Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA

Finanziato nell'ambito del Piano Nazionale di Ripresa e Resilienza PNRR. Missione 4, Componente 2, Investimento 1.3 Creazione di "Partenariati estesi alle università, ai centri di ricerca, alle aziende per il finanziamento di progetti di ricerca di base"

GRINS FOUNDATION

DELIVERABLE 1 - Working Paper Draft

Local fiscal multipliers in a data-scarce environment

The effectiveness of government spending across Italian regions

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The Effectiveness of Italian Fiscal Policy: Towards the Quantification of Regional Fiscal Multipliers

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February 28, 2024

PRELIMINARY AND INCOMPLETE VERSION

Abstract

Exploiting 1995–2020 regional (NUTS-2) data, we provide a first assessment of the efficacy of Italian fiscal policy by estimating fiscal multipliers at the national and sub-national levels. We propose a novel econometric methodology grounded in the Proxy-SVAR technique based on the use of non-fiscal instruments - crafted using principal component analysis to overcome data scarcity - to indirectly identify fiscal spending shocks from fiscal spending rules. We derive region-specific fiscal multipliers and find that expansionary spending shocks yield positive and persistent effects on regional output. Furthermore, we uncover regional disparities in the efficacy of discretionary government spending, with fiscal multipliers being larger in Centre-North compared to Southern regions. These analyses pave the way for further extensions, improvements, and comparisons with the existing literature summarized throughout the paper.

Keywords: Fiscal Multipliers, Identification, Instrumental Variables, Structural Vector Autoregressions

JEL codes: C32, C50, E62, R58

Acknoledgments The study is part of the project GRIN P9 - Spoke 4 (WP-4). This study was funded by the European Union - NextGenerationEU, in the framework of the "GRINS - Growing Resilient, INclusive and Sustainable project" (PNRR - M4C2 - I1.3 - PE00000018 – CUP J33C22002910001). The views and opinions expressed are solely those of the authors and do not necessarily reflect those of the European Union, nor can the European Union be held responsible for them.

1 Introduction

Following the collapse in 2008, there has been an increasing focus on fiscal policies among researchers and policymakers, who were previously primarily concerned with the effects of monetary policy. In response to the financial crash, many countries implemented financial consolidation policies aimed at stimulating economic growth, reducing the debt-to-GDP ratio, and mitigating financial market instability (Alesina et al., 2015, 2019). Au contraire, they proved to be ineffective, and sometimes even detrimental. For instance, Fatás and Summers (2018) warn about a possible negative and persistent effect of fiscal policies on potential output through the mechanism of hysteresis.

The main metrics used to measure the efficacy of a fiscal policy are the fiscal multipliers, whose quantification becomes of vital importance. Indeed, miscalculations can overestimate or underestimate a policy effect, mislead the policy maker and have a negative impact on the economy. Among others, Blanchard and Leigh (2013) attribute the failure of austerity to the larger-than-expected fiscal multipliers. In general, the literature agrees on the fact that expansionary fiscal stimuli yield to an increase in output, but it does not reach a consensus on the magnitude, which largely varies across studies (Gechert, 2015). The discussion on what policy instrument is more effective is still open, but the comparison is not easy. For instance, some studies indicate that government investment is less effective than other government spendings (see, *e.g.*, Pappa, 2009), while others support the opposite view (see, *e.g.*, Auerbach and Gorodnichenko, 2012). Caldara and Kamps (2008) argue that the wide range of multipliers is caused by differences in the structural identification of fiscal shocks.

The recent COVID-19 pandemic made government interventions necessary in many countries to address economic stagnation and social crisis. As observed, the pandemic has exacerbated territorial disparities, with the most economically vulnerable regions being the hardest hit. This is the case of Italy, which has experienced a worsening of the so called "North-South divide" after the pandemic. Against this background, the recently launched National Recovery and Resilience Plan (NRRP) promotes regional convergence in its agenda, allocating a significant share of public investments towards the south, thereby reducing the divide. This marks a significant discontinuity as opposed to the "austerity agenda" adopted during 2008 crisis.

In this context, the debate on fiscal multipliers magnitude in advanced countries has gained momentum and the quantification of multipliers at the national and sub-national level is compelling. Government investment and consumption multipliers, which are even less frequently calculated for sub-national territories, assume crucial significance. Recent studies by Deleidi et al. (2021); Destefanis et al. (2022); Lucidi (2022); Matarrese and Frangiamore (2023); Zezza (2022); Zezza and Guarascio (2022) attempt to address this gap exploiting Italian regional data.

Our objective is to contribute to the existing body of literature on quantifying fiscal multipliers in Italy. Drawing inspiration from Leeper et al. (1996) and Caldara and Kamps (2017), we develop a novel econometric methodology to estimate the parameters of a fiscal policy rule, *i.e.*, a function that characterizes fiscal policy behaviour. We rely on an instrumental variable approach that uses non-fiscal proxies to estimate such parameters and identify the fiscal shock of interest (see Angelini et al., 2024; Caldara and Kamps, 2017). As we are not aware of the existence of proxies suited for our case, we craft an *ad hoc* instrumental variable using Principal Component Analysis (PCA).

Our findings confirm that expansionary government spending shocks have a positive and persistent effect on output. This holds true even at the sub-national level. We derive region specific spending multipliers and provide evidence of disparities in the efficacy of fiscal policies from region to region. In particular, we observe lower multipliers in the South with respect to the Centre-North area, confirming previous results pointing at a more effectiveness of fiscal policy in developed countries (Ilzetzki et al., 2013). These findings have obvious implications for the setup of policies aimed at reducing territorial inequalities in Italy.

The reminder of the paper is structured as follows. Section 2 reviews the literature on fiscal multipliers with a focus on Italy. Section 3 describes the data used in the analysis. Section 4 introduces the econometric methodology. Section 5 presents the main findings and Section 6 concludes.

2 State-of-the-Art

2.1 Overview on Fiscal Multipliers

The literature has proposed alternative approaches to estimate fiscal multipliers, which are typically grounded in theoretical models or rely on econometric techniques. The former typically involves simulations using Dynamic Stochastic General Equilibrium (DSGE) models. These models generally share the view that fiscal expansions cause output and employment increases, but there are many discussions on the channels through which this positive relationship occurs. Indeed, the different assumptions made by competing theories lead to a wide range of multipliers values – see, *inter alia*, Christiano et al. (2011); Eggertsson (2011); Ercolani and e Azevedo (2019); Galí et al. (2007); Hall (2009); Leeper et al. (2017). Moreover, this class of models is often criticized due to its dependence on the functional form and parameters calibration they assume, which may not accurately reflect the statistical properties of the data (Canova and Ciccarelli, 2013). Think, for instance, to consumer's preferences or to real and nominal frictions.

