Blanchard and Perotti, 2002). As emphasized by Stock and Watson (2001), the most popular form of SVAR is the recursive form: based on the Choleski decomposition, it imposes restrictions for obtaining a causal order of the VAR variable (it assumes that the fiscal shock does not immediately impact some variables). One can thus neutralize the common reactions of fiscal variables in the economic cycle (Fatas and Mihov, 2001). To respond to criticism of the *ad hoc* nature of the order of the recursive representation, more developed forms of SVAR models impose elasticity values for the automatic stabilizers. Some SVAR also identify exogenous fiscal shocks by imposing sign restrictions to the impulse-response functions generated by fiscal shocks (Mountford and Uhlig, 2009). For their part, Blanchard and Perotti (2002) estimate a SVAR model increased with an event analysis in which the identification is made using institutional information on the tax and transfer system. Edelberg et al. (1999) and Eichenbaum and Fisher (2004) draw upon the work

of Ramey and Shapiro (1998) using political events to identify fiscal shocks, like the exogenous increases in military spending.

Much work has been devoted to expand the SVAR models in different directions, both from an economic and methodological standpoint. In the first direction, we are interested in modelling the joint behaviour of fiscal and monetary authorities (Favero, 2002), accounting for anticipations of the fiscal shock (Tenhofen and Wolff, 2007) or the influence of external factors such as global economic conditions and oil prices (Cimadomo and Bénassy-Quéré, 2012). In the second direction, the most recent studies estimate VAR models in panel data (Born et al., 2013). The panel size does not only increase the number of observations, while controlling for individual heterogeneity, but it also takes into account the impact of the transmission mechanisms between countries that are becoming increasingly important with the economies globalization (Canova and Ciccarelli, 2013). Finally, it should be noted the development of nonlinear modelling mechanisms. Models with threshold effect (Threshold VAR: TVAR) allow regime changes depending on the state of the economy (Baum et al., 2012; Mittnik and Semmler, 2012).

3.2.3 The narrative approach

Proposed by Friedman and Schwartz (1963) and used initially to study the effects of monetary shocks (Romer and Romer, 1989), the narrative approach was extended to the analysis of fiscal shocks. This method consists in identifying "good experiences", namely true episodes of exogenous fiscal expansions. Although few in number, contributions use war episodes as source of identification exogenous increase in public expenditure (Ramey and Shapiro, 1998) or the analysis of political discourse as a means to identify exogenous changes in taxation (Romer and Romer, 2010).

The choice of methods could heavily impact the multipliers obtained. Ramey (2011) seeks to explain why the VAR methods (which are usually based on an assumption of predetermination of public spending within a quarter) and the narrative approach often lead to conflicting results. One explanation is that the narrative method better captures when the unanticipated changes in public spending would occur. In other words, the shocks identified by VAR models would be caused in Granger sense by Ramey and Shapiro dates. The unanticipated

component of fiscal policy would therefore not be correctly entered, only in the case of narrative methods.[6]

3.2.4 The estimation of a fiscal policy rule

The fiscal shock is calculated as the difference in a fiscal rule. Specifically, drawing upon Fatas and Mihov (2003), and Afonso et al. (2010), Agnello et al. (2013) which use a residual two-step method for calculating the fiscal multipliers. This includes, firstly, the estimation of a function of fiscal policy rule (with explanatory variables, the past change in public expenditure, the change in economic activity, inflation, public debt and a trend). The discretionary part of fiscal policy is then assimilated to the residue. Secondly, the multiplier is calculated in a dynamic panel model involving the estimated residuals. This method is based on the assumption of a correct specification of the fiscal policy rule function.

3.3. Evidence of fiscal multipliers values

The literature that estimates the fiscal multipliers has gained a remarkably renewed interest, particularly because of the need to evaluate the effects of fiscal stabilization programs following the economic crisis. The studies differ depending on the econometric model, the nature of the fiscal shock, the period or country. The results are presented in two sections. In the first section, we are interested in multipliers values when taking into account the nonlinearity effects. In the second section, we present the values of the multiplier according to the country's level of development.

3.3.1 Nonlinearities in the multipliers effects

It is well known that the opening level of economies by increasing the marginal propensity to import reduces the multiplier. According to Ilzetzki et al. (2013), in relatively closed economies, long-term multipliers are close to 1, while negative in more open country. But the recent literature is exploring other nonlinearities depending upon the position of the economy in the business cycle, the initial fiscal and monetary policy context and the exchange rate regime.

[6] This is an important question, for example, when studying the response of private consumption to a fiscal shock. The narrative approach generally tends to reject the Keynesian model (identifying a drop in private consumption following a positive fiscal shock), unlike the VAR methods (see also Tenhofen and Wolff, 2007).

3.3.1.1 The value of the multiplier according to the position in the economic cycle

In the case of the United States, and over the period 1930-2008, Hall (2009) does not obtain different multipliers for expansion and recession periods. On the contrary, since the Second World War, Auerbach and Gorodnichenko (2012a) show that in the period of expansion the spending multiplier is 0 after a year and - 0.1 after two years, while in recession, the same multiplier is 1.4 after one year and 1.8 after two years. Focusing on public spending financed by deficits, Candelon and Lieb (2013) confirm these results by getting higher multipliers in a recession (between 1 and 2.4) than in a boom period (around 0.5). They defend, also, policies which aim to increase public spending rather than those of lower taxes. Such asymmetries between low multipliers in "good" times and high multipliers in "bad" times (Perotti, 1999) are also highlighted in Germany by Baum and Koester (2011), and Auerbach and Gorodnichenko (2012b) for the OECD countries (the spending multiplier is equal to -0.3 after one or two years in expansion, and 0.5 and 0.4 after one year after two years in recession). This result may be the consequence of stronger liquidity constraints in a recession. However, the literature is not consensual on this question. Using historical data for the United States (1890-2010), Owyang et al. (2013) did not observe asymmetries, unlike to what they found on Canadian data (1921-2011). Similarly, Crafts and Mills (2012) find moderate multiplier between 0.5 and 0.8 on British historical data corresponding to an overall economically difficult period (1922-1938).

These potential asymmetries therefore highlight the need for appropriate econometric techniques (see above). Baum et al (2012) estimates, with a TVAR model fiscal multipliers for United States, United Kingdom, France, Germany, Canada and Japan and finds that the spending and taxes multipliers are higher in recession. Spending multipliers are much higher than tax multipliers. Using the same technique, Batini et al (2012) study the impact of budget adjustments in the United States, in the Euro-zone, Italy, France and Japan, in periods of recession and expansion. They calculate the cumulative multipliers for spending increase and tax cuts and conclude that if the fiscal consolidation began during a recession, the multipliers were greater than 1 for spending shocks and less than 1 (positive except for France) for the tax shock. Turning to the fiscal consolidation starting in expansion stage, the main difference lies in the tax multiplier which may be negative.[7] Thus, despite the use of different variables to

[7] For example, for the United States and the euro area, the multiplier during periods of expansion is equal to 0.3 (0.4) after one year and -0.5 (0.1) after two years for the US (euro area). In periods of recession, spending multipliers worth 2.2 (2.6) after one year and 2.2 (2.5) after two years for the US (euro area).

identify the phases of the cycle, i.e. the output *gap* and real GDP growth rate, respectively the results of these two studies are comparable.[8]

3.3.1.2 Fiscal multipliers and fiscal position

Feldstein (1982), Giavazzi and Pagano (1990), Blanchard (1990), Perotti (1999) and more recently Minea and Villieu (2012) showed nonlinearities in the response of the economy to a fiscal shock. In the case of Economic and Monetary Union of West Africa (UEMOA) economies, and over the period 1986-2002, Ary Tanimoune, Combes and Plane (2008) have shown non-Keynesian effects of fiscal changes on private consumption and investment, particularly in connection with reversals in expectations in highly leveraged economies. Similarly, Minea and Villieu (2009) show anti-keynesian effects of an increase in public deficits on public investment in a context of high public debt. In the extension of this work, two recent studies explore the possible dependence of fiscal multipliers in the public debt ratio. In a sample of developed countries, Corsetti et al. (2012) show that fiscal multipliers are lower when public debt is high, i.e. over a debt ratio of 100% of GDP. A similar result is reported by Ilzetzki et al. (2013), but for a lower threshold of debt, close to 60%. Above this threshold, not only short-term multipliers are not significant, but the long term multipliers become negative. One possible explanation is the negative signal for agents of a fiscal stimulus in an already deteriorated public finances situation.

3.3.1.3 Fiscal multipliers and the monetary policy

Within the traditional ISLM model, the effects of fiscal policy strongly depend on the monetary policy. Thus, there exists a particularly interesting case, baptized "liquidity trap" by Keynes (1936), in which, from a theoretical point, fiscal shocks might be associated with remarkably high multiplier effects. Such effects are supported by the recent work of Chirstiano et al. (2011), based on a more sophisticated medium-size DSGE model, emphasizing a government spending multiplier much larger than one when there is a (future period) zero lower bound on the nominal interest rate.[9]

Two studies, however, appear contradictory. Using an empirical New Keynesian model for the US, Cogan et al. (2009) find smaller multiplier effects of government purchases during

[8] Such threshold effects also appear in Corsetti et al. (2012) who finds, in developed countries, that the fiscal multiplier is higher during periods of financial crises.

[9] Intuitively, when interest rates are close to zero, i.e. a liquidity trap, the risk of deflation increases and agents seek a greater security, and by doing so they increase the effectiveness of fiscal policy.

a zero lower bound. On the contrary, using a comparable setup, Eggertsson (2009) finds important multipliers at the zero bound. The main explanation is that, while both considered that the increase in government purchases started when the interest rate was zero, only in the former case this positive fiscal shock is equally extended over the period that was projected to have zero lower bound. The ongoing research seems to comfort the role of the liquidity trap: Hall (2009) exhorted a fairly high fiscal multiplier (around 1.7) for zero lower bound nominal interest rates, and Woodford (2011) showed that the increase in the response of output significantly falls if the increase in government purchases is expected to occur after the zero lower bound.

3.3.1.4 Fiscal multipliers and the exchange rate regime

In the Mundell-Fleming model, it is well known that the crowding out effect of fiscal policy is complete in floating exchange rate regime with capital mobility. A recent literature focuses on the actual multiplier values in a flexible exchange rate regime, sometimes with opposite conclusions to the predictions of the model: analyzing individual countries, Perotti (2006), Monacelli and Perotti (2010), Ramey (2011) and Ravn et al. (2012) emphasize positive fiscal multipliers. But more recently, using different methods, different time periods and for different levels of development, Corsetti et al. (2012), Born et al. (2013) and Ilzetzki et al. (2013) conclude that the fiscal multiplier is higher in a fixed exchange rate regime than in a flexible exchange rate regime.[10]

3.3.2 Multipliers by level of development

3.3.2.1 The case of developed countries

A very large majority of studies focuses on the United States. Blanchard and Perotti (2002) found a multiplier close to 1 for public spending. However, further work differs on the magnitude of the fiscal multiplier: Mountford and Uhlig (2009) estimate an impact multiplier of 0.65 and a long-term multiplier less than 1, and that unlike Fatas and Mihov (2001) who get above 1 values in the short-term.

Work using the VAR on the US economy also explored the sensitivity of the fiscal multiplier relative to expectations and therefore questioned the need or not to announce budgetary measures. Mountford and Uhlig (2005) conclude that the response of private

[10] Other studies, such as Bilbiie et al. (2008), David and Leeper (2011) and Coenen et al. (2012) analyze the fiscal shock transmission mechanism under different exchange rate regimes.

consumption to an increase in public spending is positive when the announcement effects are taken into account. In contrast, Tenhofen and Wolff (2007) show, for their part, that the response of private consumption to a projected increase in expenditures (defences, most assumed exogenous) is negative.

It is important to note that the results for the United States are sensitive to the method used. For example, Mertens and Ravn (2013) include a narrative identification in a SVAR model to calculate the tax multipliers. Unlike Blanchard and Perotti (2002), but in agreement with Mountford and Uhlig (2009), and Romer and Romer (2010), they highlight remarkably high fiscal multipliers.

Turning to OECD countries, Perotti (2006, 2005) reveals high multipliers between 2.3 and 3.7. Higher than unit multiplier appears to also be at work in the European Union countries: using a panel VAR model, Beetsma et al. (2008) emphasize peak multipliers around 1.6. Using the INTERLINK model, a MACRO type model, of OECD, Dalsgaard et al. (2001) propose a comparative study of spending fiscal multipliers between the United States, Japan and the Euro-zone. They are interested in spending multipliers at different horizons and in two scenarios: in the presence of a specific shock to each country and when all countries are affected by the same shock. In the first case, the multipliers decrease between the first and fourth years, from 1.1 to 0.2 for the United States, from 1.2 to 0.2 for the Euro-zone, and from 1.7 to 0.2 for Japan. Thus, higher than unit multipliers on short-term appear to coexist with fairly low multipliers on the long-term. But taking into account a global shock increases (United States) or strongly increases (Euro-zone and Japan) the short-term multiplier (multipliers are respectively 1.5, 1.9 and 2 6). In contrast, the results are slightly different for the fourth year multipliers (respectively equal to 0.3, 0.4 and 0.3).

A study on a panel of 20 high-income countries by Ilzetzki et al. (2013) confirmed the existence of positive and persistent fiscal multipliers, in agreement with the findings of Ilzetzki and Vegh (2008). This study contradicts the International Monetary Fund (IMF) study (IMF, 2008), which also gets positive multiplier, but not persistent.

3.3.2.2 The case of developing and emerging countries

The assessment of fiscal multipliers is new for this group of countries. There is a very limited number of studies, which generally rely on panel data to estimate the multiplier for developing and emerging countries: Agnelo et al. (2013), Ilzetzki et al. (2013), Ghosh et al. (2009), Ilzetzki and Vegh (2008), IMF (2008).

The IMF (2008) presents fiscal multipliers for developing and emerging countries using two alternative methods to measures of fiscal impulse, namely based on elasticities estimation (they measure the fiscal impulse using the primary cyclically adjusted balance), and estimates based on regressions (they measure the fiscal impulse using changes in the primary balance over the previous year). The results are slightly different in the two methods. In the first, the tax multiplier is 0.2 after the first and second year, while the positive spending multiplier (0.2) after a year becomes negative (-0.2) after two years. The use of regressions to calculate the fiscal shock leads to comparable results for the tax multipliers (0.1 and -0.2 after the first and second year, respectively) and expenditure multipliers (0.1 and -0.2 after one and two years). Concerning the sign of the multiplier, Agnelo et al. (2013) show for low and middle-income countries that expansionary fiscal policy has an expansive effect in the short term, but recessive in the medium term. With respect to the l multipliers values, results comparable to those of the IMF (2008) are obtained by Ilzetzki and Vegh (2008) in a panel VAR model estimated over 27 developing countries: spending multipliers equal 0.4 after one year, 0.1 after two years and -0.1 after three years.

Based on panel data for 24 developing and emerging countries, Ilzetzki et al. (2013) highlight the non-significant character of impact and cumulative multipliers for an increase in public consumption. On the contrary, an increase in public investment generates positive multipliers. These results can be explained by the characteristics of these economies. Indeed, as pointed out by Ghosh et al. (2009), emerging countries have weak institutions, less developed financial markets, less credible policies and often unbalanced current accounts.

3.4. Conclusion and Discussion: lessons for developing and emerging countries

The economic crisis continues to affect the global economy. Its importance has led many countries to adopt fiscal stimulus measures. Especially in developed countries, the importance of the relaunch was unprecedented. It was followed by an increase in debt, which has also prompted countries to adopt fiscal austerity programs. In both situations the role of fiscal policy is yet again central.

But this literature review reveals an important fact, namely an opposition between the wealth of studies for developed countries and the rarity for developing and emerging countries. In addition, the fiscal multipliers are usually lower in these countries than those observed in

developed countries.[11] The explanation does not yet appear clearly. Another question is whether it is better in developing countries to announce changes in fiscal policies.

The studies analyzing the developed countries highlight the central role played by nonlinearities, the position in the economic cycle in the multipliers assessment. According to IMF (2012), in the last twenty years, emerging and developing countries have spent more time in expansion and experienced less severe recessions than the advanced countries. Therefore, one might expect quite different values of fiscal multipliers. In addition, the developing and emerging countries have experienced significant increases in their external debt to GDP ratios, due to external shocks requiring specific analysis of fiscal multipliers. Finally, with respect to developed countries, the design and conduct of monetary policy in developing and emerging countries is significantly different. *First*, these countries have more heterogeneous forms of exchange rate regimes, ranging corner solutions, such as dollarization, the free float (see Ilzetzki and al , 2010, for a detailed classification of exchange rate regimes). *Secondly*, their monetary systems are in a constant evolution, for example, Central and Eastern Europe countries (CEEC) have recently been involved in major changes in their monetary systems, particularly in relation to the recent (for some countries) or future (for other countries) integration in the Euro-zone. *Thirdly*, their low institutional quality makes harder monetary policies, as less credible. Overall, all these arguments suggest the need for a specific analysis of the multiplier mechanisms in developing and emerging countries. This should take into account the importance of supply constraints making less operative the budgetary mechanisms transiting by the demand.

[11] With the exception of government investment multipliers: Ilzetzki et al. (2013).

Chapter 4. The Euro and the Crisis: Evidence on Recent Fiscal Multipliers

The Euro and the Crisis: Evidence on Recent Fiscal Multipliers[1]

Abstract

In response to the current economic crisis, many countries around the world adopted large fiscal stimuli, thus reviving the question of fiscal multipliers. This paper is a first attempt for a systematic analysis of the behaviour of fiscal multipliers in the Eurozone countries. Using Panel Vector AutoRegressive (PVAR) estimations for quarterly data on fiscal variables for the 1999-2012 period, we unveil several interesting results. First, tax multipliers are little affected by being a Eurozone country or not, or by experiencing the Eurozone crisis. Second, on the contrary, spending multipliers exhibit major differences depending on the considered group of countries; in particular, being part of the Eurozone or expecting to adopt the Euro in the future makes the response of output to expenditure shocks more Keynesian, as this is also the case in the group of Eurozone countries affected by the crisis.

JEL Codes: E62, E63, F62, O52

Keywords: Eurozone, fiscal multipliers, economic crisis.

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4.1. Introduction

Only several years after Euro banknotes and coins were put into circulation, the Eurozone was struck by the global financial and economic crisis. Originated from the US, the crisis progressively gained in intensity when reaching the Eurozone, nourished by a wide variety of factors such as major fiscal worsening caused by extreme increases in public spending (for example, wages and pensions, as in Greece or Portugal), property bubbles weakening the financial sector (Spain), loss of confidence due to false public statements on the condition of fiscal accounts (Greece) generating sky-jumping spreads and snow-ball effects on debt dynamics, etc. In a context of financial contagion, these imbalances coagulated into a *Eurozone crisis*, of such a magnitude to the point of being a major threatening for the perenity of the Eurozone itself.[2] At a global level, the economic importance of the Eurozone and the negative spillovers to integrated markets arising from its potential disappearance urged major institutions, including the IMF, the World Bank, the EIB or the EBRD, to join effort with EU- (such as the European Financial Stability Mechanism) or Eurozone-based (such as the European Financial Stability Facility) mechanisms in providing massive bailout for many Eurozone countries.[3] At a national level, the crisis was associated to changes in the political colour of governments in many Eurozone countries (for example, Greece, Italy, Portugal or Spain). But more importantly, many governments adopted national-level massive fiscal stimuli,[4] in addition to European-level fiscal stimuli, such as the European Economic Recovery Plan, estimated to around 2% of the EU GDP cumulated for the 2009-2010 period. However, since 2011, given the deterioration of their public finances, many European countries adopted large fiscal consolidation plans.

The underlying theoretical mechanism supporting such large fiscal efforts rests on the concept of Keynesian multiplier. According to the Keynesian fiscal multiplier, a one-unit change in a fiscal variable, such as an increase in public spending or in taxes, changes the output by more than one unit. Consequently, demand-based fiscal policies would be a virtuous tool to mitigate the negative effects engendered by the current crisis. If the emergence of Keynesian-

[2] Recent years newspaper headlines include: "Euro strikes back with biggest gamble in its 11-year history" (May 2010, in The Guardian), "Merkozy failed to save the eurozone" (December 2011, in Financial Times), or "the euro zone is in critical danger" (July 2012, by the IMF).

[3] For example, the bailout programme for Greece is designed to over 200 billion euros, around 70 billion for Portugal, and 40 billion for Spain.

[4] According to the International Institute for Labour Studies (2011), the size of the fiscal stimulus since the beginning of the crisis is above 4% of GDP in Italy or Germany, and around 1.75% of GDP in France. Particularly in France, the stimulus included the famous "Grand Emprunt", a 35 billion euros public spending devoted to financing public investment and supporting economic growth.

multiplier based economics was boosted by the devastating effects of the Great Depression (1929-1933), the current economic crisis, often called the Great Recession, brought them again into the spotlight. Indeed, a very recent and buoyant empirical literature aims at estimating the potential effects of the substantial fiscal stimuli implemented since the beginning of the crisis, as illustrated by the survey of Hebous (2011) and the meta-analysis of Gechert (2013). In particular, inspired by the work of Giavazzi & Pagano (1990) or Alesina & Perotti (1995), a recent literature discussed potential anti-Keynesian effects of fiscal policy, however without reaching a clear-cut conclusion (see, for instance, Guajardo et al., 2011). Among the different elements making the effect of fiscal policy complex, liquidity traps and high debt-to-GDP ratios play a key role. On the one hand, for instance, Denes et al. (2013) advise against fiscal consolidations in a context of liquidity trap, as the negative effects of such fiscal policies are not compensated by a decrease in interest rates. On the other hand, in a context of high indebtedness, Blanchard & Cottarelli (2010) or Corsetti et al. (2012) emphasize a credibility effect of fiscal consolidations, leading to a decrease in risk premia and thus potential positive effects on the economy. Consequently, fiscal policy recommendations could be remarkably opposite.

The current study develops the existing literature in several directions. First, if most papers gave interest to the US,[5] we focus on the Eurozone, particularly in comparison with the European Union. To the best of our knowledge, only a relatively small number of papers deal with fiscal multipliers in the Eurozone/EU area. For example, Dalsgaard et al (2001) estimate public spending multipliers above 1 after one year and below 0.7 after three years. However, the use of the MACRO-type INTERLINK model of the OECD is subject to both the Lucas' (1976) Critique and to the problems related to the identification of the shocks emphasized by Sims (1980). To deal with these shortcomings, we follow the recent literature and provide VAR-based estimations.

Second, previous VAR-based studies involving European countries can be criticized on two grounds: on the one hand, for adopting a too general perspective, by mixing both European and non-European countries. For example, Auerbach & Gorodnichenko (2013) emphasize public spending multipliers equal to 0.5 (-0.3) in recession (expansion) periods for the set of OECD countries, while Ilzetziki et al. (2013) find impact (cumulative) public spending multipliers of 0.4 (0.7) for high income countries. On the other hand, several studies adopted a

[5] See, for example, the seminal contribution of Blanchard & Perotti (2002), and also Fatas & Mihov (2001), Mountford & Uhlig (2005), Tenhofen & Wolff (2007), Romer & Romer (2010) or Mertens & Ravn (2013).

too narrow perspective, by providing country-individual estimates. For example, for the 1980-2001 period, Perotti (2005) finds spending multipliers between 0.5 (one year) and -1.1 (three years) for Germany, while between -0.3 (one year) and -0.9 (three years) for the UK, while for France Baum et al. (2012) illustrate spending multipliers of -0.1 (0.2) in expansion (recession) periods.[6] In our setup, we focus exclusively on European (Eurozone or EU) groups of countries, for which we provide panel-VAR estimations.

Third, compared to previous panel-VAR-based evidence (see, for example, Batini et al., 2012), we do not focus on the entire Eurozone, but disentangle our analysis along two dimensions. On the one hand, we aim at emphasizing if being in the Eurozone makes a difference in terms of fiscal multipliers. To this end, we take advantage of the availability of public finance quarterly data and limit our time span to the beginning of the Eurozone,[7] namely the 1999Q1-2012Q4 period. Moreover, we disentangle the Eurozone/EU areas in several groups. Thus, we compare fiscal multipliers between our benchmark case, namely panel-VAR estimations on the group of "historical" European countries (Belgium, France, Germany, Italy and the Netherlands),[8] with those based on panel-VAR estimations for the group of EU countries not expected to adopt the Euro (Denmark and the UK) and the group of some countries that recently joined the EU (in 2004), not in the Eurozone but expected to join it in the near future (the Czech Republic, Hungary and Poland). On the other hand, we explore the effects of the crisis in the Eurozone, by comparing fiscal multipliers in the benchmark group with those in the group of some Eurozone countries heavily affected by the crisis, namely the so-called "PIGS" (Greece, Italy, Portugal and Spain).

Finally, we gave particular attention to two subsequent aspects. On the one hand, in addition to public spending multipliers, we systematically present tax multipliers, for each of the groups of countries described above. On the other hand, we highlight and discuss all the types of multipliers emphasized in the literature (see, for example, Spilimbero et al., 2009, or Gechert, 2013), namely impact, at some horizon, peak and cumulative multipliers.

[6] For evidence on European individual-country multipliers using alternative methods, see HM Treasury (2003) based on the European Commission's QUEST model, or Al-Eyd & Barrell (2005) based on the National Institute's Global Econometric NiGEM model.

[7] Since we aim focusing exclusively on the Eurozone, we specifically did not combine pre- and post-1999 data as this is the case in previous studies (for example, Batini et al, 2012, select the 1985-2009 period).

[8] Given its significantly smaller size, we exclude Luxemburg of the six founding members of the European Economic Community as established by the Treaty of Rome in 1957.

Our results can be summarized as follows. First, an increase in spending or taxes increases output in the benchmark model, albeit the expenditure multiplier is little significant. Second, contrary to spending multipliers, tax multipliers are relatively less sensitive to being in the Eurozone or experiencing a crisis. Third, contrary to the negative response of output to spending shocks in the group of EU non-Eurozone countries, spending multipliers are positive both for the Eurozone group of countries and also for the group of recent EU non-Eurozone countries that might adopt the Euro in the near future. Fourth, countries affected by the Eurozone crisis present significantly positive expenditure multiplier, irrespective of the time span used to compute them, namely the entire period or only the crisis period.

Compared to previous work, emphasizing an important effect of liquidity traps and interest rate premia on public debt, our paper shows that being a member of the EU/Eurozone significantly impacts the effects of fiscal policy. Being connected to the Eurozone, by either membership or through expectations to join the Eurozone in the future, makes expenditure multipliers more in agreement with the Keynesian theory, and this is equally the case for the group of countries experiencing the current economic crisis compared to the considered group of Eurozone countries.

The reminder of the manuscript is organized as follows. Section two contains several methodological considerations and presents the data, section three illustrates results for the benchmark model, and explores the comparative differences of being a Eurozone member or being affected by the Eurozone crisis on fiscal multipliers, and section four concludes.

4.2. Methodological considerations and data

4.2.1. Methodological considerations

Following Blanchard & Perotti (2002) and the related literature, we draw upon a multivariate representation based on Vector AutoRegressive (VAR) models to estimate fiscal multipliers. Specifically, we combine VAR models with panel data and estimate the following Panel VAR (PVAR) model

$$X_{it} = a_i + B(L)X_{it} + u_{it}, \quad (1)$$

with $i = \overline{1,N}$ countries, $t = \overline{1,T}$ time periods, X the vector of the endogenous variables of the model, $B(L)$ the matrix polynomial with L the lag operator, a_i country fixed effects, and u_{it} the vector of errors.[9] With respect to our goal, several considerations should be made. First, the variables in the vector X must be stationary; we discuss below the time series properties of the variables considered from this perspective. Second, following Ilzetzki et al. (2013), we augment the PVAR with country fixed effects, in order to account for time invariant unobserved country heterogeneity. Finally, since we aim at estimating fiscal multipliers, i.e. changes in output following changes in the fiscal policy, the latter must be modelled as an exogenous shock. To this end, we draw upon the Cholesky decomposition and transform the error term such as innovations to be orthogonal.

Assuming that fiscal shocks are properly identified, we can draw upon the estimation of (1) and compute several multipliers. The impact multiplier $k_0 = \frac{\Delta Y_0}{\Delta F_0}$ measures the response of output (ΔY_0) to a fiscal shock (ΔF_0) at the initial period, i.e. when the fiscal shock occurs. To see how output changes some periods after the fiscal shock took place, we compute the multiplier at some future horizon T, namely $k_T = \frac{\Delta Y_T}{\Delta F_0}$. Then, an interesting point is to measure when occurred and how large is the strongest response of output to the fiscal shock during a horizon T, which can be done through the peak multiplier $k_M = \max_T \frac{\Delta Y_T}{\Delta F_0}$. Finally, we make use of the cumulative multiplier at some horizon T, computed as the sum of the changes in output from the current period until the period T divided by the sum of changes in the fiscal variable over the same period, namely $k_T^{LT} = \frac{\sum_{t=0}^{T} \Delta Y_t}{\sum_{t=0}^{T} \Delta F_t}$, to account for long-term effects.

[9] For a recent technical survey on the PVAR technique, including its performances when the number of cross-sections is limited, see Canova & Ciccarelli (2013).

4.2.2. Data

We first describe the data and examine the time series properties of variables, and then discuss several issues related to the identification of the PVAR model.

