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POLICY DEBATES

Fiscal policy, public investment and structural change: a P-SVAR analysis on Italian regions

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ABSTRACT

This study analyses the regional impact of public expenditures focusing on three domains central to the Italian National Recovery and Resilience Plan (NRRP): green, digital and knowledge. Relying on a regional public expenditures sectoral dataset for the period 2000–19, we perform a panel structural vector autoregressive (P-SVAR) model showing that fiscal policy has positive and long-lasting effects on gross domestic product (GDP) and private investments. A relevant heterogeneity is detected, relative to: (1) the effects of sectoral spending in crowding-in investment; (2) the impact on regions' 'structural upgrading'; and (3) a discrepancy in fiscal multipliers across macro-areas. Nevertheless, the results suggest that the NRRP may help in reducing the Italian divide.

KEYWORDS

fiscal multipliers; panel structural vector autoregressive (P-SVAR); Italian regions; North–South divide

JEL C33, E62, H70, R58

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1. INTRODUCTION

One of the major economic consequences of the COVID-19 crisis has been the deepening of territorial divides (Gräbner et al., 2020). Regions characterised by weak industrial structure, stagnant demand and high unemployment rates proved to be less resilient in the face of the pandemic shock, worsening their relative position and contributing to increased within-country polarisation (Diemer et al., 2022). This is particularly true in the case of Italy where a long-lasting 'North–South' divide (Iuzzolino et al., 2013) was already widening following the 2008 financial crisis (Odoardi & Muratore, 2019). Due to a significantly lower share of exporting firms, paralleled by an at least a 10-year-long stagnation of internal demand (particularly concerning private and public investments), the Mezzogiorno fell further behind, experiencing a partial recovery only thanks to a steady growth of the touristic sector (Bürgisser & Di Carlo, 2022).

Against this background, the recently launched National Recovery and Resilience Plan (NRRP) includes regional convergence among its top priorities.[1] About 40% of the entire NRRP's resources are expected to be spent in the Mezzogiorno (roughly €82 billion). Similarly, a large share of the projects included in the NRRP's infrastructural, digitalisation, green transition-related missions refer to investments that will be realised, in part or entirely, in the Mezzogiorno.[2] Indeed, the NRRP represents a significant discontinuity as opposed to the 'austerity agenda' that hegemonised European and Italian policymaking during the post-2008 crisis period (Cesaratto & Zezza, 2019), and is going to provide a substantial demand-side stimulus to the economy, pursuing long-term structural objectives by means of public investments. On the contrary, the across-the-board reduction in public expenditure characterising the post-2008 austerity phase prolonged the recession and proved particularly painful in the South, leading to a dramatic drop of regional gross domestic product (GDP) and employment figures (Giannola, 2014).

In this context, the NRRP combines two fundamental objectives. First, strengthening the Italian industrial structure by accelerating the two major processes of change that are already underway: green transition and digitalisation. In parallel, the plan aims at reinforcing the healthcare as well as the education and public research sectors. Second, it directs a significant share of public investments towards the South so to restore regional convergence and narrow the North–South divide.

However, some recent contributions (e.g., Lucchese & Pianta, 2021) have cast doubt on the actual capacity of the NRRP to achieve both the structural objectives included in it, as well as to restore convergence between Northern and

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Southern regions, due to: (1) the limited allotted resources, despite its size compared with other national plans (Corti et al., 2022); (2) the lack of productive and technological capabilities, which may translate into growing external imbalances (Banca d'Italia, 2022); and (3) the uneven territorial distribution of skills and knowledge-related infrastructures (Rodríguez-Pose & Ketterer, 2020).

The combination of these elements may turn into a smaller structural and macroeconomic impact of the plan, as opposed to what the Italian government has initially predicted (D'Imperio & Di Bartolomeo, 2022), particularly in the Mezzogiorno, where most of the structural and administrative weaknesses tend to concentrate (Terracciano & Graziano, 2016).