When we look at empirical models, the most commonly employed by the literature are Structural Vector Autoregressive (SVAR) models. They are easy to use, flexible and allow for isolating exogenous fiscal policy shocks through the implementation of suitable identification strategies. Once the shock is identified, computing the multiplier is straightforward. As pointed out by Caldara and Kamps (2008), there are four main approaches for isolating fiscal policy shocks in Structural VARs. The fisrt is the recursive approach based on the standard Cholesky decomposition, which uses zero restrictions to address the endogeneity issue (Fatás and Mihov, 2001). Building upon this, the second approach incorporates institutional information to capture the contemporaneous relationship between taxes and output (Blanchard and Perotti, 2002). Third, the sign restriction approach, where the exogenous fiscal shocks are identified by imposing restrictions on the sign of impulse response functions (IRFs), usually in line with the dominant economic theory (Mountford and Uhlig, 2009; Pappa, 2009). Finally, the narrative approach uses qualitative information derived from fiscal policy news to determine innovation in fiscal stance – see, for instance, Mertens and Ravn (2013) for changes in taxation and Ramey (2011); Ramey and Shapiro (1998) for government spending. Recently, Matarrese and Frangiamore (2023) propose a novel methodology using instumental varibales at a sub-national level.

Recently, the literature has started estimating fiscal multipliers employing also the Local Projections method, which entails the estimation of separate regressions for each horizon with the variable of interest following the realization of the shock. Prominent works related to our topic are, *inter alia*, Auerbach and Gorodnichenko (2017); Deleidi et al. (2020); Ramey and Zubairy (2018).

Albeit SVARs help mitigating the theoretical contamination, they are not immune to criticism. In fact, also for this class of models the size of multipliers depends on subjective assumptions that are necessary for shock identification. For example, Blanchard and Perotti (2002) estimate an impact spending multiplier equal to 0.84 in the US economy, whereas Pappa (2009) and Ramey (2011) find it equal to 1 and 0.76, respectively.

2.2 Fiscal Multipliers in Italy

Regarding the Italian case, fiscal multipliers have been examined through a wide array of models and methodologies. Most studies focus their analysis on the national level, with a few exceptions for regional analysis.

The literature focusing on the national level supports the notion of positive fiscal multipliers, with investment-related multipliers often higher than consumption-related ones. This results hold true both for model-based approaches (see, for instance, Kilponen et al. (2019) for DSGE and De Nardis and Pappalardo (2018) for large structural models) an for VAR based works. For the latter, Cimadomo and D'Agostino (2016) find a total government spending between 0.8 and 1.5 using a time-varying coefficients VAR. Batini et al. (2012) use a regime-switching VAR and find that spending multipliers range between 0.6 and 0.9, with higher values during recession than in economic expansions. Using a Threshold VAR, Caprioli and Momigliano (2013) and Afonso et al. (2018) also find positive spending multipliers. The former report a consumption multiplier of 1.04 on impact and reaching approximately 1.8 after three years. The latter identifies larger multipliers (ranging from 0.6 to 1.4) during periods of high financial stress compared to low-stress periods (ranging from 0.1 to 0.3). SVAR models are employed by Giordano et al. (2007), who estimate multipliers of 2.4 in the 4-th and 8-th quarters and 1.7 in the 12-th, and by Deleidi (2022), who estimates a peak spending multiplier of 1.87, and consumption and investment multipliers of 3.17 and 4.72, respectively.

Turning to regions, the literature becomes narrower. Acconcia et al. (2014) employ a quasi-experimental approach using NUTS-3 data and estimate a spending multiplier ranging between 1.5 and 1.9. Piacentini et al. (2016) use a large-scale macroeconometric model to estimate fiscal multipliers in Italian macro areas for the period 2011-2013. In contrast to previous literature, they find larger values of fiscal multipliers for southern regions in both current and investment expenditures.

More common is the use of Panel VARs (PVAR) on NUTS-2 regional annual data sourced by the Italian Institute of Statistics (ISTAT). Deleidi et al. (2021) estimate regional and macro-area multipliers, finding an higher cumulative multipliers associated to investment, reaching 4 in Centre-North and 2.25 in South. They identify the fiscal shock using Cholesky short-run restrictions. Destefanis et al. (2022) focus more on region-specific multipliers. Their focus is on threes sources of public spending: EU Structural Funds, Government Investment and Government Current Expenditures. Their results are rather heterogeneous. Nonetheless, they find, on average, positive multipliers for investment, even though the larger values are reported for EU structural funds. They also include more granular public expenditure data from the database "Spesa statale regionalizzata" of the General Accounting Office (Ragioneria Generale dello Stato) at the Italian Ministry of Economy and Finance. Also in this case, the identification is achieved through recursive Cholesky scheme. Lucidi (2022) estimates region-specific multipliers for real government current expenditure (*i.e.*, the sum of public final consumption and social transfers), investment and deficit. Their results reveal a discrepancy in fiscal multipliers between southern and northern regions. On the one hand, expansionary policies have larger effects in the north, with a peak multiplier of 3.78 compared to 1.65 of southern regions. On the other, the contractionary effects of fiscal consolidation are more significant in the South. They employ NUTS-2 regional annual data sourced by ISTAT and national-level data from OECD. in this case, shocks are identified through sign restrictions.

Zezza and Guarascio (2022) and Zezza (2022), instead, use the dataset "Conti Pubblici Territoriali", which is published by the Agency for Territorial Cohesion and provides very detailed information on regional public expenditure distinguished by domain. Also in this case the dataset is annual, but it starts in 2000. Zezza and Guarascio (2022) evaluate the regional effects of public investments, specifically analysing three domains of public expenditure shocks: green, digital and education. Overall, they find that fiscal policy shocks have positive and long-lasting effects on GDP and private investments. However, they also observed that the effects vary across the different domains, suggesting heterogeneity in the outcomes. Zezza (2022) uses a SVAR model to estimate regional fiscal multipliers within the Public Sector. The findings suggest that the impact of fiscal policies varies substantially depending on the specific expenditure category and the geographical region under consideration.

Recently, Matarrese and Frangiamore (2023) use the Proxy VAR approach on ISTAT NUTS-2 annual data, instrumenting the government spending shock with a series of spending changes that is unrelated to GDP and purged from predictable components. They show that fiscal policy has positive and long-lasting effects on output and confirm that Centre-North multipliers tend to be higher than South ones.

3 Data

We construct a dataset at the regional NUTS-2 level (*i.e.*, Nomenclature of Territorial Units for Statistics, level 2). It covers the period between 1995 and 2020 with annual frequency. Data is sourced by the Italian Institute of Statistics (ISTAT) and freely downloadable from the *"Conti* *e aggregati economici territoriali"* section of the national accounts.[1].