4.2.2.1. Data set and unit root tests

Since we aim at focusing on the Eurozone, we restrict the sample to the beginning of the Eurozone, namely the first quarter of 1999, until the recent period (2012Q4).[10] The vector of endogenous variables is composed of three series, namely real output, real government expenditure and real taxes.[11] Contrary to the former, the use of quarterly data for fiscal variables may be somehow problematic, especially if major fiscal changes occur on a yearly basis and quarterly data are simply interpolated. However, as documented by Eurostat, at least from 1999, Eurozone data on fiscal variables are genuine quarterly data, i.e. literally collected on a quarterly basis.[12]

Two problems arise with our data, namely seasonality and non-stationarity. A parsimonious way to deal with them jointly is to define growth rates of all variables between the value for a quarter of the current year and the value of the corresponding quarter of the previous year (for example, the growth rate between 2000Q1 and 1999Q1). By so doing the seasonality problem is obviously tackled, while to deal with the stationary problem we draw upon panel unit root tests.

[10] Given the relatively short time span, the use of the PVAR technique, increasing the time length by the panel dimension, is particularly appropriate for our analysis, and it also allows not mixing pre- with post-1999 data.

[11] We used the GDP deflator to obtain real output, while the CPI index to obtain real government expenditure and taxes. We report that using only the GDP deflator or the CPI does not alter our findings.

[12] Moreover, we gave a particular attention to taxes, which include taxes on production and imports (including VAT), current taxes on income and wealth, and capital taxes, but without social contributions. This is because the latter presents a wide variability across countries: for example, in France social contributions in 2005/2010 are 16.4%/16.7% of GDP, while only 7.6%/7.6% in the UK for the same period (for a total tax to GDP ratio around 43% in France and 36% in the UK). However, we report that adding social contributions to the tax variable does not qualitatively change our results, and particularly the response of GDP to a tax shock (results are available upon request).

Table 1. Panel unit root tests for macroeconomic series (the benchmark model)

Test	Im-Pesaran-Shin (IPS)		ADF-Fisher	
Series	with constant	with time trend	with constant	with time trend
Real GDP growth rate	-4.37 (0.00)	-3.44 (0.00)	39.1 (0.00)	29.6 (0.00)
Real Expenditure growth rate	-5.33 (0.00)	-4.61 (0.00)	50.1 (0.00)	40.7 (0.00)
Real Taxes growth rate	-4.04 (0.00)	-2.93 (0.00)	36.7 (0.00)	25.8 (0.00)

Note: the growth rate of each variable is computed as the relative change between the value of the variable in the quarter of the considered year and its value in the corresponding quarter of the previous year. We report p-values in brackets. The null hypothesis of the IPS and ADF-Fisher tests is that the panel contains a unit root after controlling for country fixed effects or for country fixed effects and country linear time trends.

Table 1 presents the results of two panel unit root tests, namely the Im, Pesaran & Shin (IPS, 2003) test and the Fisher-ADF test developed by Maddala & Wu (1999) and Choi (2001), for the group of countries in our benchmark model composed of Belgium, France, Germany, Italy and the Netherlands. For each of the two tests, the null hypothesis is the presence of a unit root after controlling alternatively by country fixed effects or by both country-fixed effects and country linear time trends. As emphasized by Table 1, irrespective of the considered test (IPS or Fisher-ADF) or of the specification (with or without time trend), we reject the presence of a unit root. Consequently, the growth rates of real GDP, expenditure and taxes are stationary in the benchmark (Eurozone) model.[13]

4.2.2.2. PVAR identification

Given that all transformed series are integrated of order zero, we explore the dynamic relationships between our variables using a PVAR model, allowing computing the response of output to fiscal policy shocks using impulse response functions. However, as this is well documented in the literature, a critical problem is related to the identification of truly exogenous fiscal shocks. As previously emphasized, we follow Fatas & Mihov (2001) and draw upon the simple and popular Cholesky decomposition, which consists in ordering the variables in the PVAR from the most to the least exogenous. Following the ISLM framework, in which fiscal

[13] Panel unit root tests for the remaining group of countries are reported in Appendix A.

policy is predetermined, we study the response of output to fiscal shocks by ordering expenditure and fiscal before output. Moreover, we follow the related literature (see the recent contributions of Beetsma & Giuliodori, 2011, and Ilzetzki et al., 2013) and order expenditure first.[14] Consequently, the order of variables in our PVAR models is expenditure-taxes-output.[15]

4.3. Results

The section is divided into three subsections. First, we present fiscal multipliers for our benchmark model. Second, we explore a potential role for the Euro regarding fiscal multipliers. Finally, we investigate the behaviour of fiscal multipliers in some countries having experienced the Eurozone crisis.

4.3.1. Fiscal multipliers: the benchmark Eurozone model

As previously emphasized, our benchmark Eurozone model is composed of founding members of the European Economic Community (except Luxemburg, given its small size), namely Belgium, France, Germany, Italy and the Netherlands. The ordering of variables is spending, followed by taxes and finishing by output (all as growth rates).

Before implementing an impulse response analysis, we must choose the optimal lag length for estimating the PVAR. According to the Schwartz information criterion reported in the second column of Table 2, we choose the lag 2.[16]

[14] In addition, we equally report results when inverting the order of the first two variables, i.e. putting first taxes and then expenditure.

[15] Remark that, similar to the SVAR of Blanchard & Perotti (2002) allowing also for non zero restrictions on the elasticities of automatic stabilizers, the ordering of our variables reproduces the idea that public spending are predetermined, in line with the IS-LM model. Alternatively, the identification of shocks could be achieved through narrative methods, which consist of identifying exogenous military spending (Ramey & Shapiro, 1998) or of using data on historical changes, such as government announcements (Romer & Romer, 2010). However, these methods are hardly appropriate for our sample, which focuses exclusively on European Union countries, for (at least) three reasons. First, in many of these countries military spending are significantly lower than in the US. Second, the approach based on announcements is difficult to implement from a cross-section perspective. Finally, recent work explores the extent to which military spending are really exogenous (Fishback, 2014).

[16] In addition Appendix B illustrates the inverse roots of the auto regressive characteristic polynomial of all estimated PVAR and clearly confirms their stationarity, since all roots lie inside the unit circle (see Lütkepohl, 2005); as such, we can use them to derive impulse response functions. Besides, the fact that in all PVAR impulse response functions rapidly come to zero after a shock equally supports their stationarity.

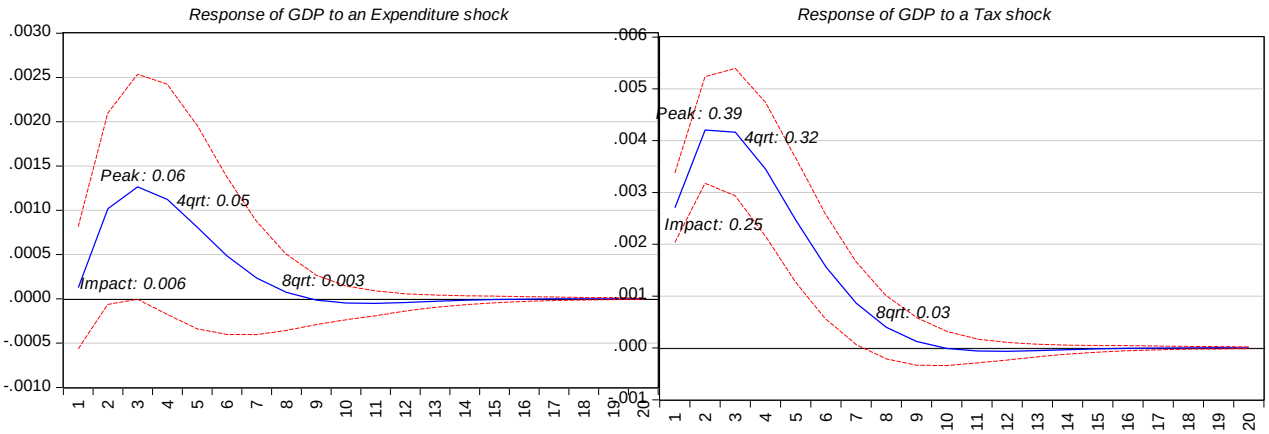
Table 2. Lag selection in all PVAR models

Lag	Benchmark (Eurozone)	EU non-Eurozone	Recent EU-non-Eurozone	Eurozone crisis
0	-12.32406	-11.83348	-9.014121	-9.251212
1	-13.44935	**-13.33337**	-9.219397	**-10.83424**
2	**-13.49002**	-13.10011	-9.987694	-10.65896
3	-13.39284	-12.86758	-10.12709	-10.43929
4	-13.32884	-12.84309	**-10.30134**	-10.28556
5	-13.19377	-12.69766	-10.27676	-10.14521
6	-13.06976	-12.46462	-9.735470	-9.943949
7	-12.95079	-12.05857	-9.473194	-9.755080
8	-12.85999	-11.83497	-9.262783	-9.624653

Note: The Schwartz information criterion is reported for each PVAR up to the eighth lag. Bolded values indicate the optimal lag for each PVAR.

Figure 1 below depicts the results of an impulse response analysis for the benchmark PVAR, together with 1000 replications Monte Carlo-based 90% confidence bands.

Figure 1. Response of output to fiscal shocks (the benchmark model)



Note: Impulse response function (solid line) of output to one standard error expenditure (left-hand side) or tax (right-hand side) shock, with 1000 replications Monte Carlo-based 90% confidence bands (dotted lines).

Figure 1 provides interesting evidence about the aggregated reaction of output to fiscal shocks for the five "historical" Eurozone countries. Let us first focus on spending multipliers. Notice that the response of output to an increase in expenditure is positive, albeit little significant. Moreover, to calculate multipliers, remark that the response of output at any period T to a 1 unit increase in government expenditure occurring in the initial period $t=1$ ($\Delta G_{t=1}$) can be computed as $\frac{\Delta Y_T}{\Delta G_{t=1}} = \frac{IRF_T}{\overline{(G/Y)}\sigma_G}$, with IRF_T the value of the impulse response function at the period T, $\overline{(G/Y)}$ the average expenditure to GDP ratio in levels for the considered time period, and σ_G the standard error of the growth rate of expenditure (the size of the assumed fiscal expenditure shock). As emphasized by the left-hand-side chart in Figure 1, spending multipliers are extremely low: a 1-unit increase in government spending increases output by only 0.006 units on the impact, by 0.05 units after 1 year, and has virtually no quantitative effect after 2 years. Regarding the peak multiplier, the largest response of output occurs after 3 quarters and it equals only 0.06. Finally, concerning cumulative multipliers, a 1-unit increase of government spending generates a cumulative increase of output of only 0.26 in the long-run (defined as the cumulated response after 20 quarters), which in addition is not statistically significant (see Appendix C).[17]

Although one should be cautious in comparing our findings with previous studies, because of different sample composition, method or time span, the expenditure multiplier we emphasize are significantly lower (see, for example, Dalsgaard et al., 2001, or Ilzetzki et al., 2013). Moreover, we report that our results are remarkably robust to several tests, namely considering different lags (for example, four, like in Ilzetzki et al., 2013) or changing the order of fiscal variables by putting taxes before spending.

Let us now turn our attention to taxes. As illustrated by the right-hand side chart in Figure 1, an increase in taxes generates a significant *positive* response of output for around 7 quarters. Moreover, the magnitude of the short-run response of output to a 1-unit increase in taxes is quite important, namely 0.25 on the impact, 0.39 at peak (after 2 quarters) and 0.32 after one year. This yields quite large long-run multipliers, namely 1.85 cumulated for 20

[17] Following a Reviewer's request, to ensure that no country appears in two different groups, we estimated the benchmark model without Italy. We report that expenditure and tax multipliers are qualitatively similar, albeit expenditure multipliers are slightly lower (0.04 at peak, against 0.06 if Italy is included) and tax multipliers are slightly larger (0.55 at peak, against 0.39 if Italy is included).

quarters, which in addition are significantly all along the considered path, as illustrated by Appendix C.

Several arguments can be put forward to support this rather puzzling positive response of output to an increase in taxes. Empirically, there is previous evidence for such an effect; for example, following his analysis performed on 5 developed countries, Perotti (2005, page 24) states that in only 2 of the 10 country-period couples considered the multiplier is significantly negative (see also Afonso, 2001, for such effects during a time span previous to ours). In addition, Gechert (2013) confirms that previous studies identified both negative and positive tax multipliers.[18] Theoretically, the positive effect of taxes on output can be compatible with the increasing side of a Laffer Curve (see, for example, Minea & Villieu, 2009a), and, more interestingly, with anti-Keynesian effects during expansion periods in which the abundance of liquidity can be compatible with Ricardian agents (roughly, the first part of our time span) or during recession periods (roughly, the last part of our time span) with damaged fiscal stance in which changes in expectations occur (see, for example, Giavazzi & Pagano, 1990, and, more recently Perotti, 1999, Alesina et al., 2002, or Minea & Villieu, 2009b, 2012, for such expectations switches in high-debt contexts).

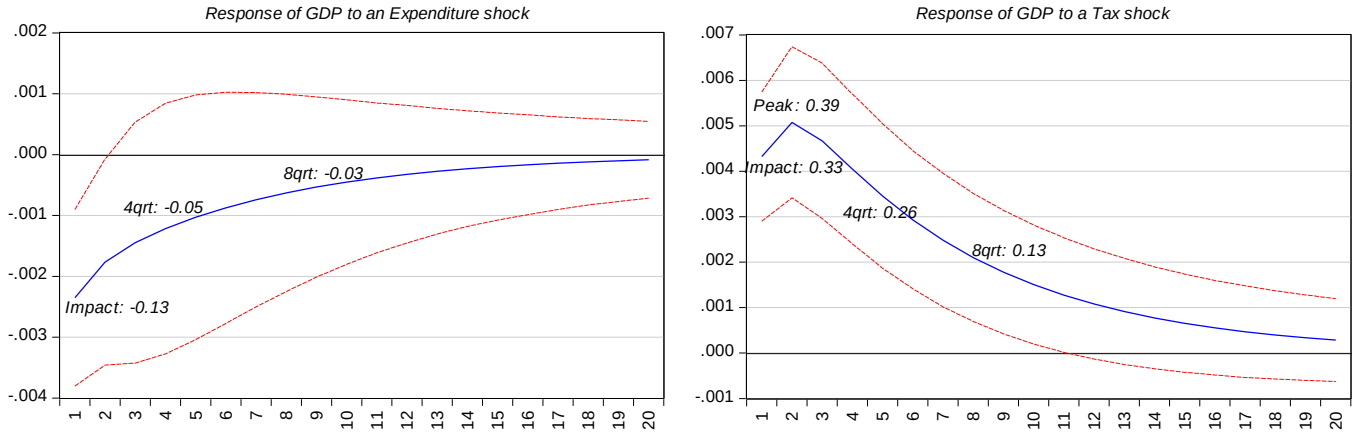
4.3.2. Fiscal multipliers: what role for the Euro?

Building on the benchmark results emphasized in the previous subsection, we aim in the following exploring if being in the Eurozone makes any difference when it comes to fiscal multipliers. To this end, we rely upon two sets of estimations.

First, we estimate a PVAR model for EU members that are not Eurozone members, and in addition are not expected to join the Euro in the future, namely Denmark and the United Kingdom. Panel unit root tests reject the presence of a unit root (see Appendix A), and the Schwartz information criterion supports a lag equal to one (see column three in Table 2 above). As for the benchmark model, we assume the order expenditure-taxes-output when computing impulse response functions.

[18] For example, in a recent paper, Tang et al. (2013) emphasize expansionary effects of tax increases in ASEAN countries.

Figure 2a. Response of output to fiscal shocks (EU non-Eurozone members)



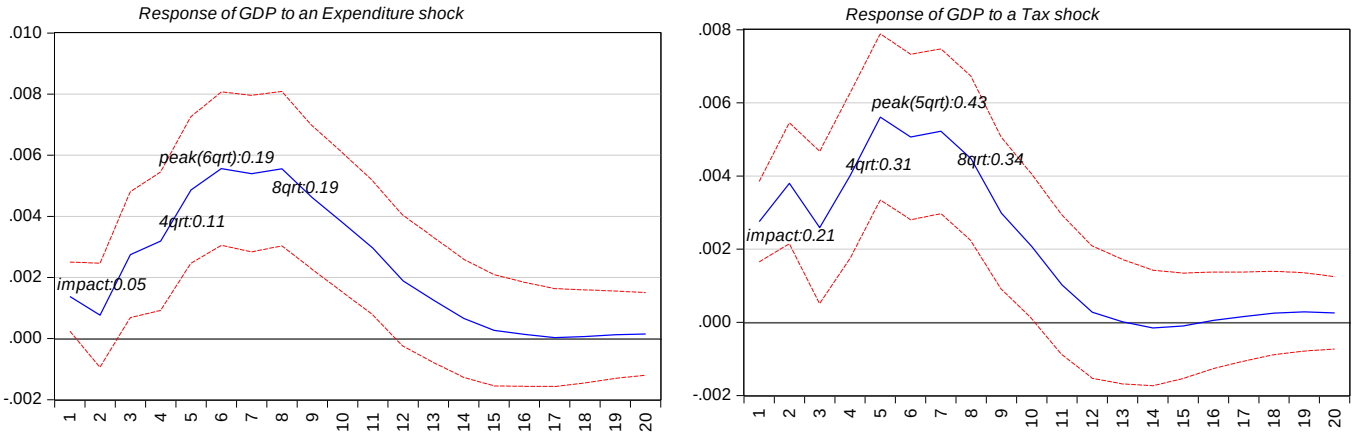
Note: Impulse response function (solid line) of output to one standard error expenditure (left-hand side) or tax (right-hand side) shock, with 1000 replications Monte Carlo-based 90% confidence bands (dotted lines).

Figure 2a illustrates the response of output to fiscal shocks in EU countries that are not to become Eurozone members in the future. Depicted on the left-hand-side chart, the response of output to an expenditure shock appears statistically significant in the short-run, albeit relatively weak (-0.13 on the impact), while rather large in the long run (-0.74). Moreover, the tax multiplier (see the right-hand-side chart) is positive, quite important (peaking at 0.39 after 2 quarters) and remarkably significant (for around 11 quarters); in addition, as emphasized by Appendix C, the cumulated tax multipliers equals 3.01. On the whole, these results outline the presence of anti-Keynesian effects in the group of EU countries not aiming at joining the Eurozone.

The second set of estimations focuses on a group of countries that recently joined the EU (in 2004) and expected to adopt the Euro at some point in the future, namely the Czech Republic, Hungary and Poland.[19] Panel unit root tests in Appendix A confirm that growth rates of all variables are stationary. According to column four in Table 2 above, we select the lag four for the estimation of the PVAR, and we compute the reaction of output to fiscal shocks using the ordering expenditure-taxes-output.

[19] In selecting these countries among those that joined the EU in 2004, we aimed at abstracting from countries that either adopted the Euro recently (such as Slovakia, 2009, or Estonia, 2011) or present a (hard) peg monetary system (such as a Currency Board in Bulgaria or a Currency Peg in Latvia).

Figure 2b. Response of output to fiscal shocks (Recent EU non-Eurozone members)



Note: Impulse response function (solid line) of output to one standard error expenditure (left-hand side) or tax (right-hand side) shock, with 1000 replications Monte Carlo-based 90% confidence bands (dotted lines).

Figure 2b plots the impulse response function of output to an expenditure shock (left-hand-side chart) and to a tax shock (right-hand-side chart). The response of output to a tax shock is significant for about 2.5 years, and the associated multipliers equal 0.21 on the impact, 0.31 after four quarters and 0.34 after 8 quarters, with a peak at 0.43 (after 5 quarters). In addition, the long-run multiplier depicted in Appendix C equals 3.11, and is significant for the entire considered path (5 years). On the contrary, the significance of the response of output to an expenditure shock depends on the time span considered: little significant for about 3 quarters, it becomes significantly positive for the following 2 years, and again not significant starting the quarter 12. As a result, expenditure multipliers are significant and positive, peaking to 0.19 after 6 quarters. Interestingly, the long-term expenditure multiplier is quite consistent: the cumulative response of output becomes significant after around 3 quarters and equals to as high as 1.58 after 5 years (see Appendix C).

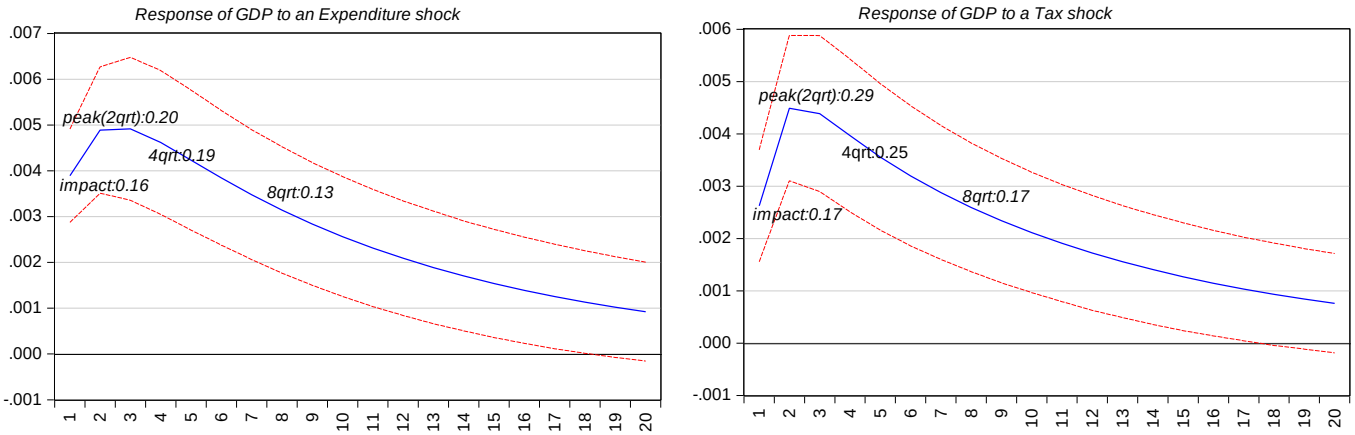
Compared to evidence based on the benchmark model, several results emerge. On the one hand, the average response of output to a tax shock is reasonably close in sign and magnitude in the Eurozone compared to the each of the two EU non-Eurozone groups of countries. Consequently, we find that being in the Eurozone does not make much of a difference when it comes to tax multipliers (except it is shorter-lived, roughly by one year), neither compared to EU non-Eurozone countries (the Denmark and UK group), nor compared to EU countries with monetary policies driven by a possible future integration in the Eurozone (the

Czech Republic, Hungary and Poland group). However, on the other hand, expenditure multipliers are much more contrasted. Compared to the weakly significant positive expenditure multipliers in the Eurozone group of countries, raising expenditure *decreases* output for the EU non-Eurozone countries, but *increases* it in the group of recent EU non-Eurozone countries. Since both non-Euro groups of countries present more flexible exchange rates, such differences in spending multipliers can be attributable, for example, to differences in their stage of economic development or in forward-looking expectations as regards a possible future integration in the Eurozone. On the whole, it appears that being in, or getting closer to, the Eurozone yields expenditure multipliers more consistent with a Keynesian view: (i) being in the Eurozone yields positive (albeit weakly significant) spending multipliers, contrary to negative multipliers in the EU non-Eurozone groups of countries; (ii) although both groups of countries present flexible exchange rates, spending multipliers are negatively significant in EU non-Eurozone countries, while significantly positive in recent EU non-Eurozone countries that might integrate the Eurozone in the near future; and (iii) the response of output to a spending shock is positive in both Eurozone countries and recent EU countries that could join the Eurozone in the next period, while more significant and larger in the latter group of countries possibly due to the presence of convergence effects.

4.3.3. Fiscal multipliers in the Eurozone: does the crisis matter?

In complement to the previous analysis which compared Eurozone groups of countries to groups of countries outside the Euro Area, we explore in the following the behaviour of some countries heavily affected by the Eurozone crisis, namely Greece, Italy, Portugal and Spain. After performing unit root tests showing that transformed series are stationary (see Appendix A), we estimate a PVAR model with variables ordered expenditure-taxes-output and the lag one (see the last column in Table 2 above).

Figure 3a. Response of output to fiscal shocks (Eurozone crisis countries)



Note: Impulse response function (solid line) of output to one standard error expenditure (left-hand side) or tax (right-hand side) shock, with 1000 replications Monte Carlo-based 90% confidence bands (dotted lines).

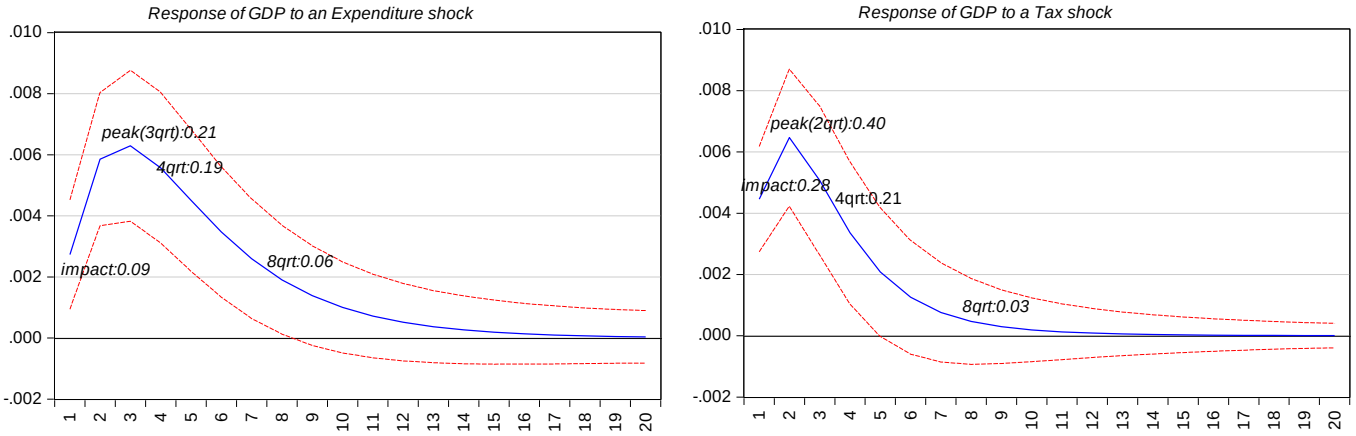
Figure 3a depicts the response of output to spending and tax shocks (left- and right-hand-side charts respectively) for the group of Eurozone crisis countries. Remarkably, the response of output to an expenditure shock is positive and significant on the impact, and the multiplier equals 0.16. The peak multiplier, equal to 0.20, arises rather rapidly, i.e. in the second quarter, after which the magnitude of the multiplier continuously decreases, for example to 0.13 after 2 years. Given that the response of output is significant for a rather long period, namely 4 and a half years, it is not surprising to find a very large cumulative (for 20 quarters) expenditure multiplier of 2.18 (see Appendix C). The response of output to a tax shock shows that the tax multiplier reaches its maximum after only 2 quarters (0.29), and is significant for about 18 quarters, leading to a cumulative multiplier (for 20 quarters) of 2.85 (see Appendix C).

These results are rather different than what we previously emphasized in the benchmark PVAR model. Regarding taxes, although output response is still positive, its magnitude is lower (for example, at peak the value of the tax multiplier decreases by around 25%), but its persistence is much higher, namely 18 quarters compared to 7 quarters in the benchmark. When it comes to expenditure multipliers, they are not only positive, as this was the case for the Eurozone group countries, but also more significant and very persistent. Thus, it appears that taxes, and particularly spending, multipliers are quite different in the Eurozone group compared to the Eurozone crisis group.[20]

[20] Such differences persist if, for example, we drop Italy out of the group of Eurozone crisis countries.

To get a closer look at these findings, we report in Figure 3b the response of output to expenditure and tax shocks from a PVAR for the same Eurozone crisis group, but estimated only for the crisis period, namely 2008Q1-2012Q4.[21]

Figure 3b. Response of output to fiscal shocks during the crisis (Eurozone crisis countries)



Note: Impulse response function (solid line) of output to one standard error expenditure (left-hand side) or tax (right-hand side) shock, with 1000 replications Monte Carlo-based 90% confidence bands (dotted lines).

Figure 3b illustrates the behaviour of fiscal multipliers during crisis. An increase in taxes significantly increases output in the short-run, consistent with a favourable effect of a tax consolidation during a crisis period. If we turn our attention to expenditure multipliers, remark that output significantly and positively responds to an expenditure shock for about 2 years, namely almost the double of the significant reaction to a tax shock, during crisis times for the group of Eurozone crisis countries. Thus, it appears that during the crisis, increasing public expenditure can be an efficient way to boost output in the short-run, consistently with the recent conclusions of Batini et al. (2012) emphasizing positive spending multipliers in recession times between 1985 and 2009 in the Euro Area.[22]

[21] The unreported Schwarz information criterion supports a lag equal to one.

[22] Although that, compared to the analysis of Fazzari et al. (2012) or Auerbach & Gorodnichenko (2012, 2013), we do not detect important magnitude differences in spending multipliers during the crisis period compared to the entire period of our sample, confirming the absence of such differences found by Cléau et al. (2013) for France.

4.4. Conclusion

This paper is a first attempt for a systematic analysis of the behaviour of fiscal multipliers in the Eurozone countries. Given the relatively limited time span, i.e. the Eurozone became effective only in 1999, we combine quarterly fiscal data and the Panel Vector AutoRegressive (PVAR) technique to describe the dynamic behaviour of output in response to fiscal shocks. We aim at exploring two questions, namely (i) are fiscal multipliers different for the countries in the Eurozone, and (ii) how did the Eurozone crisis influenced (or not) fiscal multipliers. To this end, we begin by providing PVAR-based fiscal multipliers for the benchmark model, estimated on the group of founding members of the European Economic Community (except Luxemburg, given its small size), namely Belgium, France, Germany, Italy and the Netherlands.