This study provides an empirical assessment of the regional impact of public expenditures focusing on three domains that are key for the ongoing NRRP implementation: green, digital and education/knowledge. We perform a panel structural vector autoregressive (P-SVAR) model estimating regional fiscal multipliers, and testing whether and to what extent public expenditures have contributed to regional convergence. The contribution to the extant literature is twofold. First, this is, to best of our knowledge, the first attempt to estimate regional fiscal multipliers relying on Italian data and focusing on public investments distinguished by expenditure domain. Second, by focusing on expenditures directed at green transition, digitalisation and the strengthening of the knowledge base (e.g., universities, public research institutes, industry–university joint ventures), the evidence provided here represents a solid base from which to discuss the potential and expected outcome of the NRRP in terms of both its structural impact and its ability to restore regional convergence.

The remainder of the paper is structured as follows. Section 2 briefly reviews the literature focusing on regional fiscal multipliers and on the linkage between public investments and structural change. Section 3 introduces the data used for the empirical analysis and provides some stylised facts on the Italian North–South divide. Section 4 presents the empirical strategy and discusses the main results. Section 5 discusses the policy implications. Section 6 concludes.

2. FISCAL POLICY AND STRUCTURAL CHANGE

2.1. Fiscal multipliers

To assess the values of fiscal multipliers, the macroeconomic literature provides a wide array of instruments.[3] Along with model-based estimates, in recent years there has been a strong revival in the use of structural vector autoregressive (SVAR) models,[4] which allows us to estimate the impact of exogenous spending shocks, once the appropriate identification strategy has been set.[5]

In a survey of 41 studies focusing on advanced economies, Mineshima et al. (2014) show that impact multipliers are on average equal to 0.75 for government spending and 0.25 for government revenues, supporting the standard Keynesian view for which spending is more expansionary than tax reductions, since household may save a significant amount of this extra post-tax income. Relying on a meta-analysis, Gechert (2015) reaches similar conclusions, showing that public investment multiplier are roughly equal to 1.5, while spending multipliers are close to 1.0, about 0.3–0.4 units larger than tax and transfer multipliers. He also notes, however, that the magnitude of multipliers may vary according to the model adopted, country, time horizon and data used to define the fiscal variables, leaving ample space for further empirical investigations.

On the one hand, in model-based estimates, reported multipliers depend on the theoretical approach adopted. In real business cycle models, characterised by utility-maximising representative household for whom Ricardian equivalence holds and fully competitive labour and goods markets, multipliers are very small (or even negative). In this case, fiscal expansion increase GDP via neoclassical wealth effects or substitution effects increasing labour supply, and the value of the multiplier depends upon the elasticities of demand for labour and the elasticity of substitution of consumption and leisure (Woodford, 2011). In the new-Keynesian dynamic stochastic general equilibrium (NK-DSGE) – which extends the basic neoclassical framework to introduce monopolistic competition and sticky prices or wages, allowing for an output gap in the short run and possible demand-side effects of fiscal policy – the value of the fiscal multiplier largely depends on the monetary policy reaction function, which may cause adverse effects on private demand via interest rate. Here, the presence of non-Ricardian consumers (Eggertsson & Krugman, 2012; Galí et al., 2007) or of a central bank operating at the zero lower bound (Ji & Xiao, 2016) may generate larger fiscal multipliers. The highest values reported are those stemming from large-scale backward-looking macroeconometric models of both new- and post-Keynesian fashions, as in this case short-run demand effects prevail, and fiscal expansion increase output via crowding-in effects of private consumption and investment, given the monetary policy stance and foreign trade regime.

On the other hand, one of the main issues in pure empirical approaches – such as vector autoregressives (VARs) and single-equation methods – stems from the potential endogeneity of public spending due to automatic stabilisers, which makes the identification of shocks harder, inevitably influences the values of the estimated multipliers and questions the robustness of results. We will return to this issue when discussing the fiscal data adopted in Section 3 and our identification strategy in Section 4.

Given the large number of comprehensive reviews on fiscal multipliers, in what follows we concentrate exclusively on studies that address similar research questions (e.g., regional fiscal multipliers, structural factors affecting their size) and/or focus on Italian regions.