We consider two variables for each region i: Gross Domestic Product (GDP) and Government Spending (G). The latter is obtained as the sum of Government Final Consumption Expenditure (GC) and Government Gross Fixed Capital Formation (GI). Nominal variables are transformed in real terms using the GDP deflator at the national level provided by AMECO. We consider per-capital values dividing the variables by the annual average population provided by ISTAT. Data is transformed in logarithmic terms. Table 1 provides a detailed description of the series and the transformation we apply.

The analysis includes 20 NUTS-2 Italian regions. Provincia Autonoma di Bolzano and Provincia Autonoma di Trento are considered also as part of Trentino Alto Adige. We define additional macro-areas, with different level of aggregation, that we define as follows: North-West (including Piemonte, Valle d'Aosta, Liguria and Lombardia), North-East (including Trentino Alto Adige, Veneto, Friuli-Venezia Giulia and Emilia-Romagna), Centre (including Toscana, Umbria, Marche and Lazio), South (including Abruzzo, Basilicata, Calabria, Campania, Molise, Puglia, Sardegna and Sicilia). Finally, North aggregates North-West and North-East, while Centre-North merges North and Centre.

Table 2 shows some descriptive statistics of the variables. It is evident that Southern regions have a lower GDP per capita with respect to Centre-Northern regions, reflecting the North-South divide that characterize Italy. In contrast with the output per capita, Southern regions shows higher share of government spending. This second stylized fact confirms the difficulty of the South in translating fiscal stumuli in output.

4 Econometric framework

4.1 Model and fiscal policy rule

For each region i, consider the vector of $n = 3$ endogenous regional variables Y_t. For the ease of exposition we omit the subscript i. Let us assume that $Y_t = [G_t', GDP_t']'$ follows a VAR(p) of the form

$$Y_t = \Pi X_t + u_t \tag{1}$$

where $X_t = (Y_{t-1}', \ldots, Y_{t-p})$ collects the p lags of Y_t, $\Pi = (\Pi_1, \ldots, \Pi_p)$ is a $n \times np$ matrix of coefficients and $u_t = [u_t^{G\prime}, u_t^{GDP\prime}]'$ is a n-vector of innovations associated with the VAR with $\mathbb{E}(u_t) = 0$ and $\mathbb{E}(u_t u_t') = \Sigma_u$. Without loss of generality, the specification in (1) omits deterministic terms for notation brevity. The residuals are link to the structural shocks through the linear mapping $u_t = B\varepsilon_t$, where B is a non-singular matrix of impact coefficients such that $BB' = \Sigma_u$ and ε_t are normalized such that $\mathbb{E}(\varepsilon_t \varepsilon_t') = I_n$.

We can rewrite the model in structural form as

$$AY_t = A\Pi X_t + \varepsilon_t \tag{2}$$

[1]Available at https://www.istat.it/en/analysis-and-products/databases/statbase

with $A = B^{-1}$ and $Au_t = \varepsilon_t$.

The equation system in (2) defines each element of ε_t as a function of current and past values of Y_t. Therefore, specifying the element of ε_t related to a specific fiscal policy is equivalent to specifying an equation that characterizes the policy behaviour, *i.e.*, a fiscal policy rule or *reaction function* (Caldara and Kamps, 2017; Leeper et al., 1996). Thus, let us partition the structural shocks as $\varepsilon_t = (\varepsilon_{1,t}', \varepsilon_{2,t}')'$, where $\varepsilon_{1,t}$ is a $k \times 1$ vector of fiscal policy shocks, with $1 \leq k < n$, and $\varepsilon_{2,t}$ is a $n - k \times 1$ vector collecting the remaining structural shocks. This implies the analogous partition of u_t, with $u_{1,t}$ and $u_{2,t}$ having the same dimensions of $\varepsilon_{1,t}$ and $\varepsilon_{2,t}$, respectively, and the following partitions of the matrices A and B

$$B = \begin{pmatrix} \underset{n\times k}{B_1} & \underset{n\times(n-k)}{B_2} \end{pmatrix}, \quad B_1 = \begin{pmatrix} \underset{k\times k}{b_{11}'} & \underset{k\times(n-k)}{b_{21}'} \end{pmatrix}', \quad B_2 = \begin{pmatrix} \underset{(n-k)\times k}{b_{12}'} & \underset{(n-k)\times(n-k)}{b_{22}'} \end{pmatrix}'$$
$$A = \begin{pmatrix} \underset{n\times k}{A_1'} & \underset{n\times(n-k)}{A_2'} \end{pmatrix}', \quad A_1 = \begin{pmatrix} \underset{k\times k}{a_{11}} & \underset{k\times(n-k)}{a_{12}} \end{pmatrix}, \quad A_2 = \begin{pmatrix} \underset{(n-k)\times k}{a_{21}} & \underset{(n-k)\times(n-k)}{a_{22}} \end{pmatrix}$$

Exploiting the fact that u_t encapsulates information about Y_t and its lags, we can define the fiscal policy rule directly in terms of reduced-form residuals as

$$u_{1,t} = \psi u_{2,t} + \sigma_1 \varepsilon_{1,t} \tag{3}$$

where $\psi = -a_{11}^{-1} a_{12}$ is $k \times (n-k)$ matrix of contemporaneous elasticities and $\sigma_1 = a_{11}^{-1}$ is a constant that scales the policy shock.

As, in our case, the only non-policy variable is output, fiscal variables respond contemporaneously only to it. As implication, the elements in $u_{1,t}$ respond to all the structural shocks only through output. Thus, we can derive the government spending reaction function, for region i, as

$$u_{i,t}^{G} = \psi_i^G u_{i,t}^{GDP} + \sigma_i^G \varepsilon_{i,t}^G \tag{4}$$

where ψ_i^G is the crucial fiscal (regional) elasticity, $\varepsilon_{i,t}^G$ is the shock of interest and σ_i^G the associated standard deviation.

4.2 Definition of Fiscal Multiplier

We define the fiscal multiplier as the euro response of output to a one-euro-size fiscal shock. Such definition has been embraced also by other works, as for instance, Angelini et al. (2024); Auerbach and Gorodnichenko (2012); Blanchard and Perotti (2002); Caldara and Kamps (2017).[2] In practice, this is equivalent to the ratio between output response at a particular horizon, h, and the impact effect (*i.e.*, at $h = 0$) of the fiscal policy shock to the policy variable.