To answer our first question, we compare[23] fiscal multipliers in the benchmark model with those based on estimations on two groups of countries, namely EU countries with no future commitment to adopt the Euro (Denmark and the United Kingdom) and recent EU countries that are expected to join the Euro in the future (the Czech Republic, Hungary and Poland). If tax multipliers are fairly close, expenditure multipliers are quite different, and suggest that being related to the Eurozone seems to matter when assessing the response of output to expenditure shocks. On the one hand, output positively (albeit little significantly) responds to an increase in spending for the Eurozone countries, while its response is negative (and significant in the first periods) for the EU non-Eurozone countries. On the other hand, expenditure multipliers are positive and significant for the group of recent EU non-Eurozone countries that might integrate the Eurozone in the near future.

Regarding our second question, both expenditure and tax multipliers are different in the group of some of the countries heavily affected by the Eurozone crisis (Greece, Italy, Portugal and Spain) compared to the benchmark. The response of output to a tax shock is significant, while output significantly, positively and very persistently (around 4.5 years) responds to an expenditure increase. Particularly regarding expenditure, it seems that output has again a more Keynesian response to spending shocks in Eurozone crisis countries compared to the benchmark group of Eurozone countries. Moreover, the existence of significant and positive

[23] See Table D1 in Appendix D for a synthetic overview of multipliers across groups.

expenditure multipliers for the group of Eurozone crisis countries is confirmed by estimations performed by restraining the sample exclusively for the crisis period.

Consequently, we revealed that being in the Eurozone or expecting to join the Euro Area in the future is associated to different responses of output to expenditure shocks, compared to EU non-Eurozone countries. In particular, spending multipliers are more Keynesian in Eurozone crisis countries compared to EU countries which are not in the Eurozone. One possible topic that we leave for future research might consists in exploring why tax multipliers are relatively more stable than expenditure multipliers across different groups of countries, using for example the recent method of Towbin & Weber (2013), which allows for interacted terms inside a PVAR framework.

Appendix

Appendix A. Unit root tests

Table A1. Stationarity tests for macroeconomic series (EU non-Eurozone countries)

Test	Im-Pesaran-Shin (IPS)		ADF-Fisher	
Series	with constant	with time trend	with constant	with time trend
Real GDP growth rate	-2.34 (0.00)	-2.07 (0.02)	12.5 (0.01)	10.9 (0.03)
Real Gov. Expenditure growth rate	-3.34 (0.00)	-3.35 (0.00)	19.1 (0.00)	17.5 (0.00)
Real Taxes growth rate	-2.93 (0.00)	-2.24 (0.01)	16.0 (0.00)	11.5 (0.02)

Note: the growth rate of each variable is computed as the relative change between the value of the variable in the quarter of the considered year and its value in the corresponding quarter of the previous year. We report p-values in brackets. The null hypothesis of the IPS and ADF-Fisher tests is that the panel contains a unit root after controlling for country fixed effects or for country fixed effects and country linear time trends.

Table A2. Stationarity tests for macroeconomic series (Recent EU non-Eurozone countries)

Test	Im-Pesaran-Shin (IPS)		ADF-Fisher	
Series	with constant	with time trend	with constant	with time trend
Real GDP growth rate	-1.48 (0.06)	-1.28 (0.09)	10.8 (0.09)	10.6 (0.10)
Real Gov. Expenditure growth rate	-6.84 (0.00)	-7.51 (0.00)	54.3 (0.00)	55.4 (0.00)
Real Taxes growth rate	-2.52 (0.01)	-2.16 (0.02)	17.4 (0.01)	14.1 (0.03)

Note: the growth rate of each variable is computed as the relative change between the value of the variable in the quarter of the considered year and its value in the corresponding quarter of the previous year. We report p-values in brackets. The null hypothesis of the IPS and ADF-Fisher tests is that the panel contains a unit root after controlling for country fixed effects or for country fixed effects and country linear time trends.

Table A3. Stationarity tests for macroeconomic series (Eurozone crisis countries)

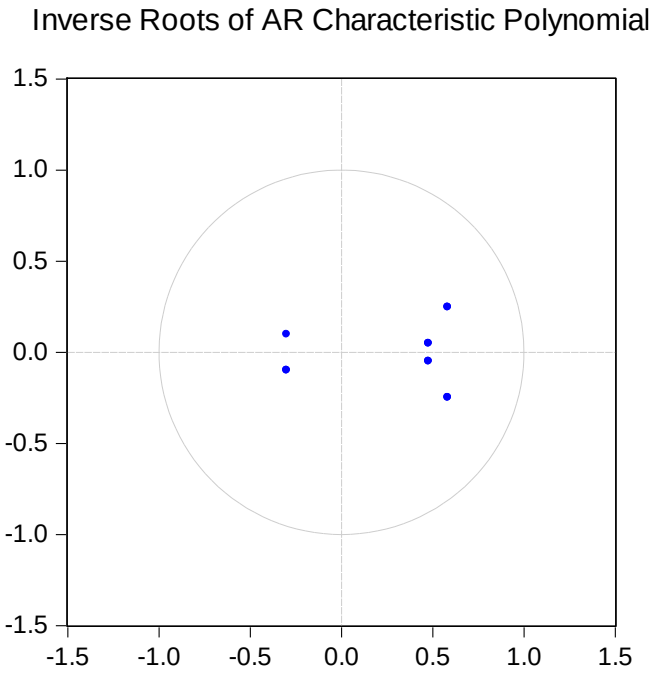
Test	Im-Pesaran-Shin (IPS)		ADF-Fisher	
Series	with constant	with time trend	with constant	with time trend
Real GDP growth rate	-2.51 (0.01)	-1.71 (0.04)	18.8 (0.02)	13.6 (0.09)
Real Gov. Expenditure growth rate	-8.69 (0.00)	-7.19 (0.00)	72.5 (0.00)	57.5 (0.00)
Real Taxes growth rate	-7.60 (0.00)	-7.45 (0.00)	63.5 (0.00)	56.9 (0.00)

Note: the growth rate of each variable is computed as the relative change between the value of the variable in the quarter of the considered year and its value in the corresponding quarter of the previous year. We report p-values in brackets. The null hypothesis of the IPS and ADF-Fisher tests is that the panel contains a unit root after controlling for country fixed effects or for country fixed effects and country linear time trends.

Appendix B. Inverse Roots of AR Characteristic Polynomial

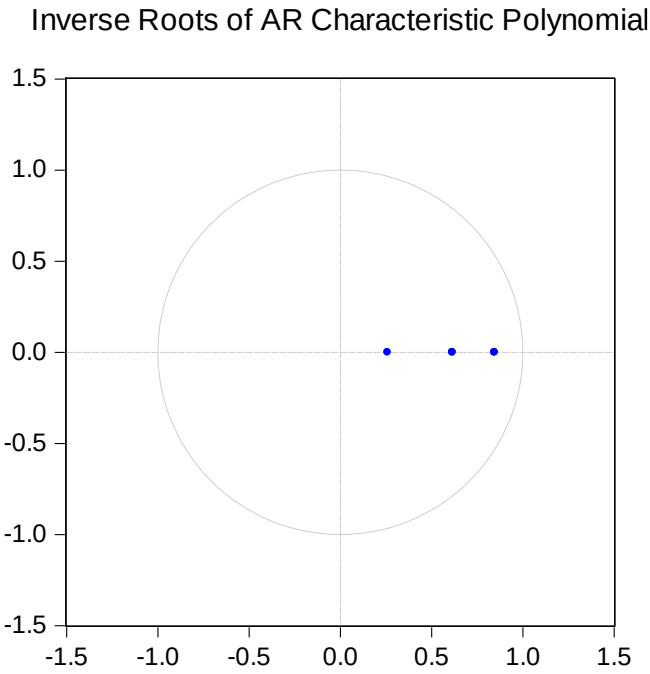
Benchmark PVAR (Group of Eurozone countries)

PVAR with 2 lags (6 roots)



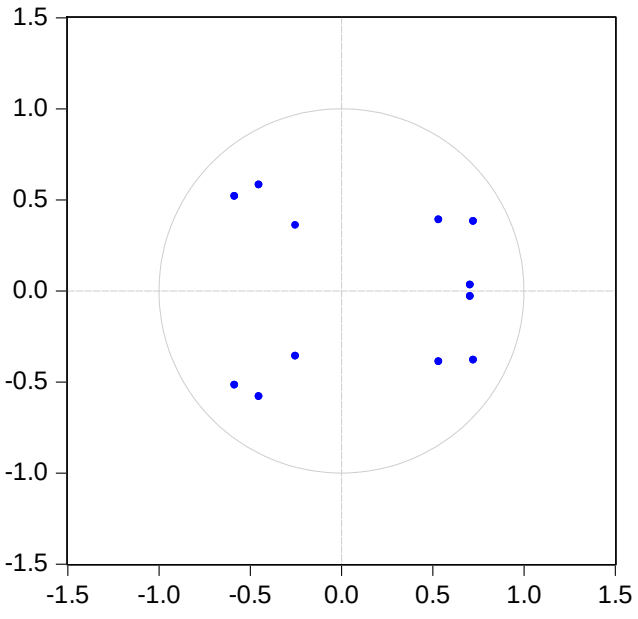
Group of EU non-Eurozone countries

PVAR with 1 lag (3 roots)



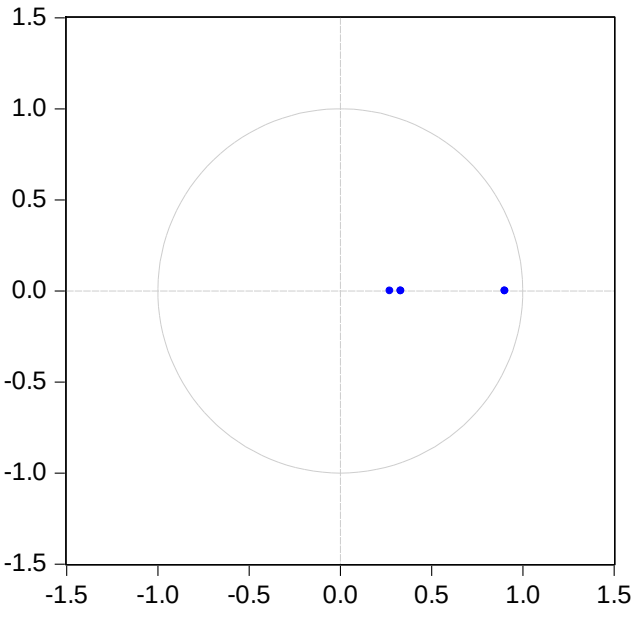
Group of Recent EU non-Eurozone countries

PVAR with 4 lags (12 roots)



Group of Eurozone crisis countries

PVAR with 1 lag (3 roots)



Appendix C. Cumulative fiscal multipliers

Figure C1. Cumulative multipliers for the Benchmark (Eurozone) PVAR

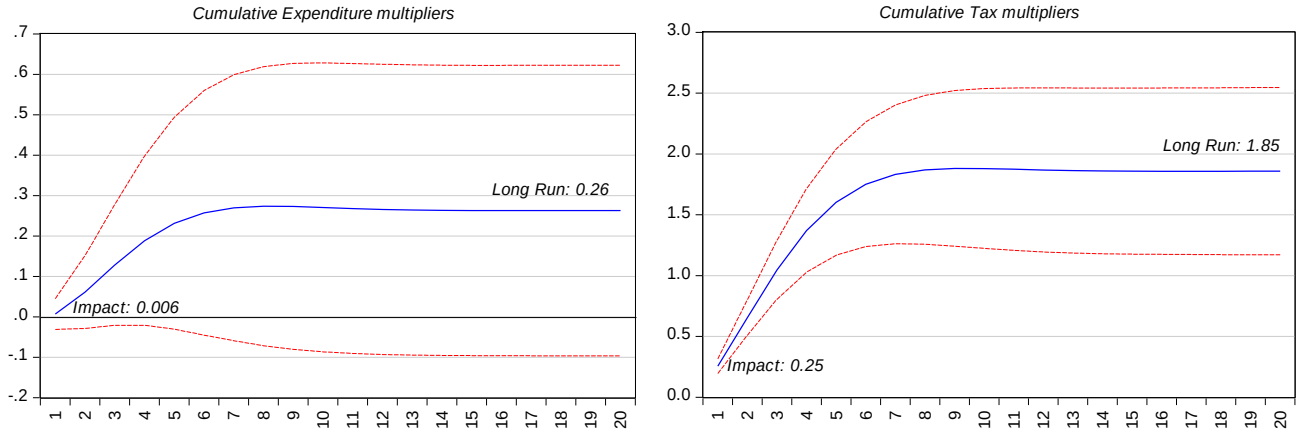


Figure C2a. Cumulative multipliers for the group of EU non-Eurozone countries

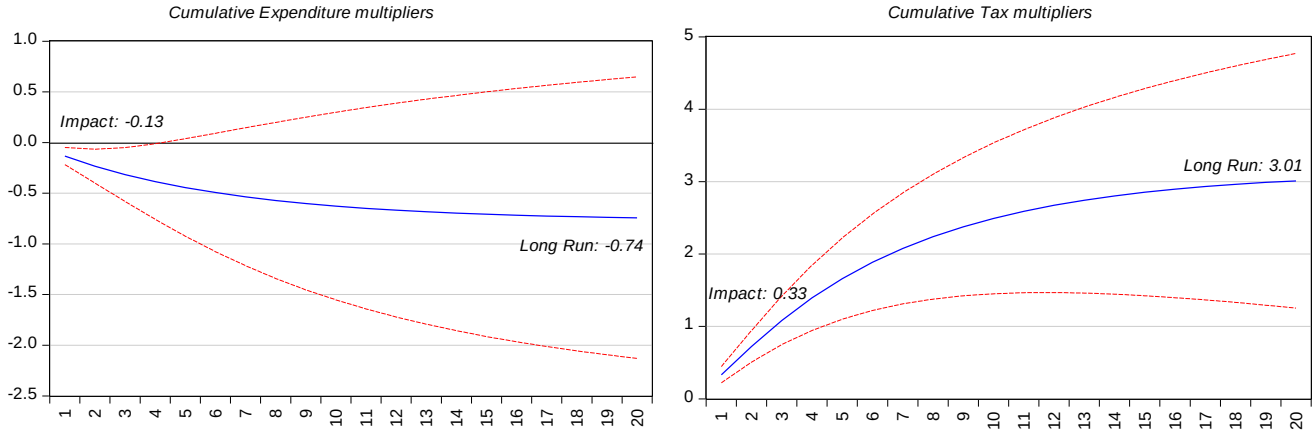


Figure C2b. Cumulative multipliers for the group of Recent EU non-Eurozone countries

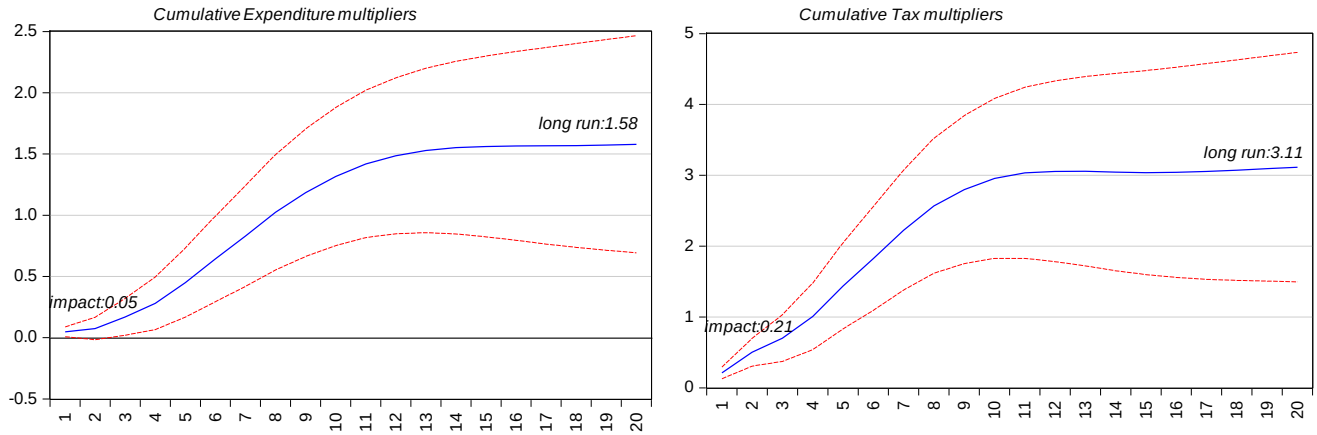


Figure C3a. Cumulative multipliers for the group of Eurozone crisis countries

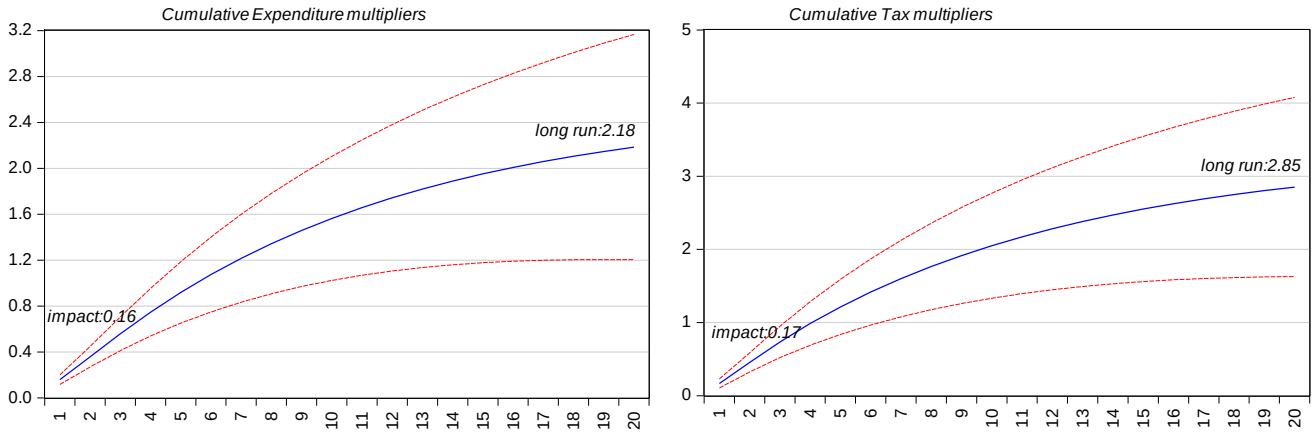
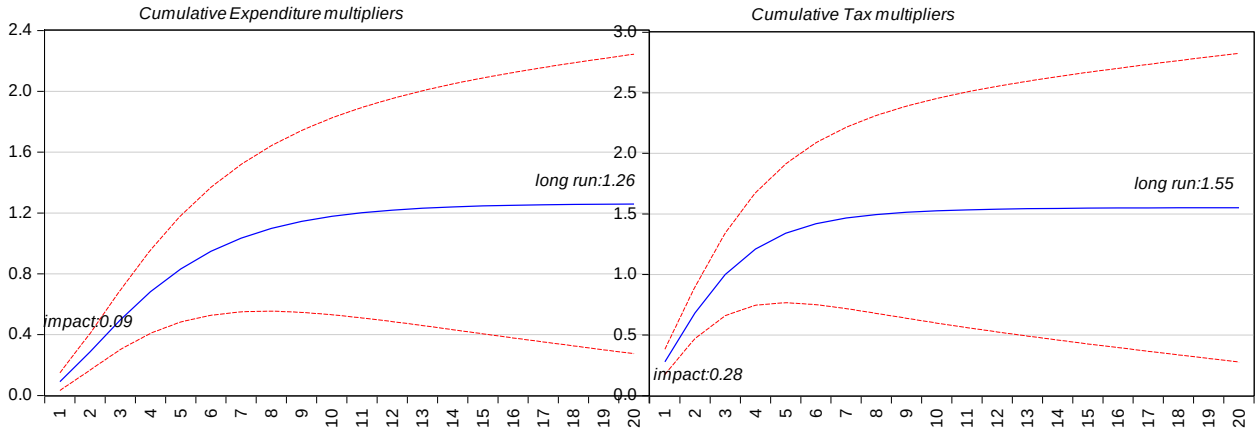


Figure C3b. Cumulative multipliers for the group of Eurozone crisis countries (2008Q1-2012Q4 period)



Appendix D. An overview of fiscal multipliers across groups

Table D1. An overview of fiscal multipliers across groups

Fiscal multipliers						
	Impact multiplier (1st quarter)		Peak multiplier (quarter)		Cumulative multiplier (quarter 20)	
	Spending	Tax	Spending	Tax	Spending	Tax
EU1	0.006	0.25	0.06 (3qrt)	0.39 (2qrt)	0.26	1.85
EU2	-0.13	0.33	-0.01 (19qrt)	0.39 (2qrt)	-0.74	3.01
EU3	0.05	0.21	0.19 (6qrt)	0.43 (5qrt)	1.58	3.11
EU4	0.16	0.17	0.20 (2qrt)	0.29 (2qrt)	2.18	2.85
EU5	0.09	0.28	0.21 (3qrt)	0.40 (2qrt)	1.26	1.55

Note: EU1 stands for the benchmark (Eurozone) group of countries, EU2 for EU non-Eurozone countries, EU3 for Recent EU non-Eurozone countries, EU4 for Eurozone crisis countries for the whole time spam, and EU5 for the Eurozone crisis countries during the crisis.

III. An assessment of fiscal multipliers in developing countries

Chapter 5. A Fresh Look at Fiscal Multipliers: One Size Fits it All? Evidence from the Mediterranean Area

A Fresh Look at Fiscal Multipliers: One Size Fits it All? Evidence from the Mediterranean Area[1]

Abstract

Following the adoption of important fiscal stimuli to fight the recent crisis, a large literature estimated fiscal multipliers. Focusing on an area particularly appealing, given its diversity and the diversity of the response of countries that compose it to the current crisis, namely the Mediterranean area, we unveil major disparities regarding the significance, sign, and size of fiscal multipliers, depending mainly on economic characteristics, the type of multiplier, the time span, and the type of fiscal stimulus. Evidence of such important heterogeneities highlights the need for better cooperation among countries, particularly regarding the design of fiscal policy. Failing to do so might divert public resources to ineffective fiscal policies in some countries, or, on the contrary, deprive other countries of potentially high benefits of appropriate fiscal policies, including a reliable tool for exiting the current crisis.

JEL Codes: E62, F62, O57

Keywords: fiscal multipliers; fiscal policy; developing and developed countries.

[1] A version of this chapter was published as "A New Look at Fiscal Multipliers: One Size Fits it All? Evidence from the Mediterranean Area", *Applied Economics*, vol. 47, pp. 2728-2744, 2015, and was written with A. Minea.

5.1. Introduction

The recent crisis embraced a global scale. However, its effect was uneven around the world: according to the World Bank, real 2009 GDP shrank in most European countries or in North America but increased in most continental Asia, while in Latin America, South-Eastern Asia and Africa the evidence is more mixed. Such output heterogeneities are probably related to the unprecedented fiscal stimuli implemented since the beginning of the crisis all over the world. Indeed, according to the 2011 "A review of global fiscal stimulus" of the IILS, the fiscal stimulus in 2008-2009 in G20 was around 2 trillion USD, while between 2.6% of 2008 GDP in Latin America and Caribbean, and up to an impressive 9.1% of 2008 GDP in Asia and the Pacific (excluding Japan and South Korea). Thus, an actual and expanding topic in macroeconomics aims at evaluating these fiscal stimuli through measuring fiscal multipliers.[2]

A large number of studies estimate fiscal multipliers, drawing upon the VAR technique.[3] In an influential paper, Blanchard & Perotti (2002) use a Structural VAR (SVAR) model, and find a spending multiplier around 1 in the US. Related work emphasized however that the size of the multiplier depends on the time span: for example, the short-run spending multiplier is between 0.65 (Mountford & Uhlig, 2009) and above 1 (Fatas & Mihov, 2001), while below 1 in the long-run (Mountford & Uhlig, 2009). Capitalizing on these findings, many studies focused on developed countries. On the one hand, fiscal multipliers seem to be large in developed countries. According to Perotti (2005), fiscal multipliers in OECD are between 2.3 and 3.7, a result confirmed for EU by Beetsma et al. (2008) who find peak multipliers around 1.6. On the other hand, the persistence of fiscal multipliers in developed countries is more subject to debate: contrary to IMF (2008), Ilzetzki et al. (2013) illustrate positive and persistent multipliers in 20 high-income countries.[4]

[2] As a cornerstone of the Keynesian theory, the fiscal multiplier plays a central role in the ISLM model of Hicks (1937), or in its versions extended to include the supply block (the ASAD model), the influence of the exchange rate regime (the Mundell-Fleming model), or economic dynamics (the dynamic-ISLM model of Blanchard, 1981). On the contrary, the development of the New Classical Economics in the 1970s focused on fiscal multipliers from a more Neoclassical perspective. However, the recent DSGE models allow analyzing multipliers in a wider environment, in which Keynesian and Neoclassical elements can coexist.

[3] Alternatively, fiscal multipliers can be estimated using MACRO models (see Chinn, 2013, for a discussion) or the narrative approach (Romer & Romer, 2010). If the former technique lost some of its interest nowadays in academia (particularly, because of the Lucas', 1976, critique), recent work provides a comparison between the narrative approach and VARs (Mertens & Ravn, 2014).

[4] Additional work on fiscal multipliers in developed countries explores their sensitivity to accounting for expectations (Tenhofen & Wolff, 2007), the phase of the economic cycle (Auerbach & Gorodnichenko, 2013), the fiscal stance (particularly the debt-to-GDP ratio, Afonso & Sousa, 2012), the method of financing (ElSayed Kandil, 2013), the openness degree (Ilzetzki et al., 2013), and monetary conditions, including the presence of a liquidity trap (Woodford, 2011) or the type of the exchange rate regime (Corsetti et al., 2012).

However, compared to the large body of literature on developed countries, the contributions devoted to developing or emerging countries are remarkably scarce. Drawing upon a PVAR analysis on 27 developing countries, Ilzetzki & Végh (2008) find remarkably weak spending multipliers, namely 0.6 on impact, 0.4 after one year, 0.1 after two years and -0.1 after three years. Using an alternative methodology, based on the estimation of elasticities and regressions to identify fiscal shocks, IMF (2008) equally outlines weak expenditure multipliers, around 0.2 after one year, and equal to -0.2 after two years. Finally, if they corroborate previous studies by showing that impact and cumulative consumption multipliers are not significant in 24 developing countries, Ilzetzki et al. (2013) also find that, on the contrary, government investment multipliers are relatively high, namely 0.57 on impact and up to 1.6 cumulated after five years. Overall, these results illustrate a potential importance of the level of economic development and of the type of the fiscal shock, confirming the important current debate in the computation of fiscal multipliers (see, the survey of Hebous, 2011, and the recent critique of Blanchard & Leigh, 2013).

Such heterogeneities are the starting point of our analysis. To take a fresh look at fiscal multipliers, we focus on the Mediterranean Area, which provides a particularly appealing environment for reappraising fiscal multipliers, for many reasons. Indeed, the area allows reproducing, at a smaller scale, worldwide differences in the response of GDP to the Great Recession. Countries in the North-West of the Mediterranean Sea, including France, Spain, or Turkey, experienced negative growth rates in 2009. On the contrary, South-Eastern Mediterranean countries, such as Morocco, Israel, or Syria, conserved positive growth rates in 2009. Next, many Mediterranean countries adopted important fiscal stimuli. For example, major international institutions (including the IMF, the World Bank or the EU) provided bailout programs between around 40 billion euros in Spain to more than 200 billion euros in Greece since the beginning of the crisis. Alternatively, many countries adopted such fiscal packages at a national level, amounting around (in 2008 GDP) 1.75% in France, more than 5% in Italy, and above 6% in Turkey. Besides, regarding Northern Africa and Asian Mediterranean countries, the 2010 FEMIP-FEMISE report for the EIB emphasized the primary role of fiscal stimuli in conducting counter-cyclical macroeconomic policies, leading to an average increase of roughly 5 pp of the deficit-to-GDP ratio in 2009 relative to 2008. Finally, located around the Mediterranean Sea, Mediterranean countries are far from an entirely homogenous area. Economically, the area is composed of developed countries (France, Italy, or Spain) and emerging and developing countries (Croatia, Morocco, or Turkey), which allows bridging a gap

between the literature on developed and developing countries on the effect of fiscal multipliers: indeed, contrary to previous studies, the groups of developed and developing countries we study are more homogenous, since part of the same Mediterranean area. Geographically, Mediterranean countries are located on three continents (Europe, Asia and Africa), and some countries, Cyprus and Malta, are islands. Lastly, the Mediterranean area is a mixture of different cultures, traditions, religions, etc.