Ilzetzki et al. (2013) discuss the structural characteristics of economies that may affect the size and degree of

persistence of fiscal multipliers. According to their analysis, the size of fiscal multipliers turns out to depend upon: the level of industrial development (the more developed the higher multiplier); the exchange rate regime (lower multipliers for flexible exchange rates regimes); the degree of openness to trade (the lower the propensity to import, the higher the fiscal multiplier); and the size of public debt (high-debt countries have lower multipliers, as fiscal stimulus is likely to have negative effects on financial market confidence, possibly leading to lower investment).

Cole and Ohanian (2004) and Gorodnichenko et al. (2012) highlight the role of labour market rules, that is, the degree of 'labour market rigidity' intended as the strength of legal safeguards against layoffs. According to their analysis, the more rigid the labour market, the larger the fiscal multipliers tend to be (as rigid wages tend to amplify the responsiveness of output to demand shocks). On the other hand, Dolls et al. (2012) reported a negative correlation between of the size of automatic stabilisers and that of fiscal multipliers; while Batini et al. (2014) found an analogous negative correlation looking at the relationship between the relative efficiency of public expenditure management and fiscal multipliers (i.e., the lower the degree of efficiency, the lower the size of multipliers).

When it comes to the Italian case, fiscal multipliers have been analysed through a wide array of models and methodologies. Model-based estimates find positive values for fiscal multipliers, with higher ones related to investment (Bulligan et al., 2017; De Nardis & Pappalardo, 2018). The literature relying on VARs to estimate fiscal multipliers is rich and heterogeneous concerning the adopted identification strategies. Nevertheless, contributions are rather homogenous in terms of results: fiscal multipliers are always positive with the investment component displaying the highest values (e.g., Cimadomo & D'Agostino, 2016; Alfonso et al., 2018; Deleidi, 2022; Deleidi et al., 2020a).

A more circumscribed number of recent studies focus on Italian regions and/or macro-areas, estimating 'local fiscal multipliers' on regional cross-sectional data using SVARs in a panel setting.[6] In a framework similar to that adopted here, Deleidi et al. (2021) investigate the effect of fiscal expansion on GDP in Italian macro-areas, decomposing public expenditures between current and investment spending. They find that the higher cumulative multipliers (10 years after the idiosyncratic shock) are those associated with investment, equal to 4.0 in the Centre–North and 2.3 in the Mezzogiorno. Their results are confirmed even when fiscal foresights are accounted for. Other studies use instead Bayesian techniques to estimate region-specific multipliers. In a five-variable Bayesian random effect P-VAR model with cross-sectional heterogeneity, Destefanis et al. (2022) focus on threes sources of public spending – EU Structural Funds, government investment and government consumption – and their effects on private investment and GDP. They find, on average, positive multipliers for government investment (even though the larger values are reported for EU Structural Funds), with generally higher values for the Mezzogiorno.[7] While both previous studies use an identification strategy based on a Choleski scheme, Lucidi (2022) uses theory-driven sign restrictions, as in Canova and Pappa (2007), estimating the effects of shocks to public current expenditure (i.e., the sum of public final consumption and social transfers), public investment and deficit, on GDP, employment and prices. His results point to a misalignment in fiscal multipliers not only between aggregates – with the highest multipliers reported for investment and the lowest for revenues – and across macro-areas – with Centre–North displaying an investment multiplier at impact of 2.5, against 1.5 in the Mezzogiorno – but also within them.[8]