Let $IRF_{k,j}(h)$ the response at horizon h of variable k to a shock at the fiscal variable j. The multiplier at horizon h for a shock to G is quantifiable as

[2] See Ramey (2019) for a discussion on alternative definitions of multiplier.

$$\mathbb{M}_G(h) = \frac{IRF_{GDP,G}(h)}{IRF_{G,G}(0)} \times \alpha_{GDP,G} \tag{5}$$

As the variables enter in log changes, the IRFs are interpreted as an elasticity. Hence, we need an *ex-post* conversion from elasticities to euros, which is obtained by means of a shock-specific scaling factor, $\alpha_{GDP,G}$. As in Angelini et al. (2024); Caldara and Kamps (2017), we set the scaling factor to the sample average of the ratio between level GDP and level P. For instance, $\alpha_{GDP,G} = mean(\exp(GDP)/\exp(G))$. See Deleidi et al. (2021) for an application of the *ex-post* conversion to Italian regional data.

4.3 Identification

The identification of structural shocks requires to impose restrictions on system (1), specifically on matrix B. The standard proxy approach requires to impose covariance restrictions using k observable instruments $m_{1,t}$ for the k regional fiscal shocks of interest $\varepsilon_{1,t}$. In order ot be able to isolate the parameters in B_1, *i.e.*, the impact coefficients associated with the fiscal shocks of interest, $m_{1,t}$ must be correlated with $\varepsilon_{1,t}$, $\mathbb{E}(m_{1,t}\varepsilon'_{1,t}) = \Phi_1 \neq 0$ (relevance condition), and uncorrelated with the remaining shocks, $\mathbb{E}(m_{1,t}\varepsilon'_{2,t}) = 0_{k\times(n-k)}$ (exogeneity condition). Under these conditions the investigator can either directly identify the IRFs to the shocks of interest (see, for instance, Mertens and Ravn, 2013), or use the proxies to identify the coefficients of the fiscal policy rule (as shown by Caldara and Kamps, 2017).

This approach use fiscal proxies to identify fiscal shocks. Alternatively, Caldara and Kamps (2017) suggest to estimate the parameters of the fiscal policy rule using non-fiscal proxies.[3]

For this purpose, let $m_{2,t}$ be a vector containing $n-k$ proxy variables for the non-policy shock $\varepsilon_{2,t}$, satisfying

$$\mathbb{E}(m_{2,t}\varepsilon'_{2,t}) = \Phi_2 \qquad (relevance), \tag{6}$$

$$\mathbb{E}(m_{2,t}\varepsilon'_{1,t}) = 0_{(n-k)\times k} \qquad (exogeneity) \tag{7}$$

where Φ_2 is $n-k \times n-k$. Conditions (6)-(7) require that non-policy proxies must be correlated with non-policy shocks and uncorrelated with policy shocks. IF these are met, we can use $m_{2,t}$ as a proxy for $u_{2,t}$ (u_t^{GDP} in our case) for estimating the parameters in ψ. In the next section, we show how we construct $m_{2,t}$.

4.3.1 Building proxies in a data-scarce environment

For the estimation of the parameters of the fiscal policy rule in (3), we need a proxy variable for u_t^{GDP}. With an instrument for u_t^{GDP} at hand, we can recover the structural shock of interest, *i.e.*, ε_t^G, and the associated elasticity ψ_G through a simple IV regression.

As we are not aware of the existence of proxies suited for our situation, we propose a strategy for constructing an *ad hoc* instrumental variable.

[3]This approach is useful, for instance, when the investigator suspects that $m_{1,t}$ are weak instruments for $\varepsilon_{1,t}$ – see Angelini et al. (2024).

Let F_t^{GDP} be the factor derived by *Principal Component Analysis* (PCA) from the set of regional GDP time series, $\{GDP_{1,t}, \dots, GDP_{20,t}\}$. Analogously, we can retrieve F_t^G from $\{G_{1,t}, \dots, G_{20,t}\}$. Then, consider the static regression

$$F_t^{GDP} = \beta_G F_t^G + z_t \tag{8}$$

The residuals, z_t, of regression (8) can be interpreted as the GDP factor orthogonalized to the fiscal spending factor. As such, we claim this can be used as instrument variable for u_t^{GDP}, for each region.

As stated above, it is well known that a proxy must satisfy the two conditions (6)-(7). Specifically, it has to be correlated with the shock of interest (relevance condition) and uncorrelated with the other shocks (exogeneity condition).

Following Caldara and Kamps (2017), we run a battery of predictive regressions to provide evidence that z_t satisfies such conditions. First, to asses the *relevance* of z_t, we regress the non-policy VAR residuals, *i.e.*, $u_{i,t}^{GDP}$, on such proxy (see also Gertler and Karadi, 2015). Stock et al. (2002) suggest an F-statistics lower than 10 as an indicator of a weak instrument. Second, to asses the *exogeneity* of the proxy with respect to the policy shocks, we are required to regress it on such shocks. Clearly, we are not able to run such regression as the shocks are not directly observed. Instead, we can consider proxies for tax and spending shocks. Thus, we can use F_t^G. Notice that, in this case the exogeneity condition is satisfied by construction.

Panel A of table 3 display the results of the regression of u_t^{GDP} on z_t, for each region, in terms of p-value and F-statistics. We observe that for all regions the F-statistics lies above the threshold of 10 specified by Stock et al. (2002), indicating the instrument is likely to be relevant for all regions. Panel B of the tables shows exogeneity test results, based on the results of the regression of the non-policy instrument on the policy proxy. Unsurprisingly, the F-test cannot reject the null that all the regression coefficient is equal to zero, indicating that the non-fiscal proxy is orthogonal to the fiscal proxy. Thus, the exogeneity condition is satisfied for the proxy of interest. Figure 1 depicts the estimated factors.

5 Results

Figure 2 shows the IRFs of regional government spending and GDP to a government spending shock. Responses are plotted for South, Centre-North and Italy for 10 periods after the shock hits. The upper panels display the IRFs estimated by the standard Cholesky approach, with government spending ordered first in the VAR, whereas lower panels show the responses to the fiscal shock identified using our proxy.

Italian output responds positively and the effect decays towards zero very slowly in the next periods, suggesting that a fiscal stimulus has a long-lasting effect on output. Similar arguments apply to South and Centre-North areas, confirming what found by previous works – as, for instance, Deleidi (2022); Deleidi et al. (2021); Destefanis et al. (2022); Giordano et al. (2007); Matarrese and Frangiamore (2023). Despite two different identification techniques, the shock to government spending has approximately the same magnitude. In contrast, the effect on output estimated vy Cholesky is larger.

We compute the associated spending multipliers as described in Section 4.2. Table 4 reports the results for the macro-areas considered. Also in this case, we offer a comparison obtained with our results with those coming from Cholesky. Regardless the identification strategy, multipliers are all positive. The average multiplier over a time span of 10 years is larger than 1 in all cases, with the only exception of the South multiplier calculated with our proxy approach. All multipliers peak at impact, where we observe values well above 1. They only fall below 1 around the 8-th year, except for the South where it happens around the 4-th year. As a direct consequence of what observed for IRFs, Cholesky multipliers are systematically larger than those estimated by proxy techniques.