Accounting for such heterogeneities when computing fiscal multipliers is at the heart of our study. Specifically, we take advantage of the diversity of Mediterranean countries and disentangle them in several groups, based on economic and geographic criteria. European countries are divided into large-EMU countries who adopted the euro in 1999 or 2001 (Group 1: France, Greece, Italy and Spain) and small-EMU countries who joined the eurozone only recently (Group 2: Cyprus and Malta, in 2008). Next, Group 3 includes developing African countries: Egypt, Morocco and Tunisia. Finally, Group 4 considers developing Asian countries: Israel, Lebanon, Syria and Turkey.[5] We estimate for each group fiscal multipliers using the Panel Vector AutoRegressive (PVAR) method. Adapted for computing output response to exogenous fiscal shocks,[6] the PVAR method is particularly appropriate for our analysis. Indeed, compared to data for GDP and government consumption, data for government investment is available for a shorter time span; thus, drawing upon PVAR allows taking advantage of the panel dimension to increase the number of observations and estimate government investment multipliers, in addition to government consumption multipliers.[7]

Using annual data for 1980-2012, we find significant positive government consumption and investment multipliers for the entire Mediterranean area. However, as illustrated by our main analysis, and backed-up by several robustness tests, these results cover important heterogeneities among groups of countries. First, following an increase in public consumption or investment, output increases in several groups, according to the Keynesian multiplier effect outlined by the traditional ISLM model. Examples include impact or cumulative consumption

[5] Given the length of the civil war in Lebanon, we equally considered Group 4 without this country. In addition, except for Croatia and Slovenia, for which the existence of some data allows constituting the Group 5 of Former Republic of Yugoslavia (FRY) countries, the lack of data made us abstract from remaining Mediterranean countries.

[6] According to Smets & Wouters (2007), the VAR method is widespread in macroeconomics, and is often used as benchmark against non-VAR models. More recently, Marglin & Spiegler (2013) concluded that, compared to alternative techniques used to compute fiscal multipliers (for example, large-scale macroecononomic or DSGE models), VAR models are superior in fitting the data.

[7] Indeed, data for government investment is less available than for government consumption. Besides, given the lack of quarterly data for fiscal aggregates for the largest majority of Mediterranean countries, our analysis is performed on annual data.

(investment) multipliers in African (Asian) countries. However, in other cases, including consumption (investment) shocks in Asian (small-EMU) countries, output response is not statistically significant, in line with the famous Ricardian Equivalence Theorem of Barro (1974). Besides, we equally unveil anti-Keynesian effects: for example, the impact investment multiplier is negative in African countries, while for large-EMU countries we reveal a dynamic trade-off between short and medium-long-run effects (i.e. the cumulative multiplier increases and then decreases).

Second, we highlight the importance of the size of the economy and of the level of economic development. On the one hand, as suggested by the Mundell-Fleming model, fiscal multipliers are less significant and/or weaker in small economies (small-EMU or FRY countries), compared to large-EMU countries. On the other hand, the influence of the level of economic development is less straightforward, and particularly depends on the fiscal shock. Indeed, peak consumption multipliers are almost double in African compared to small-EMU countries, but peak investment multipliers are higher in large-EMU compared to African countries. Similarly, cumulative multipliers are much higher in large-EMU countries, but more persistent in developing countries (for example, the consumption multiplier in Africa or the investment multiplier in Asia).

Finally, we unveil differences both in size and significance of fiscal multipliers, mainly depending on the period or the fiscal shock. For example, one interesting result is the significance (at any time span) of cumulative consumption multipliers for African countries, and of cumulative investment multipliers for Asian countries. Moreover, large-EMU countries present larger short-medium-term multipliers compared to small-EMU countries, but the consumption multiplier is significant on the impact and in the long-run only in the latter group. In addition, we reveal particularly high fiscal multipliers. For example, for large-EMU countries, the peak investment multiplier equals 1.18, while cumulative multipliers are as high as 1.84 (government consumption) or 2.15 (government investment). These strong multipliers, i.e. above 1, show that important Keynesian effects might be at work in some groups of countries.

The policy implications of our analysis are numerous. Importantly, the effects of fiscal policy depend upon the characteristics of the group of countries (such as, large or small, developed or developing, etc.). Moreover, the type of fiscal stimulus is of crucial importance, since government consumption/investment shocks can foster, or not, output for the same group of countries. Finally, the magnitude of fiscal multipliers can largely differ among groups of

countries. Consequently, our study covering a wide range of heterogeneous areas emphasizes that fiscal policy must be adapted to economic specificities, and implemented particularly in areas with comparable characteristics to areas in which fiscal multipliers were found to be significant (and, preferably, of a high magnitude).

The rest of the paper is organized as follows. Section 2 presents the methodology and data, section 3 computes output reaction to fiscal shocks in the Mediterranean area, section 4 compares fiscal multipliers across groups of countries, section 5 provides several robustness checks, and section 6 concludes.

5.2. The econometric model and the dataset

5.2.1. The econometric model

The PVAR Model

Drawing upon the recent literature computing fiscal multipliers based on Blanchard & Perotti (2002)'s seminal paper, we estimate a VAR model. Specifically, we exploit the panel dimension within a VAR framework to estimate a Panel VAR (PVAR) model (see Canova & Ciccarelli, 2013, for a survey on PVARs). Indexing countries by $i = 1,...,N$ and time by $t = 1,...,T$, our structural model is

$$AX_{it} = B(L)X_{i,t-1} + Cu_{it}, \quad (1)$$

with X the vector of endogenous variables, A and $B(L)$, with L the lag operator, matrices describing simultaneous and lagged relationships between variables, respectively, and u_{it} the vector of errors, which is orthogonal since C is a diagonal matrix.

Multiplying (1) by the inverse of A, namely A^{-1}, we obtain

$$X_{it} = A^{-1}B(L)X_{i,t-1} + A^{-1}Cu_{it}, \quad (2)$$

which we write in reduced form as

$$X_{it} = aX_{i,t-1} + \varepsilon_t, \qquad \text{where } a = A^{-1}B(L) \text{ and } \varepsilon_t = A^{-1}Cu_{it}. \quad (3)$$

Since (3) can be estimated on groups of countries, it is particularly appropriate for cases in which the time dimension of data is relatively limited. In addition, we include fixed effects in every PVAR to account for time-invariant unobserved country-heterogeneity.

PVAR identification

Provided that all variables are $I(0)$, we draw upon PVARs to compute output response to fiscal shocks, using an impulse-response analysis. Then, an important issue, already highlighted in the literature, concerns the identification of truly exogenous fiscal shocks. To do so, we draw upon the conventional Cholesky decomposition (see, e.g., Fatas & Mihov, 2001; Ilzetzki et al., 2013), implying variables in PVAR to be ordered from the most to the least exogenous. To reproduce the features of the ISLM theoretical model, and particularly the fact that fiscal policy is predetermined, we order fiscal variables before output. Next, in the spirit of Musgrave (1939), Oxley & Martin (1991) and Alesina & Perotti (1997), among others, consider that public investment is easier to change than public consumption, mainly because changing public consumption is economically more difficult (since it encloses persistent functioning or transfer spending) or politically unpopular. To account for this evidence, we order consumption before investment.[8] Finally, the number of lags is chosen separately for each PVAR using information criteria.

The fiscal multiplier

The most common definition of a fiscal multiplier is the change in output due to a one-unit change in the considered fiscal variable. The recent literature (Spilimbergo et al, 2009; Gechert & Will, 2012) emphasized several types of multipliers, depending on the assumed horizon. We focus here on four types of multipliers. To see how output (ΔY) changes some periods after the fiscal shock (ΔS) occurred, we compute the multiplier at some future horizon T, namely $m_T = \frac{\Delta Y_T}{\Delta S_1}$ (for the initial period $T = 1$ we obtain the impact multiplier). Then, we investigate when output response is the strongest by identifying the largest, or peak, multiplier

[8] In addition, the robustness section presents results based on alternative ordering of fiscal variables.

$m^{\max} = \max_{\{T\}} \left\{ \frac{\Delta Y_t}{\Delta S_1} \right\}$, over a period T. Finally, we account for medium-long-term effects using the cumulative multiplier at T, computed as the ratio between the sum of changes in output and in the fiscal variable over the period 1 to T: $m_T^{CUM} = \sum_{t=1}^{T} \Delta Y_t \Big/ \sum_{t=1}^{T} \Delta S_t$.

Regarding the magnitude of multipliers, since IRFs are computed for a shock equal to one-standard deviation, we compute multipliers for a one-unit change in fiscal stimulus as $\frac{\Delta Y_t}{\Delta S_t} = \frac{IRF_t / \sigma_S}{\overline{(S/Y)}}$. In this expression, $\overline{(S/Y)}$ is the average ratio between the fiscal variable and GDP for the considered period, and σ_S is the standard deviation of the error of the fiscal variable.

5.2.2. Dataset

For the reasons explained in introduction, we focus on Mediterranean countries. Given the lack of quarterly data for African and Asian countries in our sample, we employ annual data. In most cases, estimations are performed for the 1980-2012 period. However, for some countries (Group 3), we stopped in 2010, namely previous to the beginning of major economic imbalances due to political tensions (particularly, the Arab Spring).

We measure fiscal multipliers using three endogenous regressors. On the one hand, an outcome variable, namely real output, obtained by applying the GDP Deflator (base 2005 for all countries[9]) to nominal GDP measured in local currency units (source WDI). On the other hand, we consider two fiscal policy variables, namely government consumption and government investment. The former is measured by real public consumption, obtained by applying the GDP Deflator to nominal government final consumption expenditure.[10] According to its definition in WDI, this series contains all government current expenditures for purchases of goods and services (including compensation of employees), as well as most expenditure on

[9] The base year for the GDP deflator depends on the considered country (see WDI for details). The 2005 common base was chosen since it was already the base year for most countries, while for remaining countries the deflator was recomputed to correspond to the 2005 base year.

[10] The use of the GDP deflator for public consumption and investment was decided based on its availability. However, whenever available, we alternatively used the CPI. We report that results remain remarkably stable.

national defense and security, but excludes government military expenditures that are part of government investment.

Contrary to GDP and government consumption, data on government investment was harder to obtain. For some countries, such as France, Greece, Italy or Spain, we drew upon OECD and EUROSTAT databases to obtain nominal government investment. Moreover, for other countries, including Egypt, Morocco, Syria, Tunisia and Turkey, we computed public investment as the difference between nominal gross fixed capital formation (GFCF) and nominal private GFCF (source WDI). Finally, for remaining countries, such as Malta, Cyprus, Israel, and, for 1980-1986, Turkey, we used IMF's GFS database, and measured it by nominal government capital expenditure. As for public consumption, we used the GDP Deflator to obtain real public investment.[11]

To deal with the non-stationarity problem, we defined yearly real growth rates of variables. As illustrated by Appendix A, we examined time-series properties of variables using three panel unit root tests, namely the Im, Pesaran & Shin (IPS, 2003) test, the Fisher-ADF test developed by Maddala & Wu (1999) and Choi (2001), and the Levin, Lin & Chu (LLC, 2002) test. Low p-values reported in Appendix A lead to the rejection of the null hypothesis of a unit root for growth rates of variables. Since series are stationary, we use them in the following to estimate PVARs and compute fiscal multipliers.

[11] Special attention was paid when combining data from different sources, or when computing public investment as the difference between total and private GFCF. For example, in the latter case, we compared our data with those from individual country reports (for example, for Morocco, Tunisia or Turkey), and did not unveil major differences between series.

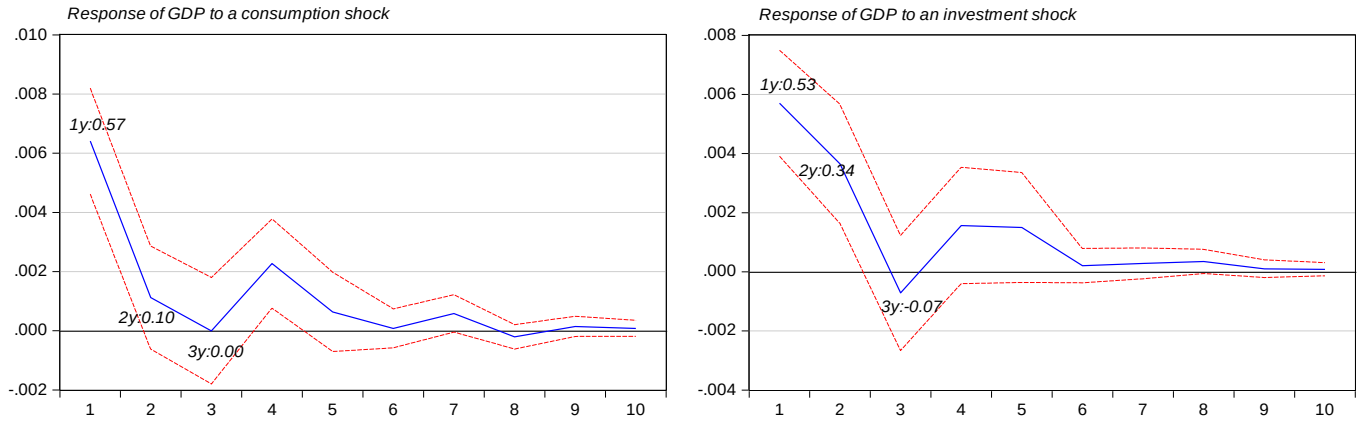
5.3. Fiscal multipliers in Mediterranean countries

We first present results for a PVAR for the entire Mediterranean area, followed by results for each group of countries.

5.3.1. Fiscal multipliers: the benchmark model

Our benchmark PVAR is estimated for all Mediterranean countries for which data were available for 1980-2012.[12]

Figure 1. Output response to fiscal shocks (benchmark)



Note for Figures 1-5: We report output response to a one standard-error shock on government consumption (left-hand side) and government investment (right-hand side). On each side are reported 90% confidence bands computed by Monte Carlo simulations with 1000 replications.

Based on the estimation of a PVAR with lag 4 (according to information criteria), Figure 1 depicts the response of GDP to a one standard-error increase in government consumption (left-hand side) and government investment (right-hand side), along with 90% confidence bands computed by Monte Carlo simulations with 1000 replications.[13] Following a positive consumption shock, output positively and significantly responds on impact. Moreover, output reaction remains positive and becomes again significant after four years, before dying out. Similarly, the response of GDP to an increase in government investment is positive and significant on impact. In addition, output is still positive and significant in the second period,

[12] Appendix D details data availability and sources for all countries.

[13] Figures illustrate that PVARs are correctly specified since IRFs return to zero. In addition, Appendix B shows that all roots of characteristic AR polynomials are inside the unit circle, confirming the stationarity of PVARs.

suggesting that the effects of investment shocks on output are more persistent than the effects of consumptions shocks. This latter result is confirmed when computing the magnitude of government consumption and investment multipliers: albeit they are fairly close on impact (around 0.55), the investment multiplier is three times larger than the consumption multiplier after one year (0.34 and 0.10, respectively). Finally, irrespective of the fiscal shock, peak multipliers correspond to first-year (or impact) multipliers.

Given that this paper is, to the best of our knowledge, the first to compute fiscal multipliers in Mediterranean countries, comparison with other studies must be done with caution. Even so, our government investment multipliers (obtained for a sample mixing developing and developed countries) are comparable to those emphasized by, for example, Ilzetzki et al. (2013), namely between 0.39 (developed countries) and 0.57 (developing countries) after one quarter. However, contrary to this study, we unveil public consumption multipliers of higher magnitude after one year.[14]

Starting from this benchmark model, the next two subsections compute multipliers for groups of countries identified using economic and geographic characteristics.

5.3.2. Fiscal multipliers in Mediterranean Europe

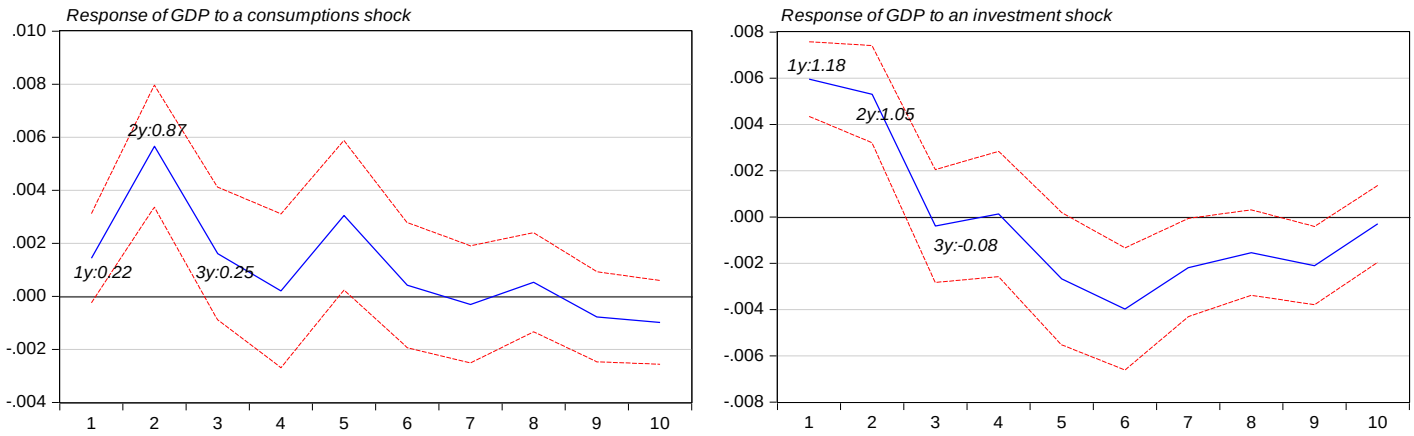
Mediterranean Europe is composed mostly of developed countries. To better capture fiscal multipliers, we divided them based on the year of adoption of the euro and the size of the country, and created two groups. Group 1 contains countries that adopted the euro from its very beginning in 1999, namely France, Italy and Spain, to whom we added Greece (who introduced it only 2 years latter, in 2001), and which are relatively large economies (Greece to a lesser extent). Group 2 includes Cyprus and Malta, who joined the eurozone in 2008,[15] and in addition are small countries.

Using information criteria, we selected the lag 4 for the PVAR for Group 1. Figure 2 reports IRFs of GDP to a one-standard error fiscal shock, and their confidence bands.

[14] In addition, our results remain robust if we move away from the optimal lag and use, for example, a lag of 2.

[15] Given its adoption of the euro in 2007, Slovenia might have also entered this group. Unfortunately, data are available only since 1990 (1995) for GDP and government consumption (investment).

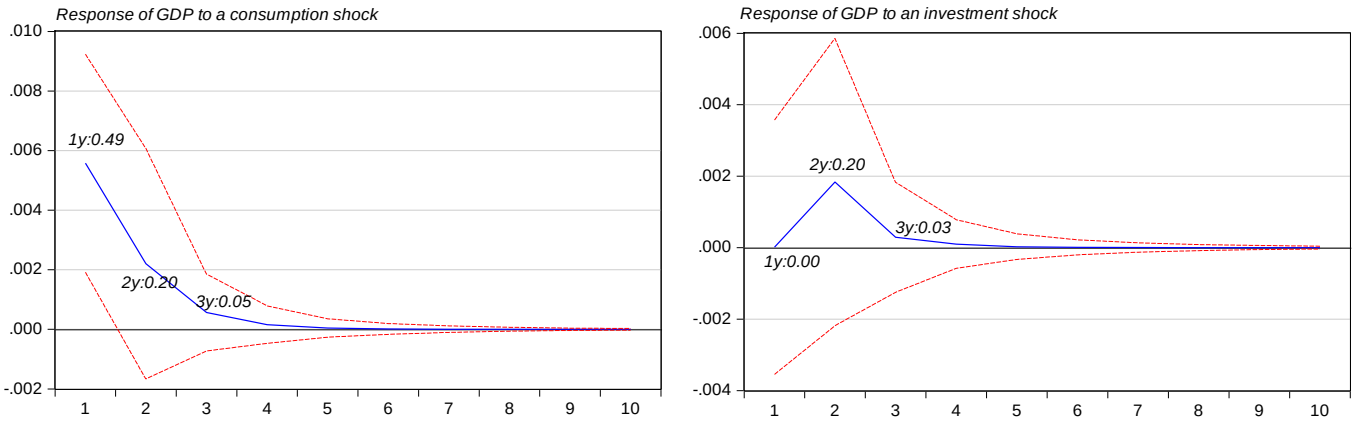
Figure 2. Output response to fiscal shocks in Group 1 (EMU-large)



Although positive, output response to a consumption shock is weakly significant on impact, but becomes significant in period 2 (and, to a lesser extent, in period 5). On the contrary, following a raise in investment, output significantly increases both on impact and in period 2, while it decreases in periods 6 to 9 (albeit the significance is weaker), and then dies out. Differences in output response to consumption and investment shocks are even more pronounced if we look at the magnitude of fiscal multipliers. Contrary to consumption multipliers, at most around 0.9 (period 2), investment multipliers are above unit in two periods (1.18 and 1.05 in the first and second year). In addition, albeit less significant, consumption multipliers are always positive, while for investment multipliers there seems to be a trade-off between significantly positive multipliers in the first periods (short-run) and significantly negative multipliers after roughly 5 years (medium-run).

Turning to Group 2 (Cyprus and Malta), Figure 3 illustrates output response from a PVAR with lag 1. Output response to a consumption shock is positive but significant only on impact, while never significant following an investment shock. In addition, fiscal multipliers are remarkably weak (for example, the peak investment multiplier equals only 0.20 and is not significant), and die out rapidly.

Figure 3. Output response to fiscal shocks in Group 2 (EMU-small)

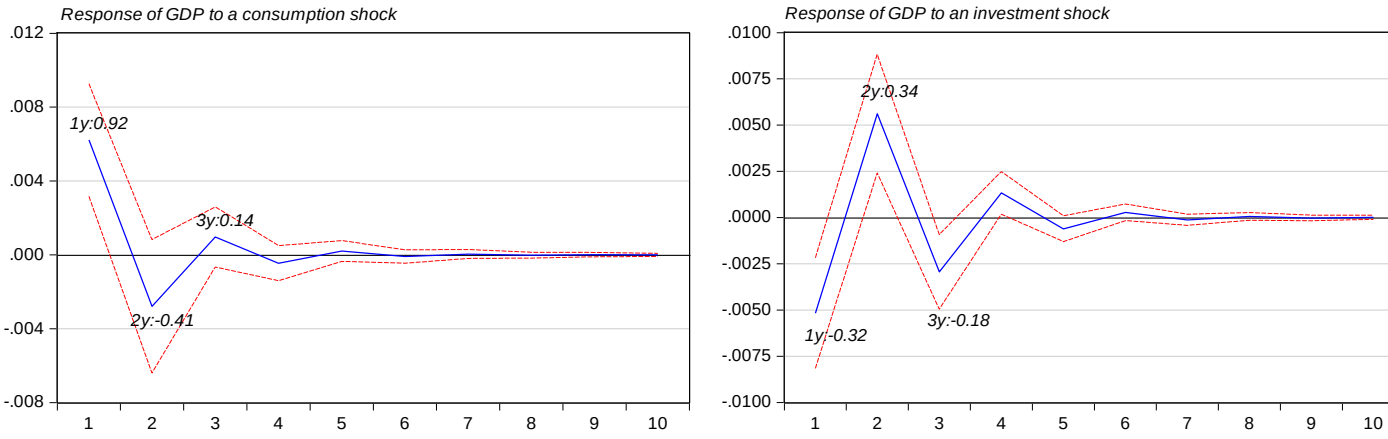


5.3.3. Fiscal multipliers in Mediterranean Africa and Asia

African and Asian Mediterranean countries are all emerging or developing countries. Because of scarcity of data, we drew upon a unique criterion, namely the geographic location, to distinguish among groups. Thus, Group 3 includes North-African countries (Egypt, Morocco and Tunisia), while Group 4 contains Asian countries (Israel, Lebanon, Syria and Turkey).

Let us first focus on Group 3. As previously emphasized, we stopped our sample in 2010, namely the year before the irruption of the Arab Spring. We estimate a PVAR with lag 1, and display in Figure 4 IRFs of output to fiscal shocks, and their 90% confidence bands.

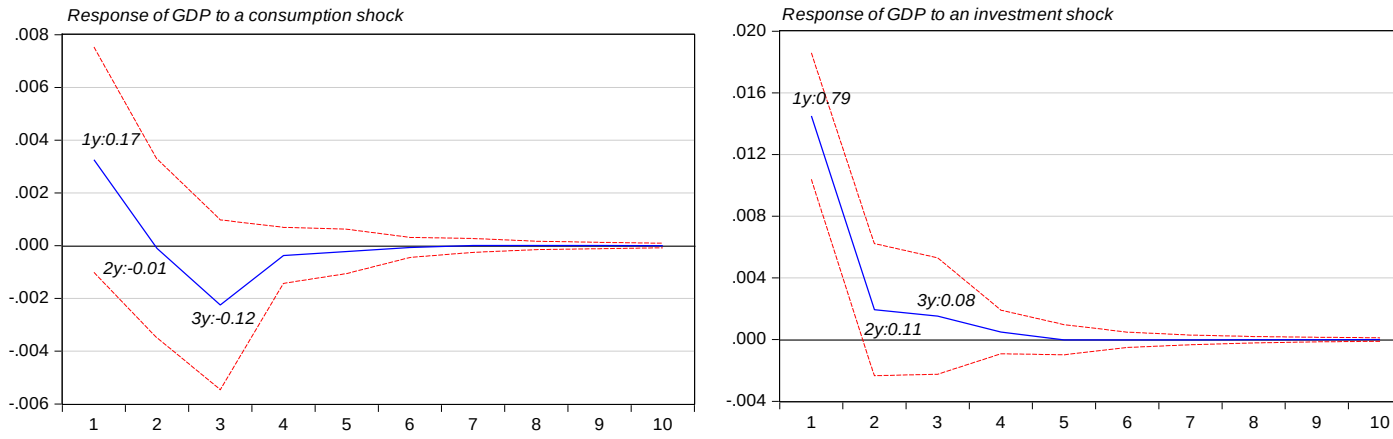
Figure 4. Output response to fiscal shocks in Group 3 (Africa)



Output response to a consumption shock is positive on impact, but not statistically significant starting period 2. On the contrary, output negatively responds on impact to an investment shock, and remains significant for the next 3-4 years. Such discrepancies equally arise for fiscal multipliers. Peak multipliers occur on impact for consumption, while in period 2 for investment shocks. The consumption multiplier is remarkably high in period 1 (0.92), while only between -0.32 and 0.34 for the investment multiplier. Indeed, consumption (investment) multipliers oscillate between positive (negative) and negative (positive) values roughly for the first five years, but only investment multipliers are statistically significant.

The last set of estimations focuses on Asian Mediterranean countries (Group 4).[16] Results based on a PVAR with lag 2 are reported in Figure 5. Output response to a public consumption shock is weak and never significant. On the contrary, output vigorously responds to a public investment change, as the impact multiplier equals 0.79 and is significant. However, output response turns into not significant starting year 2.

Figure 5. Output response to fiscal shocks in Group 4 (Asia)



[16] Due to the importance of the civil war and smaller data availability in Lebanon, we equally estimated the PVAR without this country. We report that results are consistent with conclusions in the main text.

5.4. Fiscal multipliers across Mediterranean groups of countries: A comparison

Capitalizing on the previous section, we provide a comparison between fiscal multipliers across groups of countries. We begin with short-term and peak multipliers, and then discuss cumulative multipliers.

5.4.1. Short term and peak multipliers

Table 1a presents short-run fiscal multipliers, namely on impact (y1), and after one (y2) and two (y3) years, as well as peak multipliers over the period (up to year 10). Results for the new Group 5 report output response to a consumption shock computed from a PVAR with lag 1 for two small FRY countries, namely Croatia and Slovenia (see also Appendix C).[17]

Table 1a. Short-run and peak fiscal multipliers

	y1-impact		y2		y3		peak	
	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.
All countries	0.57*	0.53*	0.10	0.34*	0.00	-0.07	0.57*	0.53*
G1 (EMU-large)	0.22	1.18*	0.87*	1.05*	0.25	-0.08	0.87*	1.18*
G2 (EMU-small)	0.49*	0.00	0.20	0.20	0.05	0.03	0.49*	0.20
G3 (Africa)	0.92*	-0.32*	-0.41	0.34*	0.14	-0.18*	0.92*	0.34*
G4 (Asia)	0.17	0.79*	-0.01	0.11	-0.12	0.08	0.17	0.79*
G5 (FRY-small)	0.61		-0.03		-0.02		0.61	

Note for Tables 1a-b: Government consumption and investment multipliers computed based on output response to changes in the corresponding fiscal variable estimated for each group of countries from the PVAR models in the previous section. * significant at the 10% level.

Regarding impact multipliers, the presence of positive and significant consumption multipliers for all Mediterranean countries (0.57) is driven by the group of small-EMU (0.49), and particularly by the group of African (0.92) countries. On the contrary, impact investment multipliers are significant only for large-EMU (1.18) and Asian (0.79) countries, and even negative for African countries (-0.32).

[17] The limited availability of government investment data (2009-2012 for Croatia) impeded computing investment multipliers. Moreover, since data for output and government consumption is available only for 1995-2012 (see Appendix D), consumption multipliers should be considered with caution.

Peak multipliers reveal that in most groups output positively and significantly responds to fiscal shocks at least in one period; exceptions are Asian and FRY countries for consumption shocks, and small-EMU countries for investment shocks. Remarkably, in large-EMU and in African countries, output significantly responds to both consumption and investment shocks, and the magnitude is higher for consumption (large-EMU), respectively investment (Africa) multipliers.

Last, short-run multipliers display little significance, with some exceptions. Regarding consumption multipliers, output increases by 0.87 for large-EMU countries. Regarding investment multipliers, output increases between 0.34 (Africa) and 1.05 (large-EMU), while it decreases by 0.18 (in y3) for African countries.

To summarize, regarding common patterns across groups of Mediterranean countries, peak multipliers are close to impact multipliers, suggesting that fiscal shocks are rapidly transmitted to output. The fact that fiscal multipliers are short-lived is confirmed by the lack of significance of virtually all multipliers in the short-run (y3). However, there are some exceptions, mainly in large-EMU and African countries, in which output response is significant even after 3-5 years.