2.2. Public investments and structural change

The number of contributions adopting a 'structural perspective' to analyse the macroeconomic impact of public demand is, so far, relatively scant. Deleidi and Mazzucato (2019, 2021) have recently studied the impact of public demand focusing on those components that can have a 'transformative potential' (e.g., infrastructural investments, public research and development (R&D), innovative public procurement, mission-oriented policies). According to this approach – which combines a supermultiplier model (SMM) of growth (Freitas & Serrano, 2015)[9] with a neo-Schumpeterian framework emphasising the entrepreneurial role of the state (Mazzucato, 2011; Tavani & Zamparelli, 2020) – public investments aiming at addressing relevant 'societal challenges' operate de facto as industrial policies having the capacity to shape economies' innovative capacity and promoting structural change. By creating a context that is favourable to the development of innovations, public investments may also stimulate firms' own innovation efforts. For example, investments strengthening knowledge infrastructures (e.g., universities, public–private research joint ventures) and/or easing technology transfer may reduce innovation-related uncertainty, thus increasing the incentive for private R&D expenditures (Mazzucato, 2018). Deleidi et al. (2020b) show how public investment are able to induce and positively affect private firms' R&D, potentially contributing to the diffusion of knowledge and innovation opportunities throughout the economy. By relying on public investments (and, more broadly, on industrial policy strategies) government interventions may go well beyond just 'fixing market failures', creating new markets, raising profit expectations and thus crowding-in private companies' innovation efforts (especially in high-tech industries, where returns on private R&D are particularly uncertain). Therefore, by producing an exogenous increase in the demand for innovative goods and services, public investments may physiologically stimulate innovation efforts aimed at capturing such demand flows. Deleidi and Mazzucato's (2021) SVAR model is estimated for the US economy, distinguishing between generic government expenditure and mission-oriented innovation policies (proxied by defence R&D expenditure) to assess the effect on GDP and on private R&D (i.e., crowding-in effect). They show that mission-oriented innovation policies

generate a larger effect on GDP than generic public expenditures. Similar results are obtained for the private R&D crowding-in effect.

Along similar lines, Crespi and Guarascio (2019) find that 'innovative public procurement' (i.e., the direct purchase of innovative goods and services by the public sector) has a positive and significant impact on industries' innovation efforts. Relying on industry-level information (24 Organisation for Economic Co-operation and Development (OECD) economies observed over the period 1995–2012), they show how public procurement is positively and significantly associated with innovation (proxied by industry-level patenting activities), confirming this result throughout specifications and robustness checks. Remarkably enough, the innovation-enhancing effect of public demand is resized in countries that are characterised by a strong import dependency testifying how the presence of solid productive capabilities is crucial to determine the ultimate macroeconomic and structural effect of public investments.

2.3. Some critical remarks on the existing literature

Considering the empirical literature on fiscal multipliers, notwithstanding the model adopted – it being a VAR or a large-scale model – there are no conclusive indications on the magnitudes of the effects of public spending on economic activity, other than that these largely depend on the institutional and economic peculiarity of the system under study. Moreover, since the recent literature on Italian regions points to different conclusions, further empirical analysis is necessary.

Second, while most studies at the national level attempt at resolving the potential endogeneity of public spending with respect to the business cycle either by excluding some components of expenditures (usually current transfers and interest payments) or focusing on subcategories of spending (such as R&D military expenditures), this is not possible using territorial statistics provided by ISTAT, which lumps all spending categories in a single voice for both current and capital expenditures.

Third, on the expenditures side, the literature has so far focused on multipliers related to aggregate public consumption, investment and transfers, while none – to the best of our knowledge – investigated separately the role of mission-oriented policies at the subnational level. These, as discussed previously, are becoming increasingly strategic for both Italy's government and the EU policy agenda.

As we discuss shortly, our work aims at filling these gaps in the literature.

3. DATA AND DESCRIPTIVE EVIDENCE

The relative lack of empirical assessments of the impact of public investment at the local level for Italy is due to the absence of detailed statistical information.[10]

We take advantage of a rich database – the CPT database – providing detailed information on regional public expenditure at current prices. CPT data are published by the Agency for Territorial Cohesion,[11] including all categories of current and capital expenditures for all institutional levels (national, regional and local administrations), and for 30 different sectors of activity. In terms of time coverage, variables are available at annual frequency from 2000 to $t-2$, where t is the current year.

We selected three key expenditure areas included in the CPT: energy and environmental transition (energy, environment, water utilities, waste disposal); digitalisation (R&D, ICT); and knowledge (education, training). Public expenditure (g_i^j) is defined – for every region i and sector j (total T, energy and environment G, knowledge K, and digital D) – as the sum of 'wages and salaries paid', 'goods and services purchased', 'investment in real estates and infrastructure' and 'investment in machineries and other movable assets'.