In general, multipliers related to the South are lower than Centre-North ones. This confirms the well-known gap between the two Italian macro-regions. Indeed, the South has always been characterized by poorer economic and institutional conditions with respect to northern regions, which translates in a less effective fiscal policy.

For a deeper understanding of regional disparities, we also compute the multipliers at NUTS-2 level, which are reported by Table 5. The picture essentially confirms what found at the macro-area level: public spending in regions from North and Center is more effective than South ones. Piemonte and Lombardia display the highest values in the North, both above 2 at impact and falling below 1 after 6 and 8 years, respectively. Liguria has a multiplier of 1.75 at impact. Valle d'Aosta starts negatively and then becomes positive, peaking at $h = 2$ with 0.86. In the North-East, Veneto has the highest multiplier at impact (1.998), followed by Emilia-Romagna (1.778). Both fall below 1 around the $4th$ years. Friuli-Venezia Giulia ranges between 0.87 and 0.308. Trentino Alto Adige show a negative multiplier at impact and close to zero in the next years. Regarding the Centre, Lazio shows the highest multipliers in the entire Italy and maintain values larger than 1 for all the 10 years considered. Umbria and Toscana peak around 1.95 at impact, and then drop under 1 after 4 and 6 years, respectively. Marche has a positive multiplier, peak in the second year with 1.988. As for the South, peaking multipliers range between 0.651 (Basilicata) and 1.718 (Sardegna). Excluding the islands, Campania shows the highest values (1.319 peak).

The results are in line with Italian studies Deleidi et al. (2021); Lucidi (2022); Matarrese and Frangiamore (2023) and, more in general, with those works that find higher multipliers associated to more developed areas, as for instance Gabriel et al. (2023); Ilzetzki et al. (2013).

6 Conclusions

We bring new evidence on regional fiscal multipliers in Italy, using NUTS-2 level data from 1995 to 2020. We develop a novel econometric methodology to estimate the parameters of the function that characterizes government spending behaviour. We rely on an instrumental variable approach that uses non-fiscal proxies to estimate such parameters and identify the fiscal shock of interest. For this purpose, we craft an *ad hoc* instrumental variable using PCA. Our findings that expansionary government spending shocks have a positive and persistent effect on output in Italy.

This holds true even at the sub-national level. We further dig into geographical heterogeneity deriving region specific spending multipliers. We provide evidence of disparities in the efficacy of fiscal policies from region to region. In particular, we observe lower multipliers in the South with respect to the Centre-North area. These findings have obvious policy implications, as they highlight the validity of public spending as a tool for stimulating the economy and potentially reducing territorial inequalities in Italy.

7 Further Developments

The present paper makes a first attempt to evaluate the efficacy of Italian fiscal policy at a local (NUTS-2) level by quantifying regional fiscal spending multipliers and capturing geographical disparities and regional heterogeneity as much as possible. To do so, we have designed a novel methodology based on the use of external instruments in a context where data availability is inherently scarce and finding proxies for the structural shocks of interest is challenging. These contributions mark an important methodological difference from the existing literature. This contribution paves the way for further extensions and improvements. Specifically, our future research aims to address the following issues:

(i) A careful comparison with the existing literature, where, to our understanding, the suggested approaches tend to implicitly undermine the role of geographical disparities through panel-type approaches;

(ii) The extension of the information set by including variables related to tax revenues reflecting the dual role of fiscal policies. This allows the simultaneous identification of spending and tax shocks (multipliers), fully addressing the multifaceted dimensions characterizing fiscal policies;

(iii) The analysis of spillover effects of fiscal policies between Italian macro-areas (NUTS-1 level): North-East, North-West, Centre, South;

(iv) The extension to European areas (NUTS-1 level) and, if possible, European countries.

References

Acconcia, A., Corsetti, G., and Simonelli, S. (2014). Mafia and public spending: Evidence on the fiscal multiplier from a quasi-experiment. *American Economic Review*, 104(7):2185–2209.

Afonso, A., Baxa, J., and Slavík, M. (2018). Fiscal developments and financial stress: a threshold var analysis. *Empirical Economics*, 54:395–423.

Alesina, A., Favero, C., and Giavazzi, F. (2015). The output effect of fiscal consolidation plans. *Journal of International Economics*, 96:S19–S42.

Alesina, A., Favero, C., and Giavazzi, F. (2019). *Austerity: When it Works and when it Doesn't*. Princeton University Press.

Angelini, G., Cavaliere, G., and Fanelli, L. (2024). An identification and testing strategy for proxy-svars with weak proxies. *Journal of Econometrics*, 238(2):105604.

Auerbach, A. J. and Gorodnichenko, Y. (2012). Measuring the output responses to fiscal policy. *American Economic Journal: Economic Policy*, 4(2):1–27.

Auerbach, A. J. and Gorodnichenko, Y. (2017). Fiscal stimulus and fiscal sustainability. Technical report, National Bureau of Economic Research.

Batini, N., Callegari, G., and Melina, M. G. (2012). *Successful austerity in the united states, europe and japan*. International Monetary Fund.

Blanchard, O. and Perotti, R. (2002). An empirical characterization of the dynamic effects of changes in government spending and taxes on output. *the Quarterly Journal of economics*, 117(4):1329–1368.

Blanchard, O. J. and Leigh, D. (2013). Growth forecast errors and fiscal multipliers. *American Economic Review*, 103(3):117–120.

Caldara, D. and Kamps, C. (2008). What are the effects of fiscal policy shocks? a var-based comparative analysis.

Caldara, D. and Kamps, C. (2017). The analytics of svars: a unified framework to measure fiscal multipliers. *The Review of Economic Studies*, 84(3):1015–1040.

Canova, F. and Ciccarelli, M. (2013). Panel vector autoregressive models: A survey. In *VAR models in macroeconomics–new developments and applications: Essays in honor of Christopher A. Sims*, volume 32, pages 205–246. Emerald Group Publishing Limited.

Caprioli, F. and Momigliano, S. (2013). The macroeconomic effects of expenditure shocks during good and bad times. *Fiscal Policy and Growth*, pages 79–110.

Christiano, L., Eichenbaum, M., and Rebelo, S. (2011). When is the government spending multiplier large? *Journal of Political Economy*, 119(1):78–121.

Cimadomo, J. and D'Agostino, A. (2016). Combining time variation and mixed frequencies: An analysis of government spending multipliers in italy. *Journal of Applied Econometrics*, 31(7):1276–1290.