Moreover, we unveil remarkable heterogeneities across groups of countries. First, fiscal multipliers are stronger and more significant in large-EMU, compared to small-EMU or small-FRY countries, confirming the predictions of the Mundell-Fleming model of lower effects in smaller and more open economies. Second, fiscal multipliers are quite opposite among African and Asian Mediterranean countries. Interestingly, output responds positively to consumption in Africa, but to investment in Asia on impact.[18] Third, in some groups, only one type of fiscal policy engenders a significant output response: only the consumption multiplier is significant in small-EMU, while only the investment multiplier in Asia.

Finally, output response to fiscal shocks differs both in sign and magnitude across groups. For example, although most investment multipliers are positive, we equally reveal negative investment multipliers in African countries, suggesting a possible crowding-out effect of public investment on private investment. In addition, large differences characterize the size of multipliers. For example, even when significant, peak consumption multipliers can be almost double in developing African countries (0.92) compared to developed small-EMU countries (0.49). These differences are even stronger for peak investment multipliers, estimated between 0.34 in developing African countries and up to 1.18 in developed large-EMU countries,

[18] Despite relatively weak consumption multipliers in y2 and y3, corroborating some findings of IMF (2008) or Ilzetzki & Végh (2008), we illustrate strong impact consumption multipliers in African developing countries.

suggesting that the level of economic development, probably correlated with the size of the country, can also play a role for fiscal multipliers. Remarkably, we emphasize investment multipliers above one (in years 1-2), coherent with the Keynesian theory, for the relatively closed and large-EMU economies.

5.4.2. Cumulative fiscal multipliers

In complement to peak and short-run multipliers, we now focus on cumulative multipliers.[19] Since we use annual data, we associate to short-, medium-, and long-run multipliers the cumulative multiplier at year 3, 5, and 10, respectively.

Table 1b. Cumulative and long-run fiscal multipliers

	y1-impact		y3 (short-run)		y5 (medium-run)		y10 (long-run)	
	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.
All countries	0.57*	0.53*	0.67*	0.80*	0.93*	1.09*	0.98*	1.18*
G1 (EMU-large)	0.22	1.18*	1.34*	2.15*	1.84*	1.65*	1.67	-0.35
G2 (EMU-small)	0.49*	0.00	0.74*	0.23	0.76*	0.24	0.76*	0.24
G3 (Africa)	0.92*	-0.32*	0.65*	-0.15	0.61*	-0.11	0.60*	-0.09
G4 (Asia)	0.17	0.79*	0.05	0.98*	0.02	1.00*	0.01	0.99*
G5 (FRY-small)	0.61		0.56		0.54		0.54	

Compared to static multipliers, cumulative multipliers in Table 1b present a more dynamic landscape of output response. Results for all countries show that, first, both consumption and investment multipliers increase in time and are significant at any time span. Second, albeit on impact output reacts more to a consumption (0.57) compared to an investment (0.53) shock, the latter multiplier becomes relatively more important starting y3 (0.80 versus 0.67). Third, both cumulative multipliers are close to one in the long-run, and the investment multiplier even climbs above unit (1.18). Nevertheless, as illustrated by Table 1b and Appendix C, results for the entire sample cover significant heterogeneities across groups of Mediterranean countries.

[19] We assume a zero-discount rate when computing cumulative multipliers. We report that results are comparable for small (for example, 2%) discount rates.

First, particularly in the groups of small countries, output response is never significant. This is the case, for example, for the consumption (investment) multiplier in small-FRY (small-EMU) countries.

Second, there exist several patterns for the significance of multipliers. Compared to the benchmark case in which multipliers are always significant, the investment multiplier is significant on impact but not in the following periods for African countries, while the consumption multiplier for large-EMU countries is not significant neither on impact nor in the long-run, but significant in the short-medium-run.

Third, some patterns equally emerge for the dynamic behavior on multipliers. Compared to the benchmark case or to groups of countries in which (i) cumulative multipliers always increase in time (investment multiplier in small-EMU), fiscal multipliers can (ii) always decrease in time (consumption multiplier in Africa), or (iii) present an inverted-U shape (consumption multiplier in large-EMU or investment multiplier in Asia). Consequently, the maximum cumulative multiplier arises at different time span: (i) in the long-run (investment multiplier in small-EMU); (ii) on impact (consumption multiplier in Africa); (iii) before the medium-run (roughly, in years 2-4, investment multiplier in large-EMU); or (iv) after the medium-run (roughly, in y8, consumption multiplier in large-EMU).

Fourth, the long-run persistence of output significant response differs both across groups and with respect to the fiscal shock. Consumption multipliers are still significant in the long-run for small-EMU and African countries, while only for Asian countries if we consider investment multipliers. Moreover, long-run fiscal multipliers are equally different in size. In particular, the long-run investment multiplier in Asian countries (0.99) is higher than the long-run consumption multiplier in small-EMU (0.76) and African (0.60) countries.

Overall, these results can be summarized as follows. In small countries, cumulative fiscal multipliers are often not significant (for example, investment (consumption) multipliers for small-EMU (FRY) countries). Besides, only in small-EMU countries the consumption multiplier is always significant, and quite important in the medium-long-run (0.76), showing that being part of the eurozone might have supported more Keynesian output responses to consumption shocks. Indeed, albeit not significant in the long-run, fiscal multipliers in large-EMU countries are remarkably high: the consumption multiplier equals 1.84 in the medium-

run and the investment multiplier is as high as 2.18 in y4.[20] Moreover, there is more than the level of economic development to explain the long-run significance and magnitude of multipliers: output significantly increases only following consumption shocks in developing African countries, but only following investment shocks in developing Asian countries. Finally, with respect to the standard ISLM model, we find evidence supporting Keynesian effects of fiscal policy in the medium-run (for example, significant consumption and/or investment multipliers in large- and small-EMU, and in African countries) and even in the long-run (for example, significant investment multipliers in Asian countries, consistent with the conclusions of the endogenous growth model with public investment of Barro, 1990). However, to an equal extent, we find no evidence of Keynesian effects in some groups of countries, as fiscal multipliers are never significant (for example, investment multipliers in large-EMU or consumption multipliers in Asian and FRY countries), coherent with the conclusions of the Ricardian Equivalence Theorem of Barro (1974). In addition, we even emphasize anti-Keynesian output responses to fiscal shocks, possibly related to crowding-out effects on private consumption and investment.[21] This is the case on impact and in the short-run for investment multipliers in African countries, while in large-EMU countries there seems to be a dynamic trade-off between output increase in the short-run and its decrease in the medium-long-run, for both consumption and investment shocks.

[20] High consumption multipliers in large-EMU countries are consistent with the work of Perotti (2005) or Beetsma et al. (2008). However, our investment multipliers are much larger than those emphasized by Ilzetzki et al. (2013) for high-income countries (which are below 1 in the short-run, and rapidly become not significant).

[21] Contrary to significantly impact or cumulative investment multipliers in developing countries in Ilzetzki et al. (2013), but consistent with the conclusions of Agnello et al. (2013), emphasizing that expansionary fiscal policies increase private consumption and investment in the short-run, but decrease them in the medium-run, in low- and lower-middle income countries.

5.5. Robustness

As previously acknowledged, our results are robust to several alternative specifications, namely for a lag different of the optimal lag, or when using (small) discount rates to compute cumulative multipliers. In the following, we consider several robustness tests.

5.5.1. Ordering of fiscal variables

In our main analysis variables were ordered as public consumption-public investment-GDP. If putting fiscal variables before GDP matches the traditional ISLM model, we account for the more mixed evidence on the exogeneity of public consumption relative to public investment, and present in Tables 2a-b fiscal multipliers based on PVARs in which we order public investment before public consumption.

Table 2a. Short-run and peak fiscal multipliers (alternative ordering of fiscal variables)

	y1-impact		y2		y3		peak	
	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.
All countries	0.55*	0.56*	0.08	0.34*	0.00	-0.07	0.55*	0.56*
G1 (EMU-large)	0.08	1.21*	0.74*	1.21*	0.25	-0.03	0.74*	1.21*
G2 (EMU-small)	0.49*	-0.09	0.22	0.16	0.05	0.02	0.49*	0.16
G3 (Africa)	0.95*	-0.30*	-0.44	0.34*	0.16	-0.18*	0.95*	0.34*
G4 (Asia)	0.16	0.79*	-0.01	0.11	-0.12	0.08	0.16	0.79*

Table 2b. Cumulative and long-run fiscal multipliers (alternative ordering of fiscal variables)

	y1-impact		y3 (short-run)		y5 (medium-run)		y10 (long-run)	
	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.
All countries	0.55*	0.56*	0.63*	0.83*	0.88*	1.13*	0.94*	1.23*
G1 (EMU-large)	0.08	1.21*	1.07*	2.38*	1.63*	1.99*	1.69	-0.02
G2 (EMU-small)	0.49*	-0.09	0.76*	0.09	0.78*	0.10	0.78*	0.10
G3 (Africa)	0.95*	-0.30*	0.66*	-0.14	0.62*	-0.10	0.61*	-0.09
G4 (Asia)	0.16	0.79*	0.04	0.98*	0.00	1.00*	0.00	1.00*

Note for Tables 2a-b: Government consumption and investment multipliers computed based on output response from PVARs, with the alternative ordering public investment-public consumption-GDP. * significant at the 10% level.

As illustrated by Tables 2a-b, irrespective of the type of multiplier (impact, peak, or cumulative) or the type of fiscal shock (consumption or investment), fiscal multipliers are remarkably close

in significance, sign and magnitude to their values in our main analysis, reported in Tables 1a-b. Thus, our results are robust to an alternative ordering of fiscal variables.

5.5.2. Control variables

Our main results are derived from PVARs composed of 3 variables (public consumption and investment, and GDP). We now extend PVARs' dimension by including, inside PVARs' structure, several control variables selected for their relevance, namely the current account, public debt, and inflation.[22] Tables 3a-b report fiscal multipliers based on PVARs augmented with control variables.[23]

Table 3a. Short-run and peak fiscal multipliers (control variables included)

	y1-impact		y2		y3		peak	
	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.
All countries	0.49*	0.37*	0.06	0.24*	-0.20	-0.06	0.49*	0.37*
G1 (EMU-large)	0.14	1.29*	1.01*	1.02*	0.42	-0.42	1.14*	1.29*
G2 (EMU-small)	0.37*	0.30	-0.02	0.15	0.44*	0.34	0.44*	0.34
G3 (Africa)	1.28*	-0.31*	-0.31	0.27*	0.04	-0.11	1.28*	0.27*
G4 (Asia)	0.20	0.77*	0.00	0.16	0.08	-0.09	0.20	0.77*

[22] These control variables are not available for FRY countries (G5), which we drop. Moreover, for small-EMU countries, we use the real effective exchange rate (REER) to capture competitiveness effects, given the lack of data for the current account. Appendix E details control variables' definitions and sources.

[23] We conserved the ordering of variables from the main analysis (namely, consumption before investment), followed by control variables ordered as: current account, public debt, and inflation.

Table 3b. Cumulative and long-run fiscal multipliers (control variables included)

	y1-impact		y3 (short-run)		y5 (medium-run)		y10 (long-run)	
	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.
All countries	0.49*	0.37*	0.35*	0.55*	0.20	0.37	0.06	-0.27
G1 (EMU-large)	0.14	1.29*	1.58*	1.89*	2.34*	1.50	3.14*	0.53
G2 (EMU-small)	0.37*	0.30	0.79*	0.79*	0.86	0.85	0.89	0.88
G3 (Africa)	1.28*	-0.31*	1.01*	-0.15	1.05*	-0.06	1.44*	0.03
G4 (Asia)	0.20	0.77*	0.29	0.85*	0.31	0.75*	0.31	0.77*

Note for Tables 3a-b: Government consumption and investment multipliers computed based on output response from PVARs extended to include control variables. G2 includes the REER instead of the current account. * significant at the 10% level.

Comparing Tables 1a-b with Tables 3a-b shows little difference regarding the significance, sign, and magnitude of fiscal multipliers, with two (minor) exceptions. First, the consumption multiplier for small-EMU countries is less persistent (not significant in y3), making corresponding cumulative multipliers not significant in medium-long-run. Second, long-run (medium-long-run) consumption multipliers are larger (above 1) for large-EMU (African) countries. These results comfort our previous findings of stronger multipliers in large, compared to small, countries, and of important consumption multipliers in African countries. Thus, accounting for current account, public debt, and inflation, allows confirming the robustness of our main findings.

5.5.3. Computation of main variables

Our main results are derived from PVARs based on growth rates of variables. From a wider perspective, these growth rates could be seen as the cyclical component of variables under the assumption that they follow a random walk (in logs). Alternatively, we can employ detrending methods that appropriately isolate the cyclical component of $I(1)$ series. In this paper, we compute these cyclical components using the most popular detrending method, namely the Hodrick-Prescott filter, with a smoothing parameter of 6.25 (Ravn & Uhlig, 2002, provide a

thorough discussion for the choice of this value for annual data). Tables 4a-b report fiscal multipliers based on PVARs on HP-detrended variables.[24]

Table 4a. Short-run and peak fiscal multipliers (HP-detrended variables)

	y1-impact		y2		y3		peak	
	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.
All countries	0.23*	0.54*	-0.07	0.21	-0.12	-0.35	0.23*	0.54*
G1 (EMU-large)	0.24*	1.14*	0.50*	0.80*	-0.34*	-0.53*	0.50*	1.14*
G2 (EMU-small)	0.12	0.08	-0.13	0.13	0.28	0.16	0.28	0.16
G3 (Africa)	1.26*	-0.34*	-0.59	0.16	-0.12	-0.11	1.26*	0.16
G4 (Asia)	0.16	1.32*	-0.03	-0.09	-0.17	-0.47*	0.16	1.32*
G5 (FRY-small)	0.69		-0.08		-0.39		0.69	

Table 4b. Cumulative and long-run fiscal multipliers (HP-detrended variables)

	y1-impact		y3 (short-run)		y5 (medium-run)		y10 (long-run)	
	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.	Cons.	Invest.
All countries	0.23*	0.54*	0.04	0.40*	0.14	0.25*	0.11	0.35*
G1 (EMU-large)	0.24*	1.14*	0.39	1.41*	-0.04	0.30	0.16	0.79*
G2 (EMU-small)	0.12	0.08	0.27	0.37	0.29	0.19	0.27	0.26
G3 (Africa)	1.26*	-0.34*	0.55	-0.29*	0.67*	-0.24*	0.66*	-0.26*
G4 (Asia)	0.16	1.32*	-0.05	0.76*	0.15	0.57*	0.10	0.70*
G5 (FRY-small)	0.69		0.22		0.40		0.38	

Note for Tables 4a-b: Government consumption and investment multipliers computed based on output response from PVARs, with variables computed by HP-detrending with a smoothing parameter of 6.25 for annual data. * significant at the 10% level.

Compared to our main findings from Tables 1a-b, the analysis based on HP-detrended series unveils the following results. First, fiscal multipliers are still weaker and less significant in the groups of small, compared to large, countries. Indeed, multipliers are never significant for small-EMU and FRY countries, contrary to large-EMU countries in which peak and cumulative multipliers are still significant and large (albeit some significance loss can be noted for cumulative consumption multipliers). Second, African and Asian countries still display

[24] Unit root tests confirm that HP-detrended series are stationary (results are available upon request).

different responses to fiscal shocks. Indeed, peak and most cumulative consumption (investment) multipliers are positive and significant for African (Asian) countries, and, remarkably, peak multipliers are now above unit. Finally, we obtain, yet again, negative investment multipliers in African countries, which corroborates previous findings of negative impact multipliers by illustrating negative cumulative investment multipliers in African countries at all horizons, including in the long-run. To summarize, using an alternative method to compute series, namely, the HP filter, leads to comparable conclusions, therefore confirming once again the robustness of our main findings.

5.6. Conclusion

To mitigate the negative effects of the current crisis, many governments around the world implemented large fiscal stimuli. This paper extends the literature by computing fiscal multipliers in groups of Mediterranean countries, which present the advantage of covering a wide range of economic and geographic contexts. Estimations based on the PVAR technique, backed-up by several robustness tests, unveiled important heterogeneities across groups of countries, depending on (i) economic characteristics, i.e. the size of the country or the level of economic development, (ii) geographical characteristics, i.e. the location of countries (Europe, Africa, Asia), (iii) the multiplier (impact, peak, cumulative), (iv) the time span (short-, medium-, long-run), and (v) the fiscal stimulus (government consumption or investment).

Such heterogeneities in fiscal multipliers clearly go against a common, unique, fiscal policy. Indeed, according to our analysis, such a policy could generate a wide range of conflicting outcomes, running from strongly Keynesian to important anti-Keynesian. To minimize such heterogeneities, two strategies might be of help. On the one hand, our results suggest that an output-enhancing fiscal policy should be implemented differentially, particularly according to the characteristics of each group of countries. On the other hand, our findings support the need for better cooperation. For the Mediterranean area, this is the underlying message of the creation, in July 2008, of the Union for the Mediterranean (UfM). Replacing the former Euro-Mediterranean Partnership (signed in 1995), the UfM aims at tightening relations between the EU and Southern and Eastern Mediterranean countries, in areas such as business, transport, and urban development, energy, water and environment, higher education and research, and social and civil affairs.

From a wider perspective, given the wide range of countries it covers (developed and developing, small or large, in a monetary union – eurozone – or with autonomous monetary policy), our study provides valuable lessons by highlighting the need for better fiscal policy cooperation among countries, aimed at generating higher cohesion, better convergence, and enhanced coordination (for example, in terms of trade, labor force mobility, monetary policies, or business cycle synchronization). Failing to do so might divert public resources to ineffective fiscal policies in some countries, or, on the contrary, deprive other countries of potentially high benefits of appropriate fiscal policies (in terms of growth, welfare, unemployment, etc.), including a reliable tool for exiting the current economic crisis.

Appendix

Appendix A. Unit root tests

Table A0. Unit root tests (benchmark – all countries)

Test	Im-Pesaran-Shin (IPS)		ADF-Fisher		Levin-Lin-Chu	
Series	constant	time trend	constant	time trend	constant	time trend
Real GDP growth rate	-17.97 (0.00)	-17.34 (0.00)	165.20 (0.00)	462.72 (0.00)	-22.82 (0.00)	-20.96 (0.00)
Real Gov. Consumption growth rate	-11.71 (0.00)	-11.87 (0.00)	162.97 (0.00)	169.67 (0.00)	-9.44 (0.00)	-10.35 (0.00)
Real Gov. Investment growth rate	-14.35 (0.00)	-13.06 (0.00)	212.74 (0.00)	180.53 (0.00)	-14.40 (0.00)	-12.77 (0.00)

Note: The null hypothesis of IPS, ADF-Fisher, and Levin-Lin-Chu tests is that the panel contains a unit root after controlling for country-fixed effects or for country-fixed effects and country-linear time trends. p-values reported in brackets.

Table A1. Unit root tests for macroeconomic series (Group 1 – France, Greece, Italy, Spain)

Test	Im-Pesaran-Shin (IPS)		ADF-Fisher		Levin-Lin-Chu	
Series	constant	time trend	constant	time trend	constant	time trend
Real GDP growth rate	-2.17 (0.01)	-1.34 (0.09)	19.18 (0.01)	17.94 (0.02)	-1.56 (0.05)	-2.53 (0.01)
Real Gov. Consumption growth rate	-5.38 (0.00)	-4.63 (0.00)	43.76 (0.00)	35.14 (0.00)	-4.03 (0.00)	-3.19 (0.00)
Real Gov. Investment growth rate	-6.24 (0.00)	-5.69 (0.00)	55.93 (0.00)	46.92 (0.03)	-7.22 (0.00)	-6.56 (0.00)

Note: The null hypothesis of IPS, ADF-Fisher, and Levin-Lin-Chu tests is that the panel contains a unit root after controlling for country-fixed effects or for country-fixed effects and country-linear time trends. p-values reported in brackets.

Table A2. Unit root tests for macroeconomic series (Group 2 – Cyprus, Malta)

Test	Im-Pesaran-Shin (IPS)		ADF-Fisher		Levin-Lin-Chu	
Series	constant	time trend	constant	time trend	constant	time trend
Real GDP growth rate	-3.92 (0.00)	-4.76 (0.00)	21.66 (0.00)	25.31 (0.00)	-3.85 (0.00)	-4.64 (0.00)
Real Gov. Consumption growth rate	-4.72 (0.00)	-5.89 (0.00)	27.73 (0.00)	31.37 (0.00)	-6.04 (0.00)	-7.03 (0.00)
Real Gov. Investment growth rate	-7.13 (0.00)	-6.83 (0.00)	42.26 (0.00)	37.06 (0.00)	-7.62 (0.00)	-7.02 (0.00)

Note: The null hypothesis of IPS, ADF-Fisher, and Levin-Lin-Chu tests is that the panel contains a unit root after controlling for country-fixed effects or for country-fixed effects and country-linear time trends. p-values reported in brackets.

Table A3. Unit root tests for macroeconomic series (Group 3 – Egypt, Morocco, Tunisia)

Test	Im-Pesaran-Shin (IPS)		ADF-Fisher		Levin-Lin-Chu	
Series	constant	time trend	constant	time trend	constant	time trend
Real GDP growth rate	-11.43 (0.00)	-11.15 (0.00)	69.88 (0.00)	127.67 (0.00)	-10.81 (0.00)	-9.72 (0.00)
Real Gov. Consumption growth rate	-4.96 (0.00)	-5.31 (0.00)	35.40 (0.00)	33.87 (0.00)	-4.46 (0.00)	-4.27 (0.00)
Real Gov. Investment growth rate	-9.88 (0.00)	-9.35 (0.00)	71.32 (0.00)	63.50 (0.00)	-8.72 (0.00)	-7.83 (0.00)

Note: The null hypothesis of IPS, ADF-Fisher, and Levin-Lin-Chu tests is that the panel contains a unit root after controlling for country-fixed effects or for country-fixed effects and country-linear time trends. p-values reported in brackets.

Table A4. Unit root tests for macroeconomic series (Group 4 –Israel, Lebanon, Syria, Turkey)

Test	Im-Pesaran-Shin (IPS)		ADF-Fisher		Levin-Lin-Chu	
Series	constant	time trend	constant	time trend	constant	time trend
Real GDP growth rate	-17.32 (0.00)	-16.32 (0.00)	61.59 (0.00)	296.17 (0.00)	-22.91 (0.00)	-20.55 (0.00)
Real Gov. Consumption growth rate	-11.06 (0.00)	-10.56 (0.01)	87.27 (0.00)	93.58 (0.00)	-8.32 (0.00)	-7.94 (0.00)
Real Gov. Investment growth rate	-7.43 (0.00)	-6.23 (0.00)	61.66 (0.00)	48.03 (0.00)	-7.27 (0.00)	-6.13 (0.00)

Note: The null hypothesis of IPS, ADF-Fisher, and Levin-Lin-Chu tests is that the panel contains a unit root after controlling for country-fixed effects or for country-fixed effects and country-linear time trends. p-values reported in brackets.

Table A5. Unit root tests for macroeconomic series (Group 5 – Croatia, Slovenia)

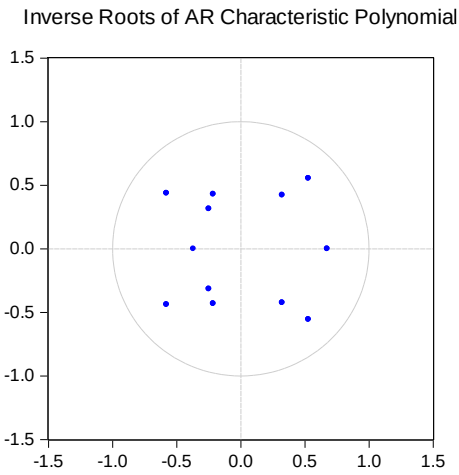
Test	Im-Pesaran-Shin (IPS)		ADF-Fisher		Levin-Lin-Chu	
Series	constant	time trend	constant	time trend	constant	time trend
Real GDP growth rate	-2.01 (0.02)	-1.39 (0.08)	11.31 (0.02)	9.01 (0.06)	-2.89 (0.00)	-3.03 (0.00)
Real Gov. Consumption growth rate	-3.58 (0.00)	-2.55 (0.00)	18.71 (0.00)	12.65 (0.01)	-3.93 (0.00)	-3.47 (0.00)

Note: The null hypothesis of IPS, ADF-Fisher, and Levin-Lin-Chu tests is that the panel contains a unit root after controlling for country-fixed effects or for country-fixed effects and country-linear time trends. p-values reported in brackets.

Appendix B. Inverse Roots of AR Characteristic Polynomials

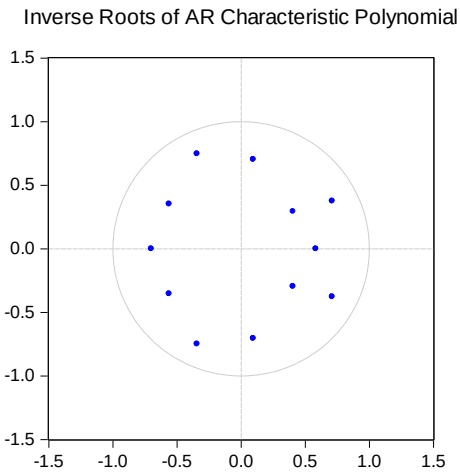
Benchmark PVAR (All countries)

PVAR with 4 lags (12 roots)



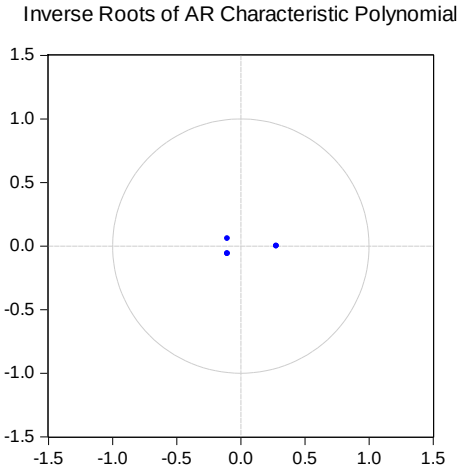
Group 1 (France, Italy, Greece, Spain)

PVAR with 4 lags (12 roots)



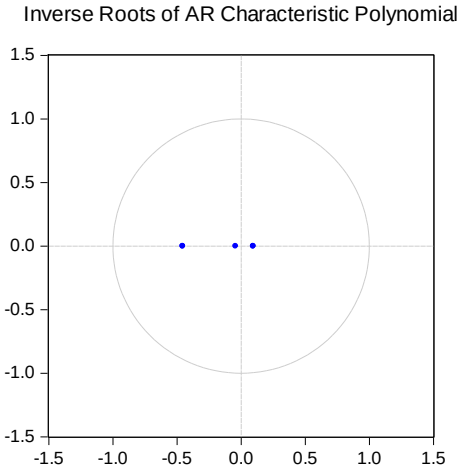
Group 2 (Cyprus, Malta)

PVAR with 1 lag (3 roots)



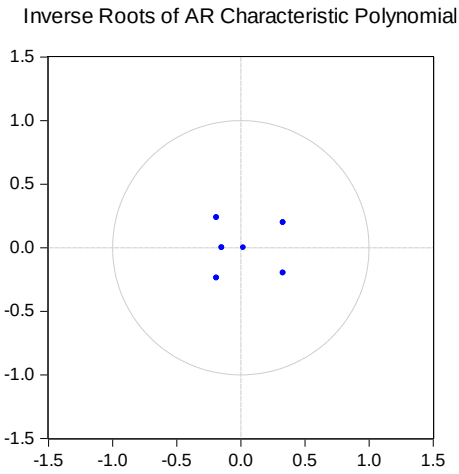
Group 3 (Egypt, Morocco, Tunisia)

PVAR with 1 lag (3 roots)



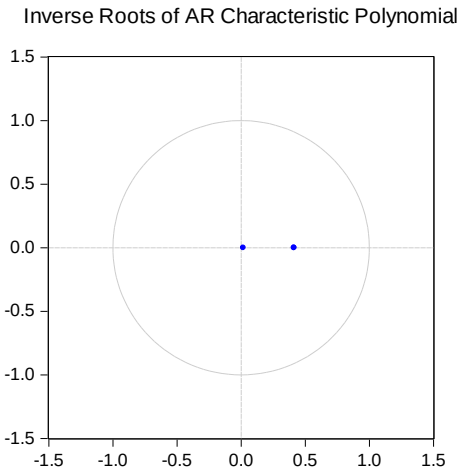
Group 4 (Israel, Lebanon, Syria, Turkey)

PVAR with 2 lags (6 roots)



Group 5 (Croatia, Slovenia)

PVAR with 1 lag (2 roots)



Appendix C. Cumulative fiscal multipliers

Figure C0. Cumulative multipliers for the Benchmark PVAR (all countries)