In contrast to existing studies, the CPT data allow us to minimise ex-ante the potential endogeneity of fiscal spending: (1) by distinguishing between sectors of intervention, we can both focus on mission-oriented policies and exclude those dealing with automatic transfers, such as social security; and (2) furthermore, we can exclude all categories of spending that represent the main sources of endogeneity inside our sectors of interest (e.g., interest payments, current and capital transfers, etc.). Indeed, only Lucidi (2022) excludes current (but not capital) transfers, while both Deleidi et al. (2021) and Destefanis et al. (2022) use total government consumption and investment expenditures, and none investigates subsectors of expenditures.

Series for regional GDP, private investment (i.e., gross fixed capital formation net of public sector) and other macroeconomic variables are recovered from ISTAT, covering the period 2000–19. All nominal variables are transformed in constant (2015) prices using the regional GDP deflator. Table A1 in Appendix A in the supplemental data online details the sources for all data used in the estimations.

3.1. The deepening of the Italian North–South divide

We now provide a comprehensive empirical assessment of the Italian North–South divide. Despite it being considered an 'endemic malaise' affecting the Italian economy since its very early stages (Iuzzolino et al., 2013), the North–South divide has widened significantly since the introduction of the common currency in 2001.

Figure 1 displays the evolution of real output (gdp_i), total public expenditure (g_i^j) and private investment (i_i) in Italian macro-areas (i.e., Centre–North versus Mezzogiorno) from 2000 to 2019.[12] Why is 2001 such a 'turning point' for the Italian North–South divide? While providing a final answer to such a complex question is well beyond the scope of this paper, some speculative explanations can be put forth. First, the introduction of the euro coincides with a substantial increase in international competition (Tiffin, 2014) and related processes of industrial restructuring.[13] Southern regions, characterised by a

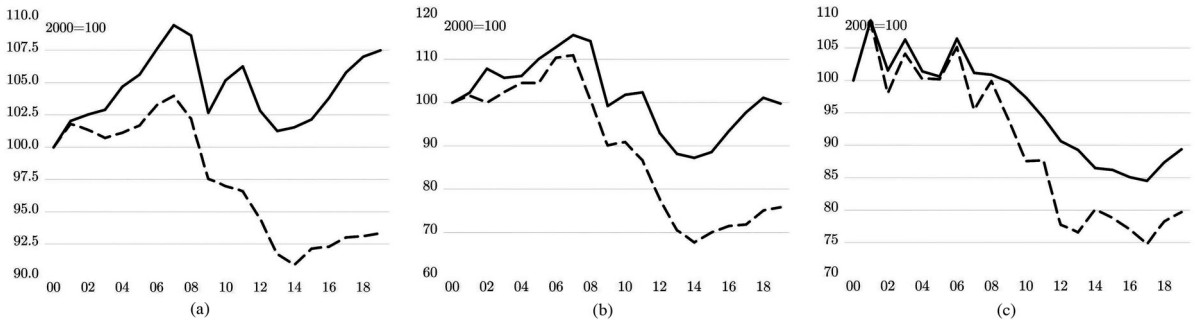

Figure 1. Selected macroeconomic variables: (a) gross domestic product (GDP); (b) private investment; and (c) public expenditure.
Note: Selected macroeconomic variables are expressed in constant 2015 prices, and equal to 100 in the base year (2000). Centre–North = solid line; Mezzogiorno = dashed line.
Sources: ISTAT, CPT database; authors' own elaboration.