De Nardis, S. and Pappalardo, C. (2018). Fiscal multipliers in abnormal times: The case of a model of the italian economy. *Ufficio Parlamentare di Bilancio, Nota di lavoro*, 1:2018.

Deleidi, M. (2022). Quantifying multipliers in italy: does fiscal policy composition matter? *Oxford Economic Papers*, 74(2):359–381.

Deleidi, M., Iafrate, F., and Levrero, E. S. (2020). Public investment fiscal multipliers: An empirical assessment for european countries. *Structural Change and Economic Dynamics*, 52:354–365.

Deleidi, M., Romaniello, D., and Tosi, F. (2021). Quantifying fiscal multipliers in italy: A panel svar analysis using regional data. *Papers in Regional Science*, 100(5):1158–1177.

Destefanis, S., Di Serio, M., and Fragetta, M. (2022). Regional multipliers across the italian regions. *Journal of Regional Science*, 62(4):1179–1205.

Eggertsson, G. B. (2011). What fiscal policy is effective at zero interest rates? *NBER macroeconomics annual*, 25(1):59–112.

Ercolani, V. and e Azevedo, J. V. (2019). How can the government spending multiplier be small at the zero lower bound? *Macroeconomic Dynamics*, 23(8):3457–3482.

Fatás, A. and Mihov, I. (2001). The effects of fiscal policy on consumption and employment: theory and evidence. *Available at SSRN 267281*.

Fatás, A. and Summers, L. H. (2018). The permanent effects of fiscal consolidations. *Journal of International Economics*, 112:238–250.

Gabriel, R. D., Klein, M., and Pessoa, A. S. (2023). The effects of government spending in the eurozone. *Journal of the European Economic Association*, page jvad006.

Galí, J., López-Salido, J. D., and Vallés, J. (2007). Understanding the effects of government spending on consumption. *Journal of the european economic association*, 5(1):227–270.

Gechert, S. (2015). What fiscal policy is most effective? a meta-regression analysis. *Oxford Economic Papers*, 67(3):553–580.

Gertler, M. and Karadi, P. (2015). Monetary policy surprises, credit costs, and economic activity. *American Economic Journal: Macroeconomics*, 7(1):44–76.

Giordano, R., Momigliano, S., Neri, S., and Perotti, R. (2007). The effects of fiscal policy in italy: Evidence from a var model. *European Journal of Political Economy*, 23(3):707–733.

Hall, R. E. (2009). By how much does gdp rise if the government buys more output? Technical report, National Bureau of Economic Research.

Ilzetzki, E., Mendoza, E. G., and Végh, C. A. (2013). How big (small?) are fiscal multipliers? *Journal of monetary economics*, 60(2):239–254.

Kilponen, J., Pisani, M., Schmidt, S., Corbo, V., Hledik, T., Hollmayr, J., Hurtado, S., Júlio, P., Kulikov, D., Lemoine, M., et al. (2019). Comparing fiscal consolidation multipliers across models in europe. *International Journal of Central Banking*, 15(3):285–320.

Leeper, E. M., Sims, C. A., Zha, T., Hall, R. E., and Bernanke, B. S. (1996). What does monetary policy do? *Brookings papers on economic activity*, 1996(2):1–78.

Leeper, E. M., Traum, N., and Walker, T. B. (2017). Clearing up the fiscal multiplier morass. *American Economic Review*, 107(8):2409–2454.

Lucidi, F. S. (2022). The misalignment of fiscal multipliers in italian regions. *Regional Studies*, pages 1–14.

Matarrese, M. M. and Frangiamore, F. (2023). Italian local fiscal multipliers: Evidence from proxy-svar. *Economics Letters*, 228:111185.

Mertens, K. and Ravn, M. O. (2013). The dynamic effects of personal and corporate income tax changes in the united states. *American economic review*, 103(4):1212–1247.

Mountford, A. and Uhlig, H. (2009). What are the effects of fiscal policy shocks? *Journal of applied econometrics*, 24(6):960–992.

Pappa, E. (2009). The effects of fiscal expansions: an international comparison. *UAB Manuscript*.

Piacentini, P., Prezioso, S., and Testa, G. (2016). Effects of fiscal policy in the northern and southern regions of italy. *International Review of Applied Economics*, 30(6):747–770.

Ramey, V. A. (2011). Identifying government spending shocks: It's all in the timing. *The Quarterly Journal of Economics*, 126(1):1–50.

Ramey, V. A. (2019). Ten years after the financial crisis: What have we learned from the renaissance in fiscal research? *Journal of Economic Perspectives*, 33(2):89–114.

Ramey, V. A. and Shapiro, M. D. (1998). Costly capital reallocation and the effects of government spending. In *Carnegie-Rochester conference series on public policy*, volume 48, pages 145–194. Elsevier.

Ramey, V. A. and Zubairy, S. (2018). Government spending multipliers in good times and in bad: evidence from us historical data. *Journal of political economy*, 126(2):850–901.

Stock, J. H., Wright, J. H., and Yogo, M. (2002). A survey of weak instruments and weak identification in generalized method of moments. *Journal of Business & Economic Statistics*, 20(4):518–529.

Zezza, F. (2022). Which role for public corporations? a panel svar analysis on italian regional data. *Journal of Regional Science*, review.

Zezza, F. and Guarascio, D. (2022). Fiscal policy, public investment, and structural change: A p-svar analysis on italian regions.

Data	**Description**
y	Gross Domestic Product
GC	Government Final Consumption Expenditures
GI	Government Gross Fixed Capital formation
gdp_{def}	GDP Deflator
pop	Annual average population
Variable	**Description**
GDP	Real per-capita GDP, $gdp = ln(y/gdp_{def}/pop)$
G	Real per-capita Public Spending, $g^C = ln((GC + GI)/gdp_{def}/pop)$

Table 1: *Regional Data, annual frequency, period 1995-2020. Source: GDP deflator from AMECO, the other variables from ISTAT regional accounts*