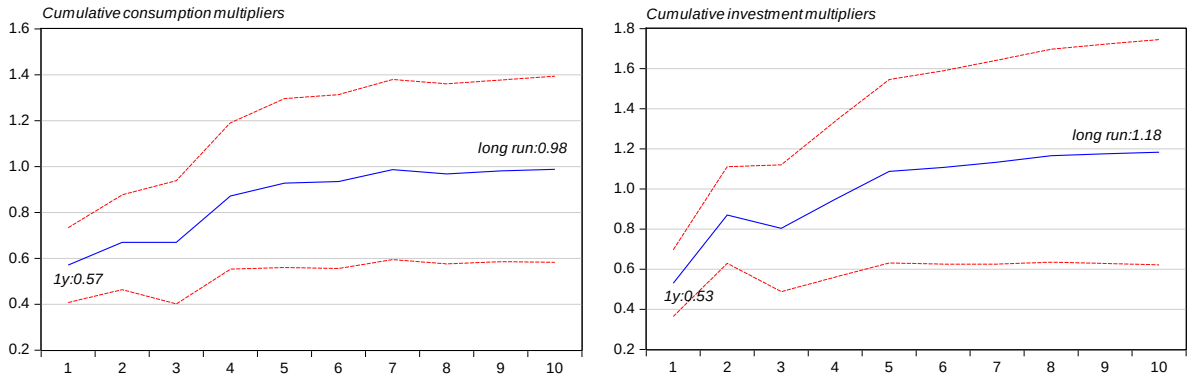


Figure C1. Cumulative multipliers for the Group 1 (France, Greece, Italy, Spain)

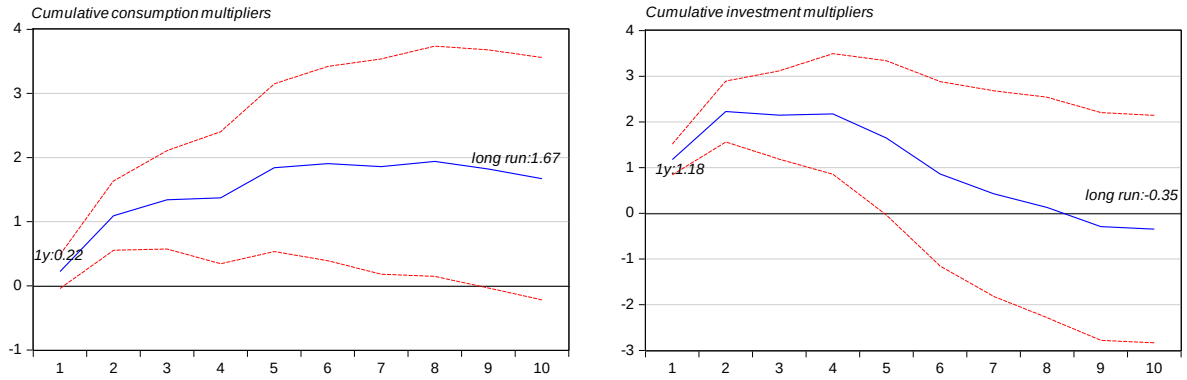


Figure C2. Cumulative multipliers for Group 2 (Cyprus, Malta)

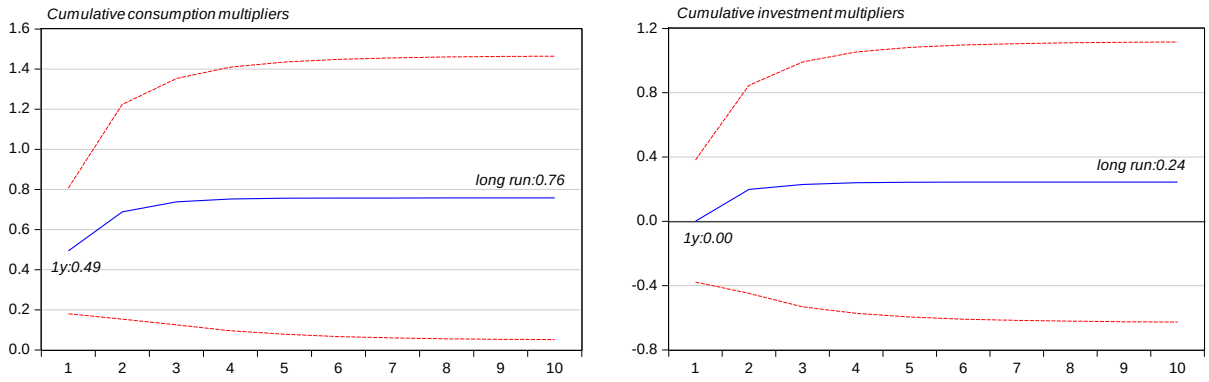


Figure C3. Cumulative multipliers for the Group 3 (Egypt, Morocco, Tunisia)

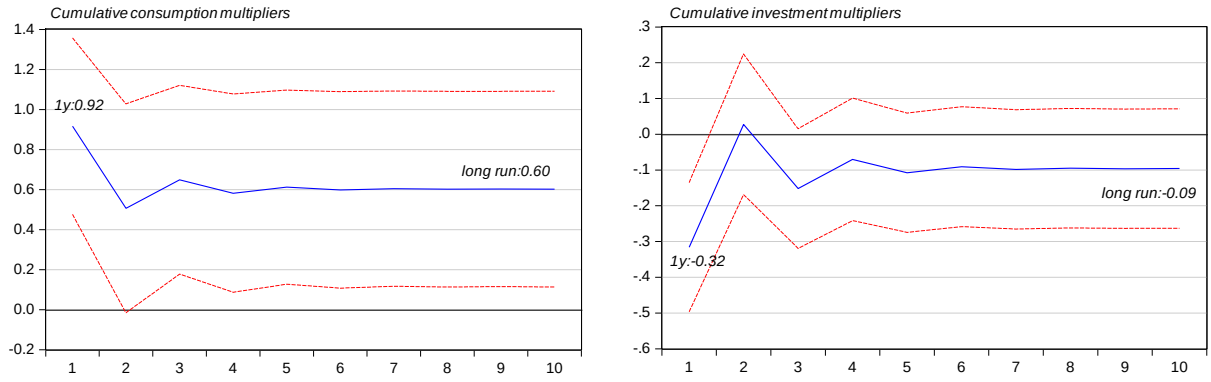


Figure C4. Cumulative multipliers for the Group 4 (Israel, Lebanon, Syria, Turkey)

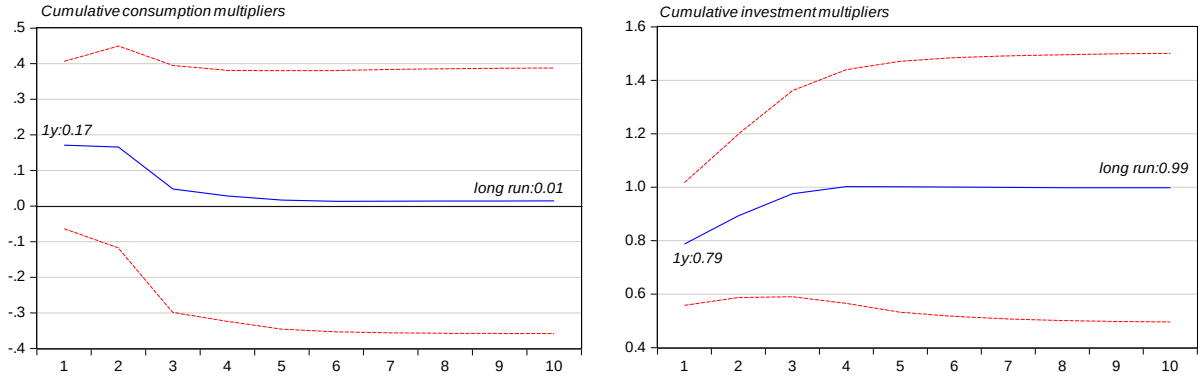
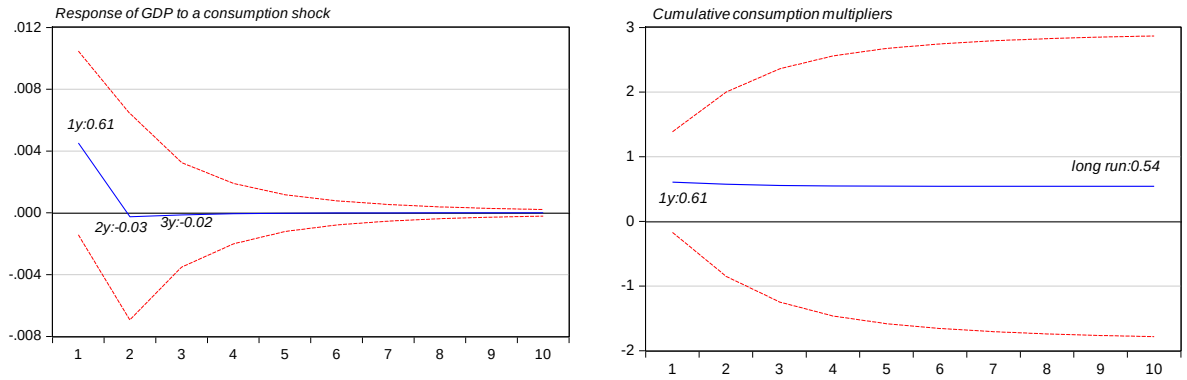


Figure C5. Output response to a consumption shock and cumulative multipliers for the Group 5 (Croatia, Slovenia)



Appendix D. Mediterranean countries and data sources

Country	GDP	Source	Government consumption	Source	Government investment	Source
Croatia	1995-2011	World Development Indicators	1995-2011	World Development Indicators	2009-2012	Eurostat
Cyprus	1980-2010		1980-2010		1980-2010	Eurostat; IMF
Egypt	1982-2010		1982-2010		1982-2010	WDI
France	1980-2012		1980-2012		1980-2012	Eurostat; OECD
Greece	1980-2012		1980-2012		1980-2012	Eurostat; OECD
Israel	1980-2012		1980-2012		1980-2012	IMF
Italy	1980-2012		1980-2012		1980-2012	Eurostat; OECD
Lebanon	1988-2012		1989-2012		1990-2012	WDI
Malta	1980-2011		1980-2011		1980-2011	Eurostat; IMF
Morocco	1980-2010		1980-2010		1980-2010	WDI
Slovenia	1990-2011		1990-2011		1995-2011	Eurostat
Spain	1980-2012		1980-2012		1980-2012	Eurostat; OECD
Syria	1980-2010		1980-2010		1980-2010	WDI
Tunisia	1980-2009		1980-2009		1980-2009	WDI
Turkey	1980-2012		1980-2012		1980-2012	WDI; IMF

Note: WDI stands for World Development Indicators.

Appendix E. Control variables

Variables	Descriptions	Source
CAB	% of GDP	IMF, WEO Database
Debt	% of GDP	IMF, Historical Public Debt Database
Inflation	Inflation (annual %) transformed in adjusted inflation computed as infl/(infl+1)	IMF, WEO Database
REER	Real effective exchange rate index (2005 = 100)	Eurostat Database

Chapter 6. Output Effects of Fiscal Stimulus in Central and Eastern European Countries

Output Effects of Fiscal Stimulus in Central and Eastern European Countries[1]

Abstract

In spite of the rapidly growing research on fiscal multipliers over the recent years, little evidence has been so far accumulated in developing and emerging economies. This paper investigates the nature and the size of fiscal multipliers in Central and Eastern European Countries (CEEC). Unlike most of existing literature, we draw upon a panel vector error correction model, which appropriately captures the common long-term path of CEEC, while allowing for different short-run dynamics, in an integrated setup. Our main results show that the spending multiplier is positive, but low on average. Moreover, its sign, significance and magnitude vary across CEEC. Finally, both impulse and cumulative fiscal multipliers are sensitive to a wide range of CEEC characteristics, including the exchange rate regime, the level of economic development, the fiscal stance, and the openness degree.

JEL Codes: E62, O11, P35

Keywords: Central and Eastern European Countries; fiscal multipliers; panel vector error correction model.

[1] A version of this chapter will be published as "Effects of Fiscal Stimulus in Central and Eastern European Countries"in *Post-Communist Economies,* and was written with J.L. Combes, A. Minea and T. Yogo.

6.1. Introduction

The fiscal multiplier has received a renewed attention since the recent financial crisis and the widespread fiscal stimulus implemented by many countries around the world. In spite of the rapidly growing research on fiscal multiplier over the recent years, so far little evidence has been accumulated in emerging and developing economies.[2]

In this paper, we develop the literature by investigating the effect of discretionary fiscal change on economic activity in 11 Central and Eastern European Countries (CEEC). CEEC share some specific characteristics that may affect the multiplier. Specifically, they are relatively small open economies with relatively low debt levels, and are currently implementing structural reforms that are more or less correlated with the accession to the European (Monetary) Union (E(M)U). In this respect, assessing the nature and the size of the effects of fiscal stimulus is of great interest to implement a more tailored fiscal policy.

The contribution of our paper is fourfold. First, unlike the existing literature that relies extensively on VAR models, our analysis uses a Panel Vector Error Correction model (PVECM), selected for its appealing features for CEEC. Indeed, on the one hand, all CEEC in our sample are expected to follow a common dynamic in the long-term, driven by their integration process in the E(M)U. As such, drawing upon methods that remove this long-term dynamic (for example, through first-differentiation, as this is the case in stationary VAR models), would significantly affect the estimation of fiscal multipliers. On the other hand, albeit following a common long-run path, CEEC may present different short-run dynamics. Models that do not account for such country-heterogeneities (such as PVAR) or abstract of the common long-run path (such as individual country-estimated VAR) are equally likely to produce biased estimations of fiscal multipliers. Consequently, unlike most studies, we take full advantage of the statistical properties of the data, and particularly of co-integration between variables, by using an error correction model on a panel data setting. This methodology is appropriate for computing both pooled and country-specific fiscal multipliers within the same framework, while controlling for the common long-run relationship between CEEC.

Second, a crucial issue is related to the identification of truly exogenous fiscal shocks. We define spending shocks as the cyclically-adjusted component of government spending. By so doing, we isolate an unexpected change in fiscal policy as the source of fiscal shocks. Third, we employ genuine (i.e. not interpolated) quarterly data for the period 1999q1-2013q3, which is fairly rare in the literature related to computing fiscal multipliers. Fourth, after presenting

[2] The next section discusses the contributions devoted to developing and emerging countries.

pooled and country-specific multipliers, we explore the sensitivity of the effect of fiscal policy by disentangling CEEC across several of their major characteristics, namely the exchange rate regime (ERR), the level of economic development, the fiscal stance, and the openness degree.

Our results are as follows. First, we find that impact and four-quarter cumulative multipliers are positive and significant for CEEC. Although the size of impact multipliers is fairly small, namely between 0.07 and 0.09 (depending on the estimation method), cumulative multipliers can be up to four times higher compared to impact multipliers, namely between 0.21 and 0.31. Second, we unveil significant differences among fiscal multipliers across CEEC. Although positive in most countries, impact and cumulative multipliers can be statistically not significant or even negative in some CEEC. In addition, the magnitude of cumulative multipliers differs by a factor of four between CEEC, and climbs up to a large value of 0.7. Third, we show that not accounting for a common (instead of country-individual) long-term path can leave to important significance and size differences for fiscal multipliers in several CEEC of our sample. Finally, both impact and cumulative fiscal multipliers are sensitive to CEEC specificities. Albeit the ERR is found to be unimportant for output's response to fiscal shocks on impact, the ERR affects its cumulative response; in particular, cumulative multipliers are significant in pegged and floating ERR, and not significant in intermediate ERR. Next, both impact and cumulative multipliers are mainly significant in relatively less developed CEEC and in CEEC with relatively lower debt-to-GDP ratios. Finally, consistent with the predictions of the Mundell-Fleming model, we find that cumulative multipliers are significant only in relatively less open CEEC.

The rest of the paper is structured as follows. Section II summarizes the findings of previous studies. Section III presents the data and outlines the methodology. Section IV illustrates the main results. Section V discusses the sensitivity of fiscal multipliers to several CEEC structural characteristics, and Section VI concludes.

6.2. Literature review

The major fiscal stimuli implemented by governments in response to the recent crisis reopened the topic of the multiplier in academia.[3] As pioneered by Keynes (1936), the multiplier predicts a more than 1 to 1 change in GDP following a fiscal shock. However, as emphasized by Blanchard and Leigh (2013), the International Monetary Fund (IMF) was significantly under-evaluating fiscal multipliers. According to Marglin and Spiegler (2013), such conflicting findings are engendered by the use of different methodologies, time span, type of government spending, and, according to Chahrour et al. (2012), different identification methods for fiscal shocks.

Indeed, the literature devoted to the estimation of fiscal multipliers is particularly rich, and involves the use of many methods. Theoretically, fiscal multipliers can be approached using (i) the ISLM model in its static (Hicks, 1937) and dynamic (Blanchard, 1981) forms, (ii) Real Business Cycle (RBC) models, developed under the New Classical economics (Long and Plosser, 1983), and (iii) New Keynesian Dynamic Stochastic General Equilibrium (DSGE) models (Gechert and Will, 2012). Econometrically, fiscal multipliers can be computed using (i) the Narrative Approach (Romer and Romer, 2010), (ii) the Vector AutoRegression (VAR) models (Blanchard and Perotti, 2002), (iii) single-equations models (Barro and Redlick, 2009), (iv) instrumental variables (Nakamura and Steinsson, 2014), (v) panel models (Almunia et al., 2010), and (vi) two-stage residual techniques (Agnello et al., 2013).

Due to the large strand of literature that focused on estimating fiscal multipliers, we present in the following the results of the studies that are the closest to our paper, by focusing on developing countries. Based on the estimation of elasticities and regressions to isolate fiscal shocks, IMF (2008) illustrates spending multipliers of 0.2 (-0.2) after one (two) years. Such low spending multipliers equally emerge from the PVAR analysis of Ilzetzki & Végh (2008), performed on 27 developing countries, namely 0.6/0.4/0.1 on impact/1st/2nd year. More recently, Kraay (2012, 2014) finds a spending multiplier of 0.5 (0.4) based on a sample of 29 (102) developing countries, while Ilzetzki et al. (2013) find public consumption multipliers equal to -0.03 (0.4) on impact (after 4 quarters). Finally, Minea & Mustea (2015) reveal short-lived impact and short-run fiscal multipliers for developing Asian and African Mediterranean

[3] At country level, many European countries took up bailout programs (30, 40, and 200 billion euros in France, Spain, and Greece, respectively). At supranational level, the EU and the US adopted fiscal packages of roughly 2% and 5% of their GDP for 2009-2010, respectively. According to the IILS (2011), fiscal stimuli during 2008-2009 were around 2 trillion USD for the G20 group, 9.1% of 2008 GDP in Asia and the Pacific (excluding Japan and South Korea), and 2.6% of 2008 GDP in Latin America and Caribbean.

countries. Overall, these studies emphasize that fiscal multipliers are fairly low in developing countries.

6.3. Data and Methodology

We aim at empirically assessing output effects of a discretionary fiscal policy in CEEC. We begin by presenting the data, and then we expose the methodology.

6.3.1. Data

We use quarterly data for a sample of 11 CEEC over the period 1999q1-2013q3 (see Tables A.1a-b in Appendix for the list of countries and descriptive statistics).[4] Except for Central Government debt, which is measured by the quarterly public sector debt of the World Bank, all data are from EUROSTAT.

Two main reasons justify the choice of quarterly data. First, as compared to annual data, the use of quarterly data is crucial for capturing the fact that fiscal authorities can respond to output shocks as rapidly as only after one quarter (Ilzetzki et al., 2013). Second, quarterly data provide a substantial increase in the number of degrees of freedom compared to annual data, an important feature given the relative small time span usually available for European post-communist economies (hardly 15 years, in our study). In particular, as pointed out by Ilzetzki et al. (2013), interpolated quarterly data may lead to spurious regressions since, by construction, the interpolation creates a strong correlation between government spending and output. Thus, we use only genuine quarterly data, namely data that were originally collected at quarterly frequency.[5]

Our main variables are the gross domestic product (GDP), the total government expenditure, defined as the sum of the general government final consumption and gross fixed capital formation, and taxes, which include taxes on imports and exports less subsidies. Prior to their use in regressions, all variables are deflated by the consumer index (CPI) and seasonally adjusted using a moving-average filter.

[4] Although collected data cover the period 1992q2-2013q3, our sample starts in 1999q1 for several reasons. First, we allow CEEC to stabilize from the major imbalances engendered by the end of the Cold War. Second, we obtain a balanced sample with data collected at quarterly frequency.

[5] Most EU countries comply with the Common statistical standard in the European Monetary Union (ESA95), which encourages the collection of fiscal data at quarterly frequency. As such, CEEC in our sample started collecting quarterly-frequency data only since 1995.

6.3.2. Time series properties of variables

We explore time series properties of variables using three types of panel unit root tests. On the one hand, the Augmented Dickey Fuller (ADF) Fisher-type test of Choi (2001) and the Im, Pesaran and Shin (IPS, 2003) unit root test, which both assume the null hypothesis that all panels contain a unit root against the alternative of at least one stationary panel. Compared to alternative tests (such as Levin, Lin and Chu, 2002), these tests present the advantages of allowing the autoregressive parameter to be country-specific and of not requiring panels to be strongly balanced. On the other hand, to account for the presence of a relatively weak number of countries and time dimension, which is inherent when analyzing CEEC, we equally draw upon the Levin, Lin and Chu (2002) unit root test.

Provided variables are integrated of the same order, we test in the following for cointegration. For this purpose, we revert to the cointegration tests coined by Westerlund (2007), which extend to panel data the time series test of Banerjee et al. (1998). These tests assume the null hypothesis of no cointegration. In particular, compared to alternative tests (such as, for example, the residual-based test of Pedroni, 2004), Westerlund (2007) tests were selected on the basis of allowing individual short-run dynamics and for remaining consistent in the presence of possibly serial-correlated errors and weak exogenous regressors.

6.3.3. The econometric model

In this sub-section, we discuss the error correction specification and the choice of the appropriate estimator. The use of the error correction framework can be justified both empirically and theoretically.

Empirically, the choice of the appropriate model strongly depends upon the statistical properties of the data. The existing literature on fiscal multipliers extensively resorts to the VAR methodology, either with country or panel data. However, the use of an error correction model is suitable when series are non stationary and cointegrated, as this is the case in our analysis.

From a theoretical standpoint, it is not unreasonable to assume that the effect of fiscal policy on output is not independent of the speed of adjustment to the long-run equilibrium, all the more given the common long-term path of CEEC, driven by their integration process in the E(M)U (see Nenovsky and Villieu, 2011). Therefore, it is suitable to account for the long-run equilibrium when assessing the response of output to the fiscal impulse.

In line with Pesaran et al. (1999), we assume an autoregressive distributed lag model (ARDL), with p lags for the dependent variable and q lags for each of the RHS variables

$$gdp_{it} = \sum_{j=1}^{p} \alpha_{ij} gdp_{it-j} + \sum_{j=0}^{q} \delta_{ij}' x_{it-j} + \mu_i + \varepsilon_{it}, \quad (1)$$

with $i = \overline{1,N}$ countries, $t = \overline{1,T}$ periods, gdp the log of real GDP, x_{it} the vector of explanatory variables, namely the log of government expenditure and of tax revenues, μ_i country-specific fixed effects, and ε_{it} the error term. Since our goal is to evaluate the effect of government spending on output, it is necessary to include taxes as a control variable, as spending are not independent of taxes (Blanchard and Perotti, 2002).[6]

Assuming that variables are I(1) and cointegrated, we reparameterise model (1) into the following error correction model (Pesaran et al., 1999)

$$\Delta gdp_{it} = \phi_i \left(gdp_{it-1} - \beta_i' x_{it} \right) + \sum_{j=1}^{p-1} \alpha_{ij}^{*} \Delta gdp_{it-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*\prime} \Delta x_{it-j} + \mu_i + \varepsilon_{it}, \quad (2)$$

where $\phi_i = -\left(1 - \sum_{j=1}^{p} \alpha_{ij}\right)$, $\beta_i = \sum_{j=0}^{q} \delta_{ij} / \left(1 - \sum_{k} \alpha_{ik}\right)$, $\alpha_{ij}^{*} = -\sum_{m=j+1}^{p} \alpha_{im}$, and $\delta_{ij}^{*} = -\sum_{m=j+1}^{q} \delta_{im}$. The first part of (2)–in levels–captures the long-run relationship, while the second part–in differences–illustrates the short-run adjustment to the long-run equilibrium. Parameter ϕ_i is the error-correcting term and measures the speed of adjustment. To validate the existence of a long-run relationship, this parameter should be negative and significant.

The literature suggests three main approaches for the estimation of model (2): (i) the dynamic fixed effect (DFE) estimator uses pooled data and allows the intercept to differ across groups; however, if the assumption of the common slope fails to hold, then the estimator is inconsistent; (ii) the pooling mean group estimator (PMG) combines both pooling and averaging; it assumes long-run coefficients to be equal across groups, but allows short-run coefficients to differ across groups, and (iii) the mean group (MG) estimator, which allows intercepts, slope coefficients and errors variances to differ across groups (Pesaran and Smith, 1995). In this paper, since we aim at capturing long-term dynamics, we start by using the DFE estimator. Then, we draw upon previous evidence and econometric tests to make the case for the use of the PMG estimator as the most appropriate for our sample of CEEC. Indeed, the use

[6] Prior to the adoption of this specification, we performed several estimations that included inflation, the real exchange rate or the interest rate as control variables. Since the inclusion of these controls does not significantly affect the coefficients of interest, we opted for this more parsimonious specification that has the merit of preserving substantial degrees of freedom, thus limiting the danger of biased estimates (see Pesaran and Smith, 1995).

of the PMG estimator will allow assessing the short-run dynamic of countries, while controlling for the long-run relationship between spending and output.

6.3.4. Building a measure of discretionary expenditure shocks

The main feature of the error correction model (2) is that short-run dynamics of variables are influenced by deviations from the long-run equilibrium. Thus, short-run coefficients capture output's responsiveness to fiscal policy adjustments with respect to the long-run equilibrium. However, there is no reason to believe that observed variations in fiscal policy are exogenous or unexpected. Usually, the related literature based on VAR models usually relies on a simple Cholesky-decomposition of shocks, in which identification arises from the ordering of variables. In this paper, we draw upon the methodology of Fatas and Mihov (2003, 2006), Afonso et al. (2010) and Agnello et al. (2013), and construct a measure of discretionary fiscal policy as follows.

Assuming that public spending can be decomposed into a structural (anticipated) and a residual (non-anticipated) component, we define discretionary spending shocks as the cyclically-adjusted component of government spending, which reflects unexpected fiscal policy changes. For each of 11 CEEC in our sample, we estimate the following model using quarterly data over the period 1999q1-2013q3

$$\log(G_{it}) = \alpha_i + \beta_i \log(G_{it-1}) + \gamma_i ogap_{it} + \delta_i debt_{it} + \xi_{it} trend + \varepsilon_{it}, \qquad (3)$$

with G total government spending, $ogap$ the output gap (based on the Hodrick-Prescott-filtered log of real GDP), $debt$ the central government debt in % of GDP, and $trend$ the time trend. Consequently, we capture spending shocks through the residuals ε.

Equation (3) differs from the specification of Fatas and Mihov (2003) and Agnello et al. (2013). Indeed, following Blanchard (1993), and closely related Fatas and Mihov (2006), we estimate equation (3) in levels. In addition, compared to Fatas and Mihov (2006) who use GDP growth, we employ the output gap to capture the business cycle, for the following reasons. Output gap has the advantage of controlling for the degree of inflation pressure. Next, it also captures the state of unemployment, because a zero output gap corresponds to full employment. Moreover, a negative output gap suggests the existence of available excess capacities, while the crowding-out of private investment may be independent of the sign of the GDP growth rate. Finally, we control for fiscal policy sustainability and for the persistence of the responsiveness

of fiscal policy to the business cycle, using the debt-to-GDP ratio and lagged government spending, respectively.

6.4. Fiscal multipliers in CEEC: Main results

6.4.1. Stationarity and cointegration

To assess the stationarity of our main variables, we report in Table 1 the results of the Fisher-ADF, IPS and LLC unit root tests. We include in the auto-regressive specification of each test both the trend and the intercept, to test for both difference and trend stationarity. As illustrated by Table 1, the log of real GDP, total government expenditure and tax revenues are nonstationary, since, irrespective of the test, we cannot reject the null hypothesis of the presence of a unit root. In addition, as emphasized by low p-values, these variables are stationary in first-difference, once again irrespective of the considered test. Since variables are integrated of the same order, we look in the following for potential cointegration relations among them.

Table 1: Unit root tests

Variables	**ADF**		**IPS**		**LLC**	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
Log(real GDP)	**Z**: 3.78	0.99	**W-T-bar**: 3.61	0.99	**T***: 2.11	0.98
	Pm: -0.21	0.58				
D(Log of real GDP)	**Z**: -3.12	0.00	**W-T-bar**: -3.30	0.00	**T***: -7.20	0.00
	Pm: 6.51	0.00				
Log(Total Government Expenditures)	**Z:** 5.11	1.00	**W-T-bar:** 5.23	1.00	**T***: 0.84	0.80
	Pm: -2.34	0.99				
D(Log(Total Government Expenditures))	**Z**: -2.04	0.02	**W-T-bar**: -2.05	0.01	**T*:**-7.70	0.00
	Pm: 2.13	0.01				
Log(Taxes revenues)	**Z**: 2.56	0.99	**W-T-bar**: 2.18	0.98	**T***: 2.80	0.99
	Pm: -2.19	0.98				
D(Log(Taxes revenues))	**Z**: -9.50	0.00	**W-T-bar**: -14.4	0.00	**T***: -15.93	0.00
	Pm: 19.1	0.00				

Note: Z is the inverse normal statistic, Pm is the modified inverse chi-squared. The null hypothesis is "all panel contain a unit root". The specification includes a trend and an intercept. We use 4 lags following the AIC test.