weaker industrial structure and poorer connections into global value chains (Celi et al., 2018), have suffered more than their Northern counterparts, with negative implications in terms of employment and GDP. Second, in 2001 the Italian administrative structure was reformed, providing financial autonomy and a number of key competences to regions (Palermo & Wilson, 2014). By reducing the redistributive power of the central government while increasing regions' autonomy in managing resources and related investment projects, this reform contributed to increase territorial inequalities as regards size and the quality of public expenditure (Del Monte et al., 2022). Being relatively weaker in terms of governance, administrative capabilities and institutional quality, in fact, the Mezzogiorno's regions increased their delay vis-à-vis Northern ones (Nifo & Vecchione, 2014). Third, the self-defeating nature of the austerity policies implemented in Italy following the 2008 financial crisis. Austerity has put an additional burden on the Mezzogiorno's economic dynamics contributing to widen the North–South gap: GDP growth (Figure 1a) in the Mezzogiorno fell to 0.3% between 2014 and 2019, against the 1.1% registered in the Centre–North. By 2019, real GDP in the Mezzogiorno was still 12% below its peak in 2008, against the −3% of the Centre–North. Similar dynamics can be seen by focusing on private investment (Figure 1b) and public expenditures in key sectors (Figure 1c), with the Mezzogiorno experiencing larger drops during the crises, and a slower recovery thereafter. In the same way, while the COVID-19 pandemic hit Italian regions rather symmetrically in 2020, the recovery in 2021 has been stronger in Northern regions (Banca d'Italia, 2022).

Moving to the additional drivers that contributed to such divergent patterns, we now focus on the evolution of industrial structures. Figure 2a shows that both areas experienced a reduction in the share of manufacturing in value added before the financial crisis, following which both regions experienced a dramatic decline. While the dynamic is partly inverted in the Centre–North, the Mezzogiorno's manufacturing share stabilised at a new (lower) level, well below the pre-crisis peak (and the values the for Centre–North). Figure 2b focuses on the share in manufacturing value added of high- and medium-high technology sectors. Here the Italian dualism is more pronounced.

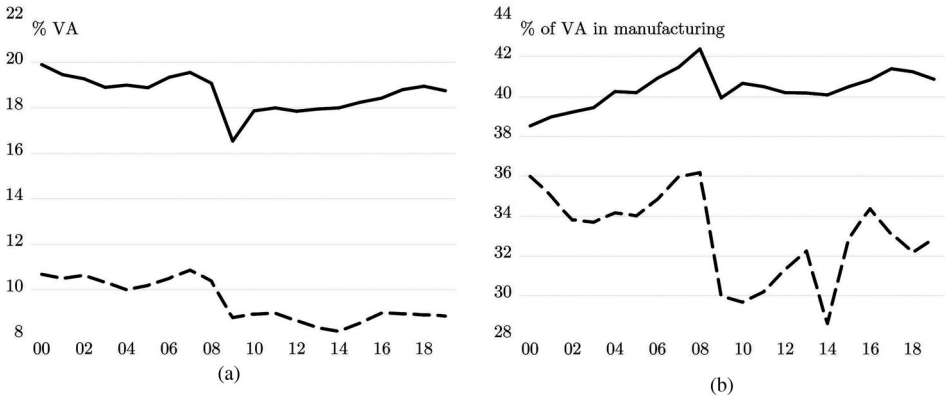

Figure 2. Industrial specialisation: share of manufacturing in (a) total value added; and (b) in value added of high- and medium-high technology manufacturing sectors.
Note: The aggregation of high- and medium-high technology manufacturing sectors follows Eurostat NACE Rev.2 at the two-digit level. Centre–North = solid line; Mezzogiorno = dashed line.
Source: ISTAT.

The Centre–North has a process of increasing specialisation in high-tech sectors, the speed of which only decelerated following the financial crisis. On the contrary, the Mezzogiorno experienced a stronger decline in manufacturing specialisation after the financial crises, which slowly reversed after 2014. This reflects a structural divide: Southern regions tend to be increasingly specialised in traditional sectors, whose wages and productivity are lower, while Northern ones strengthened their relative position, further widening the gap (Castelnovo et al., 2020).