Regions	GDP	G	$G(\%)$
Abruzzo	24654.51 (854.66)	6184.83 (373.89)	25.10
Basilicata	20942.98 (872.28)	6550.66 (493.64)	31.29
Calabria	17148.88 (928.97)	6675.63 (498.33)	38.94
Campania	18852.03 (971.42)	5894.18 (526.23)	31.24
Emilia-Romagna	34607.48 (1279.77)	5987.60 (363.92)	17.30
Friuli-Venezia Giulia	30385.04 (1252.80)	7039.60 (614.89)	23.16
Lazio	35307.14 (2342.23)	6600.03 (644.09)	18.68
Liguria	30750.41 (1472.74)	6559.34 (364.49)	21.34
Lombardia	38025.82 (1289.26)	5607.60 (324.70)	14.75
Marche	27109.24 (1385.66)	5877.75 (371.35)	21.68
Molise	21541.04 (1539.06)	7291.55 (783.10)	33.85
Piemonte	30607.74 (1487.10)	5912.76 (513.74)	19.32
Provincia Autonoma Bolzano	42243.71 (1824.75)	10701.83 (431.04)	25.39
Provincia Autonoma Trento	37690.83 (1230.16)	9746.79 (805.29)	25.86
Puglia	18233.47 (751.19)	5569.50 (398.36)	30.55
Sardegna	20479.93 (930.50)	7172.23 (471.84)	35.01
Sicilia	18210.22 (988.77)	6666.94 (559.50)	36.58
Toscana	30373.81 (1224.58)	6052.32 (395.38)	19.93
Trentino Alto Adige	39930.06 (920.24)	10217.53 (561.91)	25.60
Umbria	26714.70 (1963.70)	6384.06 (471.93)	23.93
Valle d Aosta	39244.60 (2252.86)	13717.56 (1465.49)	34.91
Veneto	32102.56 (1234.02)	5663.68 (362.34)	17.65

Table 2: *Descriptive statistics of data. Average of regional per-capita real variables for the period 1995-2020. In brackets the standard deviations. The last column provide the share of G over* GDP.

(A.) *Relevance of Non-Fiscal Proxies*		
	p-val	F-stat
Abruzzo	0.00	35.04
Basilicata	0.00	36.26
Calabria	0.00	19.40
Campania	0.00	53.63
Emilia-Romagna	0.00	55.33
Friuli-Venezia Giulia	0.00	55.22
Lazio	0.00	33.29
Liguria	0.00	36.86
Lombardia	0.00	66.69
Marche	0.00	69.43
Molise	0.00	21.87
Piemonte	0.00	46.38
Provincia Autonoma Bolzano	0.00	22.76
Provincia Autonoma Trento	0.00	42.11
Puglia	0.00	58.03
Sardegna	0.00	28.74
Sicilia	0.00	37.29
Toscana	0.00	75.63
Trentino Alto Adige	0.00	82.01
Umbria	0.00	50.42
Valle d Aosta	0.00	40.49
Veneto	0.00	51.24
(B.) *Exogeneity of Non-Fiscal Proxies*		
	pval	F-stat
F_g	0.90	0.01

Table 3: *Relevance and Exogeneity test for the non-fiscal proxy*

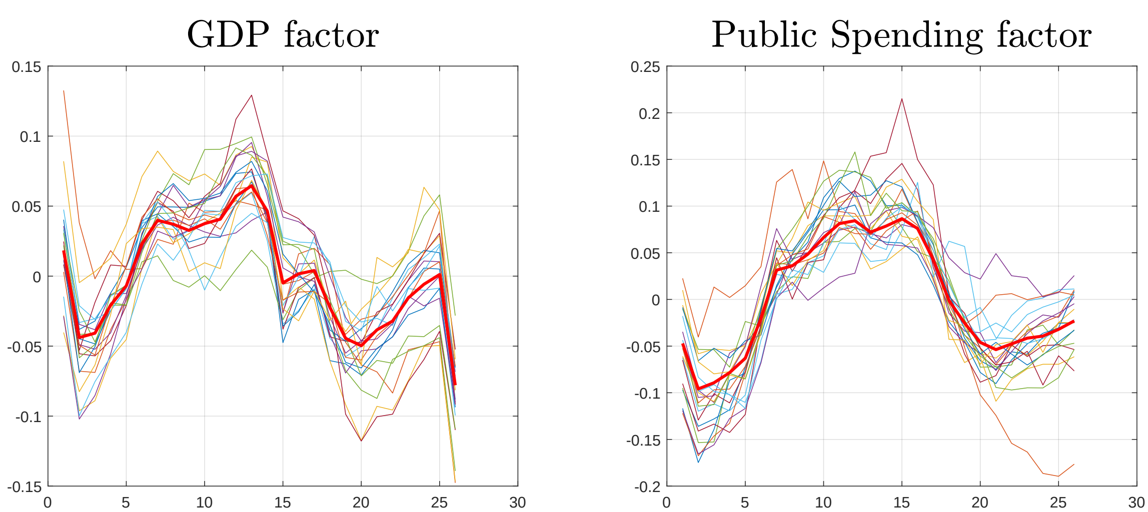

Figure 1: *Factors (bold red lines) obtained through PCA on data series (thin lines)*

Macro-Area	$\mathbb{M}$	Impact	2Y	4Y	6Y	8Y	10Y	Peak(h)	Avg
Italy	$\mathbb{M}_G$	2.053	1.577	1.300	1.086	0.909	0.762	2.053(0)	1.263
	$\mathbb{M}_G^{chol}$	3.256	1.954	1.528	1.264	1.057	0.885	3.256(0)	1.594
Centre-North	$\mathbb{M}_G$	2.403	1.756	1.414	1.159	0.952	0.783	2.403(0)	1.385
	$\mathbb{M}_G^{chol}$	3.673	2.138	1.638	1.331	1.092	0.898	3.673(0)	1.720
South	$\mathbb{M}_G$	1.416	1.180	0.987	0.826	0.692	0.579	1.416(0)	0.940
	$\mathbb{M}_G^{chol}$	2.287	1.550	1.224	1.010	0.843	0.706	2.287(0)	1.237