To assess cointegration, we draw upon Westerlund's (2007) tests. These tests assume the null hypothesis of no cointegration, against four different specifications of the alternative hypothesis: the group mean test and its asymptotic version, which consider the alternative

hypothesis that the panel is cointegrated as a whole, and the panel mean test and its asymptotic version, which consider the alternative hypothesis that there is at least one cross-section unit for which the series are cointegrated. To preserve the consistency and the size accuracy in the case of cross-sectional dependence, we carry out the tests using bootstrap with 1000 replications. Table 2 provides the results of testing for a potential cointegration relationship between real GDP, government expenditure and taxes. Irrespective of the considered test, low p-values in Table 2 support the presence of cointegration between variables.

Table 2: Westerlund (2007) cointegration tests

Statistic	Value	Z-value	P-value
Gt	-2.896	-3.100	0.003
Ga	-13.982	-2.568	0.003
Pt	-8.476	-2.706	0.033
Pa	-10.233	-2.591	0.039

Note: Gt and Pt are respectively the group mean test and the panel mean test. Ga and Pa refer to the asymptotic version of the test. The null hypothesis is "no cointegration". We use 3 lags following the AIC test.

Given that series in level are all I(1) and co-integrated, we will draw in the following upon an error correction models to compute output's response to spending shocks.

6.4.2. Fiscal multipliers in CEEC countries: full sample

To estimate fiscal multipliers, we proceed in three steps. First, we isolate public spending shocks. Table 3 illustrates the results of the OLS estimation of equation (3), for each of the 11 CEEC in our sample.[7] As signalled by positively-significant coefficients of output gap, government expenditure is pro-cyclical in all (but Croatia) CEEC in our sample, consistent with previous evidence on developing and emerging countries (see Dalic, 2013). Furthermore, non significant or positive debt coefficients suggest that the adjustment in response to indebtedness takes place more likely through an adjustment of taxes than of public spending. Finally, irrespective of the considered country, fairly high R2 values support the quality of our specification for purging most of anticipated public spending, and isolate public spending shocks through the country-specific error terms.

[7] Fatas and Mihov (2003) noticed that using OLS or IV in this first-stage regression leads to comparable results. We tested several specifications, in which output gap is generated alternatively using one and three GDP lags, to avoid reverse causality. We report that we did not unveil significant changes in our results (estimations are available upon request).

Table 3: Estimates of the discretionary component of the fiscal policy

Dependent variable: Log(Total Government expenditure)	Bulgaria	Croatia	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Log(Total Government expenditure),t-1	0.882***	1.100***	0.740***	0.968***	0.745***	0.857***	0.905***	0.682***	0.526***	0.765***	0.846***
	(0.0999)	(0.0393)	(0.0999)	(0.0476)	(0.0817)	(0.0846)	(0.0848)	(0.0949)	(0.0747)	(0.0932)	(0.0686)
Output gap	1.134**	0.00541	0.541***	0.339**	0.826***	0.327*	0.475**	0.568***	1.464***	0.512**	0.441*
	(0.552)	(0.180)	(0.187)	(0.161)	(0.267)	(0.173)	(0.222)	(0.195)	(0.273)	(0.226)	(0.259)
Real debt of the central government % GDP	0.0192		0.0237*	0.238***	0.0247**	-0.0291	0.0322	-0.0321	0.0609	-5.67e-05	-0.0105
	(0.0116)		(0.0125)	(0.0725)	(0.0106)	(0.0390)	(0.0227)	(0.0199)	(0.0547)	(0.0118)	(0.0133)
Time trend	0.00197	-0.00237***	0.00263*	-0.00114	-0.00207***	0.00122	0.000443	0.00382***	0.00213**	0.00286***	0.000267
	(0.00214)	(0.000546)	(0.00149)	(0.000791)	(0.000685)	(0.00180)	(0.00158)	(0.00134)	(0.000976)	(0.000998)	(0.000366)
Constant	1.878	-1.617**	4.676**	0.541	4.703***	2.318*	1.555	5.991***	8.542***	3.998**	2.662**
	(1.581)	(0.658)	(1.783)	(0.740)	(1.493)	(1.324)	(1.354)	(1.792)	(1.339)	(1.610)	(1.180)
Observations	46	42	50	51	51	51	51	51	43	50	51
Adjusted R-squared	0.969	0.991	0.992	0.988	0.877	0.960	0.981	0.936	0.960	0.980	0.951
F-stat	348.9	1488	1457	1053	89.78	301.8	643.8	183.3	255.0	607.5	245.9

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Debt data is unavailable for Croatia.

Second, we use these recovered shocks as a measure of unanticipated public spending in the estimation of the error correction model. However, drawing upon residuals from another equation in the error correction model may lead to biased estimates. Therefore, we correct standard errors using the Jackknife resampling procedure, which consists of repeatedly computing standard errors, by omitting each time one observation.[104] In our specific case, to take into account both individual and time variability, the statistics are computed leaving out one country.[105]

The first column of Table 4 reports the results of the error correction model used to compute the effects of unanticipated public expenditure on output for the full sample of 11 CEEC, based on the dynamic fixed effect (DFE) estimator with four lags, as suggested by AIC tests. Several points must be highlighted. The error correction term is significant and negative, thus supporting our modelling strategy. Next, the fourth lag of unexpected expenditure is significant, consistent with the tests for the choice of the optimal lag. Finally, our strategy of controlling for tax revenues is supported by their significant coefficients. Based on this model, we compute in the following fiscal multipliers.

[104] Note that performing a standard bootstrap would underestimate time variability in our analysis.

[105] In addition, this procedure allows detecting outliers using Jackknife pseudo-values (Mooney and Duval, 1993). This is a particularly appealing feature, given that the estimator we use is sensitive to outliers especially when the cross-section dimension is weak (Pesaran et al., 1999).

Table 4: Output's response to fiscal policy

	DFE	PMG
Long Run		
Log(Real GDP)		
Error correction term	-0.0386***	-0.0375*
	(0.0121)	(0.0220)
Log(Total Government expenditure)	0.223	0.829***
	(0.326)	(0.0652)
Log(Tax revenues)	0.545**	-0.231***
	(0.262)	(0.0763)
Short Run		
D(Log(Real GDP))		
D(Log(Real GDP),t-1)	0.796***	0.626***
	(0.0543)	(0.0701)
D(Log(Real GDP),t-2)	-0.759***	-0.183*
	(0.0597)	(0.0962)
D(Log(Real GDP),t-3)	0.659***	0.216***
	(0.0684)	(0.0681)
D(Log(Real GDP),t-4)	0.0516	-0.00700
	(0.0575)	(0.0781)
D(Log(Unexpected Government expenditure))	0.0283***	0.0401***
	(0.00759)	(0.0112)
D(Log(Unexpected Government expenditure),t-1)	0.00755	-0.00515
	(0.00906)	(0.00879)
D(Log(Unexpected Government expenditure),t-2)	0.0465***	0.0109
	(0.00820)	(0.00719)
D(Log(Unexpected Government expenditure),t-3)	0.0141	0.0189
	(0.0114)	(0.0119)
D(Log(Unexpected Government expenditure),t-4)	0.0358***	0.0253***
	(0.00447)	(0.00416)
D(Log(Tax revenues))	0.220***	0.221***
	(0.0312)	(0.0283)
D(Log(Tax revenues),t-1)	-0.0589***	-0.00177
	(0.0203)	(0.0219)
D(Log(Tax revenues),t-2)	0.0954***	-0.0101
	(0.0211)	(0.0177)
D(Log(Tax revenues),t-3)	-0.0744***	0.000766
	(0.0197)	(0.0243)
D(Log(Tax revenues),t-4)	-0.0909**	0.00451
	(0.0425)	(0.0292)
Constant	0.219***	0.294*
	(0.0599)	(0.169)
Observations	482	482
Number of countries	11	11
Log Likelihood		1942
Hausman Test p-value		0.1842

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Total government expenditure captures the discretionary component of government spending (the residuals of equation (3)). Standard errors are corrected using the Jackknife procedure. The null hypothesis of the Hausman test is that countries share a common long-run trend. The p-value of this test equals 0.18, thus accepting the null hypothesis and suggesting that the PMG estimator is preferred.

The third and last step consists of computing fiscal multipliers. Following the related literature, we focus on two multipliers. On the one hand, we compute the impact multiplier as $\mu^0 = \frac{\Delta Y_t}{\Delta G_t} = \frac{m_0}{\overline{(G/Y)}}$, with $m_0 = \frac{\Delta gdp_t}{\Delta exp_t}$ the derivative of the log of GDP with respect to the log of expenditure, and $\overline{(G/Y)}$ the average expenditure-to-GDP ratio. On the other hand, we compute the cumulative multiplier over four quarters (1 year) as $\mu^4 = \frac{M_4}{\overline{(G/Y)}}$, with $M_4 = \sum_{k=0}^{4} m_k$ and $m_k = \frac{\Delta gdp_t}{\Delta exp_{t-k}}$.

For the full sample model, $m_0 = 0.0283$ (see Table 4) and $\overline{(G/Y)} = 0.4280$ (see Table A.2a in the Appendix), leading to an impact multiplier equal to 0.07. Since the multiplier is significant (see Table 5), we find that, in other words, an increase of 1 unit in government expenditure increases GDP by 0.07 units. In addition, to account for a possible delay in output's response to the fiscal stimulus, we compute the cumulative multiplier. Given that $M_4 = 0.1323$ (see Table 4), the one-year cumulative multipliers equals 0.31 (and is significant, see Table 5). These findings call for two remarks.

First, although spending multipliers are positive and significant, their magnitude is weak. As such our results for emerging CEEC are consistent with previous studies emphasizing fairly small multipliers in developing countries.

Second, note that these values are based on the DFE estimator. However, this estimator rests on the assumption that all CEEC in our sample share a common long-term path and a common short-run dynamic. Regarding the latter, there are several reasons making the assumption of a common short-run dynamic unrealistic. Indeed, for example, given that some CEEC in our sample integrated the EU in 2004, others in 2007, and other did not integrate the EU yet, and the fact that our sample mixes CEEC that adopted the euro with CEEC that did not, we allow in the following for different short-run dynamics for the CEEC in our sample. Regarding the former assumption, we draw upon the Hausman Chi-2 test, which tests the null hypothesis of a common long-term coefficient against the alternative of different coefficients. Based on the associated p-value equal to 0.18 (see the bottom of Table 4), we accept the null hypothesis of a common long-term path for the CEEC in our sample. Consequently, in the following, our baseline specification assumes a common long-term path and different short-run dynamics, by using the Pooled Mean Group (PMG) estimator.

PMG-based estimated impact and cumulative multipliers equal 0.09 and 0.21, respectively, and are significant. Thus, accounting for different short-run dynamics slightly increases output's response on impact, but decreases it by roughly one-third cumulated for four quarters. In what follows, we draw upon PMG estimators to compute country-specific fiscal multipliers.

Table 5: Impact and cumulative fiscal multipliers for the full sample

	Dynamic Fixed Effects (DFE)		Pooling Mean Group (PMG)	
Multiplier	Value	Std Dev	Value	Std Dev
Impact	0.07***	0.01	0.09***	0.02
Cumulative	0.31***	0.07	0.21**	0.07

Note: *** p<0.01, ** p<0.05, * p<0.1.

6.4.3. Fiscal multipliers in CEEC: country-evidence

One of the key contributions of this paper is to provide both full sample (aggregate) and country estimates of the fiscal multiplier within a unique framework. Based on PMG estimations of the effect of public expenditure on output (see Table 6), Table 7 reports fiscal multipliers for each of the 11 CEEC in our sample (Table A.2a in the Appendix presents country-specific descriptive statistics for public expenditure).

Table 6: Pooling Mean Group (PMG) country-estimates of the effect of public spending on output

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Short run coefficient by country											**LR**
Dependent variable: GDP per capita growth	Bulgaria	Croatia	Czech R.	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia	
Log(Real GDP)												
Log(Total Government Expenditure)												0.813***
												(0.0702)
Log(Tax revenues)												-0.221***
												(0.0823)
Error correction term	-0.119***	-0.0940***	0.000599	-0.0227**	-0.0578**	-0.0243*	-0.0578***	-0.0279*	-0.176***	-0.00662	-0.0508**	
	(0.0368)	(0.0240)	(0.00480)	(0.00900)	(0.0247)	(0.0135)	(0.0131)	(0.0145)	(0.0396)	(0.00915)	(0.0219)	
D(Log(Real GDP))												
D(Log(Real GDP),t-1)	0.725***	0.264*	1.023***	0.403**	0.879***	0.765***	0.505***	0.646***	0.491***	0.925***	0.471***	
	(0.137)	(0.139)	(0.153)	(0.160)	(0.144)	(0.146)	(0.123)	(0.155)	(0.128)	(0.152)	(0.107)	
D(Log(Real GDP),t-2)	-0.575***	-0.0670	-0.417	0.317*	-0.364*	-0.232	0.0587	-0.0642	-0.542***	-0.546***	-0.160	
	(0.189)	(0.135)	(0.254)	(0.188)	(0.194)	(0.156)	(0.148)	(0.205)	(0.164)	(0.181)	(0.115)	
D(Log(Real GDP),t-3)	0.640***	0.242**	0.391	-0.0865	0.334*	0.358**	-0.0993	0.209	0.227	0.505***	0.124	
	(0.177)	(0.119)	(0.241)	(0.180)	(0.193)	(0.157)	(0.148)	(0.183)	(0.204)	(0.191)	(0.115)	
D(Log(Real GDP),t-4)	0.365*	-0.257***	-0.0208	-0.175	-0.226*	-0.290**	0.00684	-0.181	0.399***	-0.169	0.387***	
	(0.200)	(0.0843)	(0.143)	(0.140)	(0.134)	(0.121)	(0.130)	(0.127)	(0.152)	(0.153)	(0.0986)	
D(Log(Unexpected Government Expenditure))	0.00652	0.0598***	0.0975***	0.0465***	0.0249	0.0122	0.0619***	0.0470***	-0.0214	0.0384	0.0818***	
	(0.0153)	(0.0102)	(0.0264)	(0.0113)	(0.0169)	(0.0129)	(0.0146)	(0.0112)	(0.0181)	(0.0239)	(0.0151)	
D(Log(unexpected Government expenditure),t-1)	0.0159	-0.0172	0.0130	0.0201	-0.0152	-0.0285**	0.0174	0.0133	-0.0726***	-0.0553***	0.00515	
	(0.0157)	(0.0129)	(0.0287)	(0.0129)	(0.0167)	(0.0124)	(0.0182)	(0.0148)	(0.0182)	(0.0202)	(0.0179)	
D(Log(Unexpected Government expenditure),t-2)	0.0211	-0.00433	0.0945***	-0.000310	0.0137	-0.0103	-0.0103	0.0441***	0.00902	0.0488**	7.50e-05	
	(0.0139)	(0.0163)	(0.0248)	(0.0121)	(0.0190)	(0.0127)	(0.0170)	(0.0154)	(0.0222)	(0.0241)	(0.0180)	
D(Log(Unexpected Government expenditure),t-3)	0.0170	-0.0428***	0.0832***	0.0508***	0.0115	-0.0200*	0.0432***	0.00540	-0.0276	-0.0104	0.0433**	
	(0.0115)	(0.0154)	(0.0248)	(0.00904)	(0.0158)	(0.0119)	(0.0160)	(0.0130)	(0.0226)	(0.0214)	(0.0177)	
D(Log(Unexpected Government expenditure),t-4)	0.0292***	0.0153	0.0436*	0.0371***	0.0172	0.0428***	0.0367***	0.0432***	0.0163	0.0326	-0.00970	
	(0.00973)	(0.0132)	(0.0247)	(0.0111)	(0.0190)	(0.0120)	(0.0109)	(0.0127)	(0.0185)	(0.0214)	(0.0145)	
D(Log(Tax revenues))	0.122***	0.350***	0.0890**	0.173***	0.247***	0.229***	0.242***	0.241***	0.366***	0.124**	0.244***	
	(0.0467)	(0.0361)	(0.0415)	(0.0300)	(0.0744)	(0.0387)	(0.0539)	(0.0491)	(0.0701)	(0.0485)	(0.0453)	
D(Log(Tax revenues),t-1)	-0.145**	0.133**	9.90e-05	-0.0639	-0.0400	-0.0176	0.0913	0.0267	0.0356	-0.0382	0.0644	
	(0.0610)	(0.0618)	(0.0463)	(0.0403)	(0.0777)	(0.0494)	(0.0612)	(0.0608)	(0.0909)	(0.0521)	(0.0418)	
D(Log(Tax revenues),t-2)	0.0921	-0.0435	-0.0671	0.0392	-0.0614	0.0732	-0.00154	-0.0823	-0.0295	0.00764	-0.0358	
	(0.0723)	(0.0592)	(0.0507)	(0.0451)	(0.0818)	(0.0470)	(0.0605)	(0.0579)	(0.0596)	(0.0589)	(0.0401)	
D(Log(Tax revenues),t-3)	-0.0866	0.151***	-0.0439	0.131***	-0.0642	-0.0135	-0.110*	-0.0234	0.0492	-0.00398	0.0440	
	(0.0710)	(0.0470)	(0.0490)	(0.0420)	(0.0798)	(0.0464)	(0.0588)	(0.0562)	(0.0534)	(0.0532)	(0.0395)	
D(Log(Tax revenues),t-4)	0.000854	0.136***	-0.0807*	0.0989**	0.107	-0.0399	0.0365	0.0160	-0.127**	0.0669	-0.178***	
	(0.0542)	(0.0490)	(0.0475)	(0.0386)	(0.0771)	(0.0457)	(0.0650)	(0.0520)	(0.0612)	(0.0560)	(0.0369)	
Constant	-0.899***	0.731***	-0.00248	0.161**	0.465**	0.177*	0.434***	0.241*	1.412***	0.0538	0.387**	
	(0.272)	(0.182)	(0.0383)	(0.0630)	(0.198)	(0.0975)	(0.0960)	(0.124)	(0.295)	(0.0696)	(0.169)	
Observations							482					
Log likelihood							1939					
Number of countries							11					

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Total government expenditure captures the discretionary component of government spending.

Table 7a: Fiscal multipliers by country (PMG estimator)

Multiplier	Impact	Std dev	Cumulative	Std dev
Bulgaria	0.02	0.03	0.07	0.10
Croatia	0.13***	0.02	0.07	0.10
Czech Republic	0.21***	0.04	0.68***	0.16
Estonia	0.10***	0.02	0.29***	0.05
Hungary	0.06*	0.04	0.07	0.13
Latvia	0.03	0.03	-0.01	0.09
Lithuania	0.15***	0.03	0.34**	0.11
Poland	0.12**	0.03	0.35**	0.11
Romania	-0.05*	0.03	-0.18**	0.08
Slovakia	0.09**	0.04	-0.01	0.10
Slovenia	0.19***	0.03	0.29**	0.09

Note: *** p<0.01, ** p<0.05, * p<0.1.

Analogous to estimations for the pooled sample, we present results for both impact and cumulative multipliers. Let us discuss impact multipliers. First, regarding sign differences, although most multipliers are positive, we equally reveal statistically not significant multipliers (for example, in Bulgaria or Latvia), and even a negative impact multiplier in Romania (albeit weakly significant). Second, we emphasize magnitude differences across multipliers in CEEC: for example, the impact multiplier in Czech Republic and Slovenia is roughly four times higher compared to Romania (in absolute value), and roughly two times higher if we stick to significant positive multipliers, for example in Estonia and Poland.

Such sign and magnitude heterogeneities equally arise if we consider the cumulated response of GDP to fiscal shocks after four quarters. On the one hand, cumulative multipliers are positive in most countries, and remain non significant in Bulgaria or Hungary. However, we now find negative multipliers in three out of the eleven countries of our sample, namely Latvia, Romania and Slovakia. On the other hand, the magnitude of cumulative multipliers is stronger compared to impact multipliers; for example, the multiplier is around 0.3 in four countries (Estonia, Lithuania, Poland and Slovenia), and even as high as 0.7 in Czech Republic.

These results call for two remarks. On the one hand, recall that multipliers were computed based on a model that assumed a common long-term path and different short-run dynamics among CEEC. If the fact of not accounting for the long-term path (for example, like in PVAR models) is an obvious drawback, we can illustrate the differences induced by not accounting for a common trend by comparing our results with mean group (MG) estimates, which assume different long-term paths (in addition to different short-run dynamics) among CEEC (see Table A.5 in the Appendix for MG estimated coefficients).

Table 7b: Fiscal multipliers by country (MG estimator)

Multiplier	Impact	Std dev	Cumulative	Std dev
Bulgaria	-0.04	0.04	0.07	0.12
Croatia	0.13***	0.03	0.02	0.16
Czech Republic	0.05	0.06	-0.05	0.26
Estonia	0.10**	0.03	0.32***	0.07
Hungary	0.02	0.05	0.01	0.19
Latvia	0.11**	0.04	0.41**	0.18
Lithuania	0.17***	0.04	0.55**	0.18
Poland	0.11**	0.04	0.31**	0.15
Romania	-0.01	0.05	0.06	0.15
Slovakia	0.02	0.06	0.03	0.15
Slovenia	0.15**	0.04	0.26**	0.13

Note: *** p<0.01, ** p<0.05, * p<0.1.

Compared to Table 7a, Table 7b emphasizes significant difference for both impact and cumulative multipliers. Focusing on impact multipliers, not accounting for a common long-term path would (i) overestimate their significance in Latvia and underestimate it in Czech Republic, Slovakia, and, to some extent, in Romania, and (ii) overestimate their size in Latvia and underestimate it in Czech Republic and Slovakia. These differences are reinforced regarding cumulative multipliers. For example, not accounting for a common long-term path would (i) overestimate their significance in Latvia and underestimate it in Czech Republic, Romania and Slovakia, and (ii) overestimate their size in Latvia and Lithuania, and underestimate it in Czech Republic and in Romania (particularly for Romania, the estimated coefficient would be positive, instead of significantly negative).

On the other hand, country-evidence unveils important short-run heterogeneities across CEEC. Consistent with the standard ISLM model, we emphasize Keynesian effects of fiscal policy both on impact and after one year, in most of CEEC in our sample. However, in several countries we do not find significant multipliers, neither on impact (for example, in Bulgaria and Hungary), nor cumulated after four quarters (for example, in Bulgaria and Latvia), in line with the Ricardian Equivalence Theorem of Barro (1974). In addition, we even find anti-Keynesian effects of fiscal policy on output, in the form of negative multipliers (for example, in Romania on impact, and in Latvia, Romania and Slovakia cumulated after four quarters). Thus, even if CEEC are expected to converge in the long-run towards a common steady-state, the dynamic of their output following fiscal shocks might be quite different. This calls for a closer look at specificities at work in CEEC.

6.5. Fiscal multipliers in CEEC: Conditionality upon structural characteristics

Heterogeneities in output's response to fiscal policy unveiled in the previous section are probably related to economic and structural differences among CEEC. In the following, we analyze the sensitivity of multipliers to such differences.

We consider four structural characteristics of CEEC. First, we seize differences in monetary policy by considering alternatively countries with fixed (pegged), intermediate and flexible exchange rate regime (ERR), using the classification of Ilzetzki et al. (2010) reported in Table A.3 in the Appendix. Second, to account for the level of economic development, we divide CEEC using the level of income (average over 1999:q1-2013:q3), into low- and high-income CEEC, respectively. Third, we capture the fiscal stance using the public debt[106] to distinguish among low-debt CEEC (with a debt ratio of 22% of GDP on average over 1999:q1-2013:q3) and high-debt CEEC (with an average debt ratio of 48% of GDP for the same period).[107] Finally, we take into account the openness degree using the level of exports in percentage of GDP, and, accordingly, we divide CEEC into countries with relatively low and high openness degree, respectively. Table 8 presents the countries in each group.

Table 8: List of groups of countries based on CEEC' structural characteristics

	Exchange Rate Regime (ERR)			**Level of income**		**Public Debt (%GDP)**		**Openness degree (%GDP)**	
	Pegged	**Intermediate**	**Floating**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Group mean	**-**	**-**	**-**	**5.25e+07**	**2.84e+08**	**22.42**	**48.29**	**45.11**	**69.25**
	Bulgaria	Croatia	Poland	Bulgaria	Czech R.	Czech R.	Bulgaria	Bulgaria	Czech R.
	Estonia	Czech R.	Romania	Croatia	Hungary	Estonia	Croatia	Croatia	Estonia
	Lithuania	Hungary		Estonia	Poland	Latvia	Hungary	Latvia	Hungary
	Slovenia	Latvia		Latvia	Romania	Lithuania	Poland	Lithuania	Slovakia
		Slovakia		Lithuania	Slovakia	Romania	Slovakia	Poland	Slovenia
		Slovenia		Slovenia		Slovenia		Romania	

Based on Table 8, Table 9 presents the estimations of the effect of unexpected government spending on output using the PMG estimator,[108] and Table 10 reports the associated multipliers (Table A.2b in the Appendix presents descriptive statistics for each group of countries).

[106] We use the gross consolidated debt of the central government (the same measures is used, for example, by Ilzetzki et al., 2013).

[107] We split countries based on the median public debt to GDP ratio for the sample period 1999:q1-2013:q3. Considering median public debt, instead of an exogenous threshold of 60% (as suggested by the Maastricht Treaty), is justified by the fact that in our sample only Hungary presents a debt ratio above this threshold.

[108] Since the lag structure changes across structural characteristics, and due to the loses in degrees of freedom, we set the number of lags equal to 4 (the same is done by Ilzetzki et al., 2013, in their analysis based on quarterly data).

Table 9: PMG estimates of the effect of unexpected government spending on output when accounting for CEEC' structural characteristics

	Full model	Exchange Rate Regime (ERR)			Level of income		Public debt (% of GDP)		Openness degree	
		Pegged	Intermediate	Floating	Low	High	Low	High	Low	High
Long Run										
Log(Real GDP)										
Error correction term	-0.0375*	-0.0121	-0.182**	0.0452	-0.0260	-0.170***	-0.0766	-0.0905**	0.0101	-0.125
	(0.0220)	(0.0414)	(0.0751)	(0.0769)	(0.0328)	(0.0551)	(0.0845)	(0.0418)	(0.00907)	(0.0777)
Log(Total Government Expenditure)	0.829***	1.146***	0.772***	0.809***	0.899***	0.130***	0.677***	0.281***	2.779	0.581***
	(0.0652)	(0.107)	(0.0314)	(0.114)	(0.0559)	(0.0502)	(0.0373)	(0.0918)	(1.827)	(0.0615)
Log(Tax revenues)	-0.231***	-0.517***	0.272***	0.258**	-0.289***	0.736***	0.332***	0.611***	-1.872	0.405***
	(0.0763)	(0.110)	(0.0235)	(0.123)	(0.0670)	(0.0456)	(0.0293)	(0.0961)	(1.975)	(0.0470)
Short Run										
Control for Real GDP (up until the lag 4)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
D(Log(Unexpected Government Expenditure))	0.0401***	0.0510***	0.0347**	0.0541***	0.0479***	0.0245*	0.0481***	0.0260**	0.0400***	0.0363**
	(0.0112)	(0.0197)	(0.0136)	(0.0202)	(0.0122)	(0.0137)	(0.0107)	(0.0106)	(0.0131)	(0.0144)
D(Log(Unexpected Government Expenditure),t-1)	-0.00515	0.0139***	-0.0103	0.0203	0.00183	-0.0214	-0.00226	-0.00592	-0.00339	-0.0184
	(0.00879)	(0.00482)	(0.0142)	(0.0149)	(0.00754)	(0.0162)	(0.0122)	(0.0123)	(0.00908)	(0.0156)
D(Log(Unexpected Government Expenditure),t-2)	0.0109	0.00610	0.0195	0.0378***	0.00169	0.0134***	0.0101	0.00648	0.00870	-0.00211
	(0.00719)	(0.00854)	(0.0244)	(0.0143)	(0.00664)	(0.00171)	(0.00785)	(0.00701)	(0.00965)	(0.00627)
D(Log(Unexpected Government Expenditure),t-3)	0.0189	0.0390***	0.0166	0.0329***	0.0175	0.0176*	0.0377***	-0.00325	0.00266	0.0313***
	(0.0119)	(0.0100)	(0.0210)	(0.00918)	(0.0144)	(0.00903)	(0.0107)	(0.0156)	(0.0134)	(0.00943)
D(Log(Unexpected Government Expenditure),t-4)	0.0253***	0.0290***	0.0329*	0.0388	0.0271***	0.0147*	0.0307***	0.0214***	0.0347***	0.0119
	(0.00416)	(0.00990)	(0.0195)	(0.0276)	(0.00690)	(0.00780)	(0.00980)	(0.00314)	(0.00532)	(0.00933)
Control for Taxes (up until the lag 4) and for the Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	482	179	237	77	262	220	267	215	254	228
Number of countries	11	4	7	2	6	5	6	5	6	5
Log Likelihood	1942	752.0	1028	286.4	1116	843.3	1098	851.6	996.4	931.0

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Total government expenditure captures the discretionary component of government spending (the residuals of equation (3)). Standard errors are corrected using the Jackknife resampling procedure. We control for Real GDP and for Taxes up until the lag 4 (the full table is reported in Appendix as Table A.4).