Table 4: *Macro-Area Multipliers - comparison with Cholesky approach*

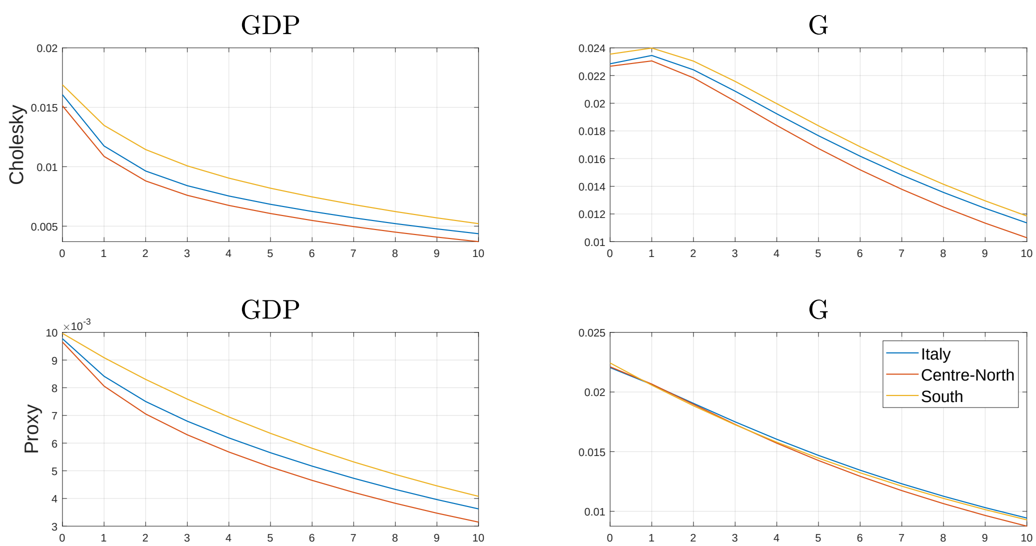

Figure 2: *IRF to spending shock for Italian macro-areas*

Regions	$\mathbb{M}$	Impact	2Y	4Y	6Y	8Y	10Y	Peak(h)	Avg
Abruzzo	$\mathbb{M}_G$	0.991	0.719	0.457	0.288	0.181	0.114	0.991(0)	0.449
	$\mathbb{M}_G^{chol}$	0.923	0.706	0.450	0.284	0.179	0.113	0.923(0)	0.436
Basilicata	$\mathbb{M}_G$	0.651	0.102	-0.049	-0.068	-0.051	-0.033	0.651(0)	0.062
	$\mathbb{M}_G^{chol}$	1.064	0.239	-0.013	-0.065	-0.057	-0.038	1.064(0)	0.144
Calabria	$\mathbb{M}_G$	1.063	0.909	0.770	0.651	0.549	0.464	1.063(0)	0.731
	$\mathbb{M}_G^{chol}$	1.637	1.386	1.171	0.989	0.834	0.704	1.637(0)	1.114
Campania	$\mathbb{M}_G$	1.319	1.129	0.944	0.786	0.654	0.544	1.319(0)	0.892
	$\mathbb{M}_G^{chol}$	2.154	1.484	1.175	0.965	0.800	0.665	2.154(0)	1.178
Emilia-Romagna	$\mathbb{M}_G$	1.778	1.025	0.650	0.431	0.291	0.199	1.778(0)	0.694
	$\mathbb{M}_G^{chol}$	1.791	1.030	0.652	0.432	0.292	0.199	1.791(0)	0.697
Friuli-Venezia Giulia	$\mathbb{M}_G$	0.870	0.766	0.621	0.493	0.390	0.308	0.870(0)	0.574
	$\mathbb{M}_G^{chol}$	1.895	1.081	0.771	0.593	0.465	0.367	1.895(0)	0.823
Lazio	$\mathbb{M}_G$	2.416	2.339	2.062	1.796	1.562	1.358	2.440(1)	1.930
	$\mathbb{M}_G^{chol}$	3.417	2.715	2.331	2.023	1.758	1.529	3.417(0)	2.269
Liguria	$\mathbb{M}_G$	1.756	1.295	0.912	0.632	0.435	0.299	1.756(0)	0.872
	$\mathbb{M}_G^{chol}$	2.269	1.595	1.104	0.760	0.522	0.359	2.269(0)	1.075
Lombardia	$\mathbb{M}_G$	2.183	1.871	1.493	1.186	0.942	0.749	2.183(0)	1.399
	$\mathbb{M}_G^{chol}$	3.514	2.025	1.573	1.248	0.991	0.787	3.514(0)	1.613
Marche	$\mathbb{M}_G$	1.418	1.988	1.589	1.245	0.975	0.763	2.070(1)	1.382
	$\mathbb{M}_G^{chol}$	2.582	2.344	1.847	1.447	1.133	0.887	2.584(1)	1.712
Molise	$\mathbb{M}_G$	0.717	0.556	0.419	0.313	0.233	0.173	0.717(0)	0.397
	$\mathbb{M}_G^{chol}$	1.288	0.955	0.709	0.526	0.391	0.290	1.288(0)	0.681
Piemonte	$\mathbb{M}_G$	2.371	1.440	1.054	0.833	0.677	0.555	2.371(0)	1.111
	$\mathbb{M}_G^{chol}$	4.364	2.170	1.421	1.076	0.861	0.702	4.364(0)	1.656
Prov. Aut. Bolzano	$\mathbb{M}_G$	-1.450	-0.326	-0.155	-0.077	-0.038	-0.019	-0.019(10)	-0.275
	$\mathbb{M}_G^{chol}$	-0.157	-0.278	-0.143	-0.071	-0.036	-0.018	-0.018(10)	-0.130
Prov. Aut. Trento	$\mathbb{M}_G$	0.136	0.130	0.114	0.097	0.083	0.071	0.136(0)	0.105
	$\mathbb{M}_G^{chol}$	1.643	0.543	0.257	0.170	0.132	0.110	1.643(0)	0.417
Puglia	$\mathbb{M}_G$	0.981	0.988	0.857	0.717	0.593	0.490	1.019(1)	0.777
	$\mathbb{M}_G^{chol}$	2.009	1.350	1.041	0.841	0.689	0.567	2.009(0)	1.054
Sardegna	$\mathbb{M}_G$	1.718	1.246	0.947	0.722	0.552	0.421	1.718(0)	0.916
	$\mathbb{M}_G^{chol}$	2.075	1.427	1.079	0.823	0.628	0.480	2.075(0)	1.058
Sicilia	$\mathbb{M}_G$	1.129	1.097	0.929	0.781	0.656	0.550	1.165(1)	0.862
	$\mathbb{M}_G^{chol}$	1.575	1.273	1.067	0.895	0.752	0.631	1.575(0)	1.022
Toscana	$\mathbb{M}_G$	1.941	1.451	1.108	0.847	0.648	0.495	1.941(0)	1.064
	$\mathbb{M}_G^{chol}$	2.620	1.634	1.229	0.939	0.718	0.549	2.620(0)	1.234
Trentino Alto Adige	$\mathbb{M}_G$	-0.849	0.042	0.039	0.030	0.024	0.019	0.043(3)	-0.054
	$\mathbb{M}_G^{chol}$	0.490	0.054	0.040	0.031	0.024	0.019	0.490(0)	0.080
Umbria	$\mathbb{M}_G$	1.935	1.364	0.974	0.699	0.502	0.361	1.935(0)	0.950
	$\mathbb{M}_G^{chol}$	3.198	1.979	1.354	0.959	0.686	0.493	3.198(0)	1.390
Valle d Aosta	$\mathbb{M}_G$	-0.143	0.857	0.664	0.486	0.354	0.258	0.857(2)	0.483
	$\mathbb{M}_G^{chol}$	0.021	0.855	0.658	0.481	0.351	0.256	0.855(2)	0.497
Veneto	$\mathbb{M}_G$	1.998	1.065	0.649	0.425	0.288	0.197	1.998(0)	0.726
	$\mathbb{M}_G^{chol}$	2.629	1.294	0.751	0.479	0.321	0.219	2.629(0)	0.883

Table 5: *Regional Multipliers - comparison with Cholesky approach*