Table 10: Fiscal multipliers when accounting for CEEC' structural characteristics (PMG)

Multiplier	Impact	Std dev	Cumulative	Std dev
Full model	0.09***	0.02	0.21**	0.07
Exchange Rate Regime				
Pegged	0.11**	0.04	0.32***	0.05
Intermediate	0.07**	0.03	0.20	0.15
Floating	0.13**	0.05	0.46***	0.04
Level of Economic Development				
Low income	0.11***	0.02	0.22**	0.06
High income	0.05	0.03	0.11	0.07
Level of Debt-to-GDP Ratio				
Low debt	0.10***	0.02	0.28***	0.07
High debt	0.06**	0.02	0.10	0.06
Openness Degree				
Low openness	0.11***	0.02	0.26**	0.07
High openness	0.08**	0.03	0.13	0.09

Note: *** p<0.01, ** p<0.05, * p<0.1.

Let us first focus on the type of the exchange rate regime. As shown by Table 10, the ERR does not seem to matter for the impact response of output to changes in fiscal policy: impact multipliers equal 0.11, 0.07 and 0.13, respectively. On the contrary, cumulative multipliers are highly sensitive to the ERR. For example, on the one hand, the cumulated response of output is 0.32 for pegged ERR, compared to statistically 0 (i.e. not significant) for intermediate ERR, consistent with the Mundell-Fleming model and previous evidence of more effective fiscal stimulus under pegged regimes in developed countries (Born et al., 2013). On the other hand, the cumulated fiscal multiplier for floating ERR equals 0.46, and is equally higher than for intermediate ERR, consistent yet again with evidence for developed countries (Monacelli and Perotti, 2010, Ramey, 2011).[109] These results asserting that corner (namely, pegged and flexible) ERR perform better than intermediate ERR when it comes to fiscal multipliers seem to suggest that the weak credibility of intermediate ERR in CEEC in our sample reduces the efficiency of fiscal policy.

Second, using median income as cut-off, Table 10 shows that the multiplier is sensitive to the level of economic development. Specifically, both impact and cumulative multipliers are significant only in low-income, relative to high-income CEEC. Thus, our findings suggest the presence of growth-effects of fiscal policies in less developed CEEC.

[109] Albeit inconsistent with the predictions of the Mundell-Fleming model, this result meets some recent findings in the literature on developed countries; for example, Corsetti et al. (2012) explain that an expansionary fiscal policy can be associated with a real depreciation of the currency, thus boosting economic activity. For a recent discussion of heterogeneities related to the exchange rate regime in CEEC, see Josifidis et al. (2013).

Third, to account for a potential role of the fiscal stance, we compute multipliers for CEEC with relatively low and high debt-to-GDP ratios, respectively. Result in Table 10 display impact multipliers of 0.10 and 0.06, and cumulative multipliers of 0.28 and statistically 0 for CEEC with low and high debt, respectively. Thus, our findings mirror the recent literature emphasizing nonlinear effects of fiscal policy on economic growth in a context of relatively high public debt,[110] and defend sound macroeconomic environments (and particularly, low debt) as a tool for reinforcing the efficiency of fiscal-policy-based measures for supporting economic growth.

Finally, we use the level of exports in percentage of GDP to divide CEEC between countries with low and high openness degree, respectively. As this was the case for the ERR, the openness degree is not found to influence the effects of fiscal policy on impact. On the contrary, cumulative multipliers are significant only in relatively less open CEEC (0.26, against statistically 0 in relatively more open CEEC), consistent with the predictions of the conventional Mundell-Fleming model.

6.6. Conclusion

Despite an impressive strand of literature estimating fiscal multipliers in developed countries, evidence for developing and emerging countries remains remarkably scarce. This paper provides new insights into how fiscal stimulus affects the output in 11 emerging Central and Eastern European Countries, based on a rather different methodological approach. Indeed, if most studies draw upon VAR models, we use a Panel Vector Error Correction model, selected for its particularly appealing features when it comes to CEEC: on the one hand, it allows accounting for their common long-run path, supported by their integration in the E(M)U, and, on the other hand, it permits computing different short-run dynamics in an integrated framework that controls for their common long-run path. In addition, we pay special attention to identifying truly exogenous shocks, through implementing an econometric procedure together with using genuine quarterly data.

Estimations performed over the period 1999q1-2013q3 unveil the following results. First, fiscal multipliers are positive and significant for CEEC, albeit with important differences between impact and four-quarter cumulative multipliers. Second, country-specific multipliers

[110] Such nonlinear effects of fiscal policy on growth in high-debt contexts are emphasized by Minea & Parent (2012) and Egert (2015) in developed countries, and by Eberhardt & Presbitero (2013) and Kourtellos et al. (2013) in developing countries. In addition, fiscal multipliers were also find to decline in developed countries, but above higher debt thresholds, namely 60% (Ilzetzki et al., 2013) or 100% (Corsetti et al., 2012).

are heterogeneous across CEEC, in sign, significance, and magnitude. Third, impact and cumulative fiscal multipliers are strongly sensitive to CEEC' characteristics. In particular, we find significant multipliers in CEEC with fixed or floating ERR, in less developed CEEC, in the CEEC with relatively low public debt-to-GDP ratios, and in relatively less open CEEC.

These results have important policy implications. Overall, the presence of relatively small multipliers suggests that the efficiency of expansionary fiscal policies is rather limited. However, this also means that CEEC countries in our sample are likely to be little affected by policies that involve fiscal consolidations. Example of such policies include fiscal reforms designed to ensure fiscal convergence towards the fiscal conditions in E(M)U countries, including more public-investment oriented policies, reforms aimed at reducing the weight of wasteful public spending, the adoption of fiscal rules related to the Stability and Growth Pact, and so forth.

In addition, our results also highlight the presence of important heterogeneities among the CEEC in our sample, which provides interesting insights regarding the path they should follow for increasing the convergence towards the EMU. First, our findings suggest that a strategy for improving growth effects of fiscal policy in small open CEEC is to move towards extreme ERR. This is a particularly appealing finding: compared to the CEEC that already integrated the euro zone, the remaining countries should perform structural reforms allowing moving towards more fixity in their exchange rate arrangements, thus creating an additional incentive for joining the eurozone in the future. Second, since multipliers are relatively larger in a context of sound fiscal stance, our paper makes the case for reforms that foster fiscal discipline, including the adoption of fiscal rules as the ones at work in the EMU. Finally, since the effects of fiscal policy are found to be significant exclusively in less developed CEEC, drawing upon a sound fiscal policy might improve the convergence process towards countries in the euro zone.

Appendix

Table A.1a: List of countries

Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia

Table A.1b: Descriptive statistics

Variables	Observations	Mean	Standard Dev	Min	Max
Real GDP	482	1.59e+08	1.78e+08	1.68e+07	8.76e+08
Government expenditure	482	6.75e+07	7.19e+07	7246924	4.21e+08
Tax revenues	482	1.91e+07	2.25e+07	1757586	1.16e+08
Real exchange rate	482	101.3819	11.21874	69.44	135.55
Central government debt (% GDP)	429	29.68998	18.11024	1	81
Export of goods & services (% GDP)	482	55.67858	16.1442	23.62175	89.89667

Table A.2a: Summary statistics of government expenditure in % of GDP (by country)

	Mean	Std Dev
Full model	42.79962	6.02706
Bulgaria	39.34807	7.50139
Croatia	44.42253	3.09011
Czech Republic	46.89297	3.09541
Estonia	47.13088	4.45549
Hungary	43.43218	5.52663
Latvia	44.40612	6.04969
Lithuania	41.18482	4.95491
Poland	38.35802	5.01909
Romania	39.54567	5.12169
Slovakia	44.36725	7.31942
Slovenia	42.85272	2.58801

Table A.2b: Summary statistics of government expenditure in % of GDP (by category)

	Mean	Std Dev
Full model	42.79962	6.02706
Pegged regime	42.82518	5.972292
Intermediate regime	45.07149	5.150866
Floating regime	39.68591	4.971359
Low income	42.77994	5.701126
High Income	42.82263	6.395615
Low Debt	43.80545	5.278542
High Debt	42.79962	6.02706
Low Openness	40.65295	5.876038
High Openness	45.20631	5.239712

Table A.3: CEEC' ERR classification based on Ilzetzki, Reinhart and Rogoff (2010)

Code	Fine classification	Coarse classification	Countries
1	No separate legal tender		Bulgaria, Estonia
2	Pre announced peg or currency board	Pegged	Lithuania, Slovenia
4	De facto Peg		
8	De facto crawling band that is narrowed than or equal to+/-2%		Croatia, Czech Republic
9	Pre announced crawling band that is wider than or equal to +/-2%		Hungary, Latvia
10	De facto crawling band that is narrower than or equal to +/-5%	Intermediate	Slovakia
11	Moving band that is narrower than or equal to +/-2%		Slovenia
	(i.e., allows for both appreciation and depreciation over time)		
12	Managed floating	Floating	Poland, Romania
14	Freely falling		
15	Dual market in which parallel market data is missing.	Other	

Table A.4: PMG estimates of the effect of unexpected government spending on output when accounting for CEEC' structural characteristics (full Table 9)

	Full model	Exchange Rate Regime (ERR)			Level of income		Public debt (% of GDP)		Openness degree	
		Pegged	Intermediate	Floating	Low	High	Low	High	Low	High
Long Run										
Log(Real GDP)										
Error correction term	-0.0375*	-0.0121	-0.182**	0.0452	-0.0260	-0.170***	-0.0766	-0.0905**	0.0101	-0.125
	(0.0220)	(0.0414)	(0.0751)	(0.0769)	(0.0328)	(0.0551)	(0.0845)	(0.0418)	(0.00907)	(0.0777)
Log(Total Government Expenditure)	0.829***	1.146***	0.772***	0.809***	0.899***	0.130***	0.677***	0.281***	2.779	0.581***
	(0.0652)	(0.107)	(0.0314)	(0.114)	(0.0559)	(0.0502)	(0.0373)	(0.0918)	(1.827)	(0.0615)
Log(Tax revenues)	-0.231***	-0.517***	0.272***	0.258**	-0.289***	0.736***	0.332***	0.611***	-1.872	0.405***
	(0.0763)	(0.110)	(0.0235)	(0.123)	(0.0670)	(0.0456)	(0.0293)	(0.0961)	(1.975)	(0.0470)
Short Run										
D(Log(Real GDP))										
D(Log(Real GDP),t-1)	0.626***	0.506***	0.614***	0.603***	0.524***	0.751***	0.619***	0.628***	0.668***	0.691***
	(0.0701)	(0.0671)	(0.0859)	(0.0298)	(0.0736)	(0.104)	(0.0685)	(0.123)	(0.0426)	(0.0978)
D(Log(Real GDP),t-2)	-0.183*	-0.0701	-0.217**	-0.0848	-0.0811	-0.228	-0.114	-0.248	-0.179	-0.169
	(0.0962)	(0.207)	(0.0924)	(0.341)	(0.128)	(0.147)	(0.128)	(0.202)	(0.180)	(0.132)
D(Log(Real GDP),t-3)	0.216***	0.0873	0.306***	0.179	0.148	0.296***	0.136*	0.430***	0.310***	0.174**
	(0.0681)	(0.161)	(0.0762)	(0.140)	(0.113)	(0.0360)	(0.0807)	(0.103)	(0.108)	(0.0880)
D(Log(Real GDP),t-4)	-0.00700	0.162	-0.0195	0.221	0.0290	0.0589	0.144	-0.125**	0.00320	0.0446
	(0.0781)	(0.168)	(0.160)	(0.381)	(0.132)	(0.102)	(0.124)	(0.0511)	(0.134)	(0.108)
D(Log(Unexpected Government Expenditure))	0.0401***	0.0510***	0.0347**	0.0541***	0.0479***	0.0245*	0.0481***	0.0260**	0.0400***	0.0363**
	(0.0112)	(0.0197)	(0.0136)	(0.0202)	(0.0122)	(0.0137)	(0.0107)	(0.0106)	(0.0131)	(0.0144)
D(Log(Unexpected Government Expenditure),t-1)	-0.00515	0.0139***	-0.0103	0.0203	0.00183	-0.0214	-0.00226	-0.00592	-0.00339	-0.0184
	(0.00879)	(0.00482)	(0.0142)	(0.0149)	(0.00754)	(0.0162)	(0.0122)	(0.0123)	(0.00908)	(0.0156)
D(Log(Unexpected Government Expenditure),t-2)	0.0109	0.00610	0.0195	0.0378***	0.00169	0.0134***	0.0101	0.00648	0.00870	-0.00211
	(0.00719)	(0.00854)	(0.0244)	(0.0143)	(0.00664)	(0.00171)	(0.00785)	(0.00701)	(0.00965)	(0.00627)
D(Log(Unexpected Government Expenditure),t-3)	0.0189	0.0390***	0.0166	0.0329***	0.0175	0.0176*	0.0377***	-0.00325	0.00266	0.0313***
	(0.0119)	(0.0100)	(0.0210)	(0.00918)	(0.0144)	(0.00903)	(0.0107)	(0.0156)	(0.0134)	(0.00943)

D(Log(Unexpected Government Expenditure),t-4)	0.0253***	0.0290***	0.0329*	0.0388	0.0271***	0.0147*	0.0307***	0.0214***	0.0347***	0.0119
	(0.00416)	(0.00990)	(0.0195)	(0.0276)	(0.00690)	(0.00780)	(0.00980)	(0.00314)	(0.00532)	(0.00933)
D(Log(Tax revenues))	0.221***	0.178***	0.181***	0.279***	0.218***	0.142***	0.188***	0.208***	0.253***	0.145***
	(0.0283)	(0.0341)	(0.0532)	(0.0224)	(0.0323)	(0.0217)	(0.0456)	(0.0428)	(0.0311)	(0.0347)
D(Log(Tax revenues),t-1)	-0.00177	-0.0106	-0.0416	-0.000159	0.00391	-0.0586***	-0.0204	-0.0311	-0.0356	-0.0407
	(0.0219)	(0.0549)	(0.0289)	(0.0497)	(0.0391)	(0.0103)	(0.0235)	(0.0384)	(0.0217)	(0.0254)
D(Log(Tax revenues),t-2)	-0.0101	0.0226*	-0.0831**	-0.00679	0.0190	-0.0998***	-0.0160	-0.0430	-0.0214	-0.0447
	(0.0177)	(0.0127)	(0.0360)	(0.0557)	(0.0200)	(0.0275)	(0.0318)	(0.0510)	(0.0439)	(0.0353)
D(Log(Tax revenues),t-3)	0.000766	0.0103	-0.0371	-0.0580***	0.0292	-0.105***	-0.0261	-0.0594	-0.0505	-0.0139
	(0.0243)	(0.0570)	(0.0456)	(0.0106)	(0.0416)	(0.0220)	(0.0421)	(0.0438)	(0.0328)	(0.0402)
D(Log(Tax revenues),t-4)	0.00451	-0.0291	-0.0670	-0.0985	-0.00281	-0.0760	-0.105***	0.0239	-0.0304	-0.0474
	(0.0292)	(0.0537)	(0.0679)	(0.114)	(0.0428)	(0.0564)	(0.0392)	(0.0317)	(0.0461)	(0.0641)
Constant	0.294*	0.0744	0.0771**		0.187	0.737***	0.0901	0.326**	0.358	0.208
	(0.169)	(0.272)	(0.0314)		(0.238)	(0.238)	(0.0984)	(0.153)	(0.314)	(0.131)
Observations	482	179	237	77	262	220	267	215	254	228
Number of countries	11	4	7	2	6	5	6	5	6	5
Log Likelihood	1942	752.0	1028	286.4	1116	843.3	1098	851.6	996.4	931.0

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Total government expenditure captures the discretionary component of government spending (the residuals of equation (3)). Standard errors are corrected using the Jackknife resampling procedure.

Table A.5: MG country-estimates of the effect of public spending on output

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Short run coefficient by country										
Dependent variable: GDP per capita growth	Bulgaria	Croatia	Czech R.	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Log(Real GDP)											
Log(Total Governement Expenditures)	6.860	0.937***	0.620***	0.599	0.280**	-0.876**	0.722***	0.270**	-0.175	0.794***	0.805***
	(20.72)	(0.327)	(0.0785)	(0.520)	(0.125)	(0.420)	(0.165)	(0.132)	(0.307)	(0.243)	(0.236)
Log(Taxes revenues)	-5.958	-0.467	0.375***	0.208	0.821***	2.487***	0.263	0.614***	1.044***	0.476**	-0.878***
	(19.73)	(0.689)	(0.0602)	(0.582)	(0.133)	(0.587)	(0.285)	(0.139)	(0.367)	(0.224)	(0.257)
Error correction term	0.0159	-0.0880*	-0.415***	-0.0775	-0.362***	-0.0935***	-0.160***	-0.216**	-0.235*	-0.153***	-0.0832**
	(0.0511)	(0.0467)	(0.114)	(0.0740)	(0.110)	(0.0259)	(0.0606)	(0.0866)	(0.142)	(0.0559)	(0.0396)
D(Log(Real GDP))											
D(Log(Real GDP),t-1)	0.638***	0.262	0.893***	0.370*	0.749***	0.619***	0.531***	0.327	0.674***	0.712***	0.351**
	(0.150)	(0.194)	(0.165)	(0.197)	(0.163)	(0.165)	(0.148)	(0.203)	(0.183)	(0.186)	(0.145)
D(Log(Real GDP),t-2)	-0.674***	-0.0644	-0.344	0.453*	-0.0896	-0.104	0.0948	0.308	-0.463***	-0.414*	-0.0798
	(0.196)	(0.189)	(0.250)	(0.239)	(0.234)	(0.181)	(0.188)	(0.245)	(0.178)	(0.213)	(0.144)
D(Log(Real GDP),t-3)	0.495***	0.217	0.175	-0.138	0.392*	0.261	-0.0559	0.239	0.321	0.258	0.110
	(0.183)	(0.173)	(0.232)	(0.225)	(0.217)	(0.183)	(0.186)	(0.236)	(0.223)	(0.230)	(0.139)
D(Log(Real GDP),t-4)	0.515**	-0.249**	0.0661	-0.240	0.0815	-0.136	0.0895	-0.155	0.580***	-0.214	0.489***
	(0.208)	(0.119)	(0.154)	(0.241)	(0.200)	(0.161)	(0.172)	(0.160)	(0.200)	(0.180)	(0.160)
D(Log(Total Governement Expenditures))	-0.0191	0.0595***	0.0256	0.0516***	0.00990	0.0509***	0.0708***	0.0437**	-0.00569	0.00989	0.0665***
	(0.0176)	(0.0155)	(0.0303)	(0.0149)	(0.0219)	(0.0189)	(0.0195)	(0.0172)	(0.0199)	(0.0297)	(0.0205)
D(Log(Total Governement Expenditures),t-1)	-0.00853	-0.0170	-0.0611*	0.0196	-0.0162	0.0266	0.0292	0.0296	-0.0452**	-0.0420*	0.0144
	(0.0174)	(0.0195)	(0.0352)	(0.0163)	(0.0242)	(0.0239)	(0.0251)	(0.0192)	(0.0207)	(0.0231)	(0.0234)
D(Log(Total Governement Expenditures),t-2)	0.0269**	-0.00416	-0.0147	-0.00997	-0.00712	0.0368	0.0152	0.0193	0.0261	0.00564	0.00310
	(0.0132)	(0.0259)	(0.0339)	(0.0162)	(0.0230)	(0.0245)	(0.0262)	(0.0207)	(0.0232)	(0.0290)	(0.0224)
D(Log(Total Governement Expenditures),t-3)	0.000933	-0.0406*	0.0324	0.0510***	0.0152	0.0215	0.0639***	0.00967	0.0156	0.0156	0.0364*
	(0.0120)	(0.0242)	(0.0302)	(0.0112)	(0.0199)	(0.0220)	(0.0233)	(0.0187)	(0.0250)	(0.0250)	(0.0214)

D(Log(Total Governement Expenditures),t-4)	0.0276***	0.0150	-0.00851	0.0403***	0.00393	0.0484***	0.0520***	0.0186	0.0364*	0.0277	-0.00741
	(0.00974)	(0.0189)	(0.0312)	(0.0136)	(0.0217)	(0.0137)	(0.0149)	(0.0172)	(0.0197)	(0.0249)	(0.0171)
D(Log(Taxes revenues))	0.0827*	0.359***	0.0147	0.147***	0.0655	0.0568	0.169**	0.232***	0.111	0.0699	0.240***
	(0.0492)	(0.0606)	(0.0546)	(0.0532)	(0.102)	(0.0685)	(0.0782)	(0.0637)	(0.137)	(0.0675)	(0.0543)
D(Log(Taxes revenues),t-1)	-0.144**	0.142	-0.112**	-0.0910*	-0.0962	-0.168**	0.0191	-0.00654	-0.0718	-0.0343	0.0963
	(0.0610)	(0.0917)	(0.0555)	(0.0537)	(0.0919)	(0.0661)	(0.0856)	(0.0783)	(0.124)	(0.0788)	(0.0591)
D(Log(Taxes revenues),t-2)	0.0520	-0.0315	-0.116**	0.00156	-0.194**	-0.0481	-0.0738	-0.125	-0.119	0.0225	-0.0146
	(0.0696)	(0.0872)	(0.0570)	(0.0617)	(0.0959)	(0.0627)	(0.0907)	(0.0810)	(0.0957)	(0.0767)	(0.0722)
D(Log(Taxes revenues),t-3)	-0.0541	0.164**	-0.0848	0.119*	-0.217**	-0.0790	-0.181**	-0.142*	-0.163*	-0.00360	0.0581
	(0.0691)	(0.0725)	(0.0524)	(0.0615)	(0.104)	(0.0564)	(0.0848)	(0.0795)	(0.0989)	(0.0716)	(0.0602)
D(Log(Taxes revenues),t-4)	-0.181**	0.145**	-0.200***	0.0845	-0.102	-0.123*	-0.0429	-0.0747	-0.259***	0.0987	-0.136**
	(0.0727)	(0.0740)	(0.0627)	(0.0595)	(0.107)	(0.0635)	(0.0910)	(0.0757)	(0.0872)	(0.0716)	(0.0622)
Constant	0.0655	0.849**	0.619***	0.327	-0.0353	-0.525**	0.241	0.837**	1.099***	-0.486*	1.526***
	(0.415)	(0.357)	(0.201)	(0.273)	(0.343)	(0.241)	(0.230)	(0.347)	(0.398)	(0.254)	(0.578)
Observations	482	482	482	482	482	482	482	482	482	482	482
Log likelihood	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Number of countries	11	11	11	11	11	11	11	11	11	11	11

Note: Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Total government expenditure captures the discretionary component of government spending (the residuals of equation (3)). Standard errors are corrected using the Jackknife resampling procedure.

Concluding remarks

Concluding remarks

Some of the major effects of the recent crisis include unemployment increases and economic growth downturns. As emphasized in introduction, world economies are still struggling with these problems, and try to find the appropriate policy combination to fight the effects of the crisis and put their economies back on track. In this context, our work found inspiration in the rule of thumb known as Okun's Law (Okun, 1962) and in the concept of fiscal multiplier (popularized by Keynes, 1936), as the starting point for a series of discussions centred on the relationship between supply, demand and economic growth.

The objective of this thesis was to contribute to this debate and to provide policymakers with information regarding specific regions and areas, in order to implement appropriate policy measures to stimulate economic growth. More precisely, we focused our analysis on the unemployment-output growth relationship and on the output effects of fiscal stimuli. The addressed topics and the econometric methods used in this thesis make our results a contribution to the ongoing discussion on how to reduce unemployment and on the growth consequences of fiscal stimuli. The results of our analysis can generate reflective tracks likely to fuel the ongoing debate. These results and tracks are presented in the six chapters of this thesis.

After briefly presenting in the General Introduction the effects of the recent crisis, we approach in Chapter 1 the unemployment problem in two emerging CEE countries selected for their relevance, namely the Czech Republic and Slovakia. Drawing upon Okun's (1962) work, our results show that the negative relationship between the GDP cycle and the unemployment cycle stands for the two countries, both at country and regional level. In addition, we emphasized important heterogeneities among Czech and Slovak regions when it comes to the significance of the coefficients. Considering the regions where the coefficient is not significant and the fact that after the Cold War these countries entered an unemployment-generating deindustrialization process, our findings raise questions about the possibility of some regions to enter in an underemployment trap after being already in an underdevelopment trap (characterized by low economic growth rates). Moreover, these regions are characterized by low levels of FDI, GFCF, R&D spending or low number of students. To this end, policymakers should consider supply-based policies in order to reduce the unemployment, together with policies aiming at attracting FDI (a successful example is the Moravian Silesian region in

Slovakia). Capitalizing on these results, Chapter 2 presents evidence of regional Okun's Law in another emerging CEE country, namely Romania, selected for being the second largest emerging CEE country (after Poland). The results suggest that, in the majority of regions, demand-based policies of Keynesian inspirations can be put in place in order to reduce unemployment and to stimulate regional economic growth. The two regions in which the Okun's coefficient is not significant are characterized by the highest growth rates over the studied period, suggesting that only supply-based policies can affect the unemployment.

Turning to the fiscal multiplier, Chapter 3 surveys the recent (i.e. since the beginning of the recent crisis) literature on this topic. The survey highlights that the recent literature is almost exclusively focused on developed countries, while studies dealing with emerging and developing countries are remarkably rare (and in particular, multipliers are found to be relatively lower in the latter countries). Furthermore, we emphasized the way the fiscal multiplier may be sensitive to a wide set of variables: (i) the position in the economic cycle suggests that multipliers are bigger in recession periods; (ii) the fiscal position reveals lower multipliers when public debt is high, (iii) the monetary policy, specifically during zero lower bond periods, fosters fiscal multipliers, and (iv) the fixed exchange rate regimes is related to higher multipliers. Following Blanchard and Perotti (2002) and Ilzetzki and al. (2013), but focusing on European countries that are in, intend to, or do not intend to join the Eurozone, Chapter 4 reveals the following results regarding the behaviour of the fiscal multiplier. Regarding tax multipliers, no significant differences can be observed between the different groups of countries. On the contrary, an expenditure shock generates a positive and significant response of output in Eurozone countries, Eurozone crisis countries and countries that have the intention to join the Eurozone in the future, while a negative and significant response for countries that are not expected to join the Euro area. As such, our analysis suggests that being part of a Monetary Union or having the intention to join one in the future, generates positive and significant fiscal multipliers. When controlling for the crisis period, we obtained results consistent with previous conclusions of the literature, namely higher (peak) multipliers in crisis periods.

We extend our research by focusing in Chapter 5 on the Mediterranean Area, which is appropriate for studying output effects of fiscal stimuli, since it regroups developed and developing countries, small and large countries, and also countries that are in a monetary union and countries with an autonomous monetary policy. To this end, we made use of the PVAR methodology, and we used a wide set of alternative specifications (ordering of the fiscal

variables, control variables, computation of the main variables), in order to test the robustness of our results. The response of output to public consumption and public investment shocks is consistent with the Keynesian theory; this is the case for example for consumption (investment) impact and cumulative multipliers in African (Asian) countries. A not significant output response, in accordance with the Ricardian Equivalence (Barro, 1974), is obtained for an investment (consumption) shock in small EMU (Asian) countries. Moreover, our estimations also reveal anti-Keynesians output responses, i.e. at impact, for an investment shock in African countries. All these results remain remarkably stable to several robustness tests, and highlight, on the one hand, that policy measures, including the choice of the type of fiscal stimulus, should be carefully designed in accordance with country/area economic characteristics and needs. On the other hand, our results suggest the need for better convergence and policy coordination between countries.

Finally, we develop the previously-used methods by drawing in Chapter 6 upon a panel vector error correction model (PVECM), and focusing on emerging Central and Eastern European Countries. We considered this methodology to be the most appropriate for this area, taking into account that, although these countries may display different paths in the short-run, they share a long-run common path, namely the integration process in the EMU. Our analysis unveils relatively small expenditure multipliers, which might suggest that expansionary fiscal policies have a fairly weak effect. However, we equally emphasize important heterogeneities at country-level. Specifically, we reveal significant multipliers for less developed CEEC countries, in relatively closed CEEC, in the CEEC with low debt to GDP ratio and with fixed or floating exchange regime rates.

To fight the recent crisis, governments all over the world put in place at first stimulus packages followed by stabilization measures, thus recognizing the importance of the demand mechanism on the short and medium term. Our research purpose was to analyze the complexity of demand, supply and growth relationship. In order to do this we studied different regions, countries and areas for a better and complex understanding of how these relationships work. Our results reveal strong heterogeneities between regions and countries for both studied topics in this thesis, namely the Okun Law and the fiscal multiplier, suggesting that there is no unique optimal design for economic policy and that policy measures must be established taking into account each economy characteristics and needs.

The results obtained in this thesis could be extended in several directions. As showed by our results, the regional significance of Okun's coefficient may differ across the considered country, in the sense that the coefficient is significant in developed Czech and Slovak regions, while not significant in Romanian developed regions. Future work could explore the sources of such heterogeneities, and an appealing and viable starting point will be to upgrade Okun's Law with variables that account for the quality of institutions or corruption index, given the importance of institutions in these countries. Regarding multipliers, an immediate development would be to provide an explanation as why tax multipliers are relatively more stable across different groups of countries. Next, our results could be developed by taking a closer look at possible sources of nonlinearities in the significance, size and magnitude of fiscal multipliers, such as the phase of the economic cycle or the type of the fiscal policy (i.e. restrictive or expansionary). Furthermore, from an econometric standpoint, an interesting development of our work would consist of accounting for possible spillovers, both at regional and country-level, to better understand the behaviour of Okun's coefficients and of fiscal multipliers, through the use of appropriate spatial econometrics techniques. Finally, our research could be developed to allow accounting for the impact of monetary policy when analyzing the relationship between unemployment, fiscal policy and economic growth.

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