The second channel relates to international trade. Following the euro's inception, the Italian economy worsened its position in many foreign markets, mostly due to the parallel strengthening of Germany's external competitiveness both within and outside the EU (Simonazzi et al., 2013). This has weighed on growth, contributing to enlarge the gap between Italy and the German manufacturing core (Stehrer & Stöllinger, 2015). Nonetheless, exports remained a fundamental driver of growth for Italian regions, particularly during austerity phases characterised by weak internal demand. But since most exporting firms are localised in the North, export-related economic opportunities are distributed rather unevenly across regions, opening an additional divide deemed to grow steadily during post-crisis phases. Figure 3a shows that, between 2000 and 2019, Southern regions registered an average current account balance deficit of over 20% of GDP, mirrored by a 7% surplus in the Centre–North. The dramatic fall in Mezzogiorno disposable incomes that followed the 2008 financial crisis led to a decline in its deficit, which however remains at very high levels. On the other hand, Figure 3b shows the regional exports of goods (as a percentage of GDP) towards 'dynamic sectors'.[14] Both macro-areas display an increase in the share of exports over GDP, which accelerated from 2014, but the traded volumes are significantly different: while in the Centre–North dynamic exports account for almost 10% of GDP (equal to roughly €128.4 billion in 2019, in real terms), in the Mezzogiorno the figures are halved: 5.2% of GDP (€19.6 billion in 2019). However, there are also promising signs of change. Figure 3c shows the degree of export specialisation (e.g., the share of dynamic sectors in total export). While Centre–North regions kept a 30% share of their export coming from sectors with dynamic world demand, data show a steady increase in specialisation in the Mezzogiorno, from 29% to over 40% between 2012 and 2019, pointing to the relative resilience (and economic dynamism) of its export sector. It is a resilience that so far has failed to impress a macroeconomic stimulus capable to reduce the structural gap vis-à-vis Northern regions.

The evidence provided in this section documented the depth and dynamics of the Italian North–South divide, providing some insights about its potential structural drivers. In what follows, we empirically assess how public demand and investments may affect Italian regions' macroeconomic and structural dynamics.

4. EMPIRICAL STRATEGY AND RESULTS

4.1. Empirical strategy

This section presents the P-SVAR methodology[15] and reports the main results.

First, we assess the impact of shocks to mission-oriented fiscal expenditures (g_i^j), where i stands for the 20 Italian NUTS-2 regions and j for total fiscal expenditure (excluding automatic stabilisers, g_i^T), made of green (g_i^G), digital (g_i^D) and education/knowledge-related public investments (g_i^K). The aim is to test whether and to what extent public expenditures and, more importantly, NRRP-related components of public investments:

- stimulate private investment (i_i) and expand output (gdp_i); and
- contribute to regional structural upgrading, supporting trade performance (proxied by export specialisation, xd_i) and strengthening regions' industrial structure (proxied by the share of high- and medium-high technology manufacturing value added, ht_i).

Second, we explore the role of regional heterogeneities, testing whether the North–South divide is also reflected in

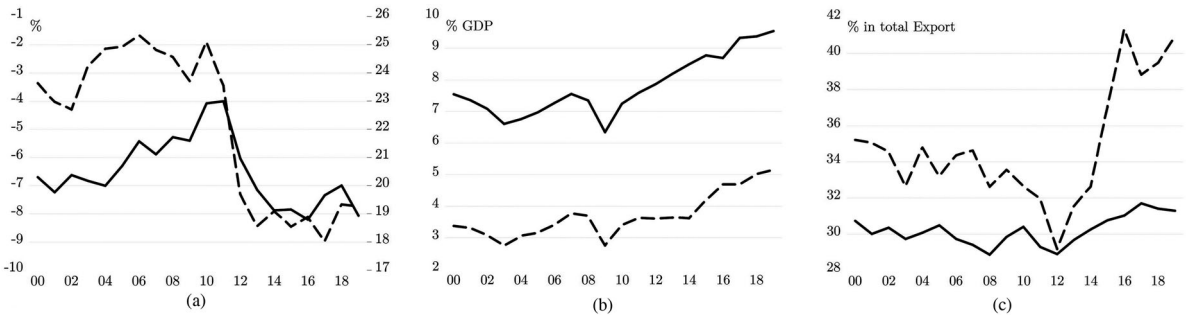

Figure 3. Trade performance: (a) economic dependency: net total imports as a share of gross domestic product (GDP); (b) export of sectors with dynamic world demand as a share of GDP; and (c) degree of export specialisation, for example, the share of export of sectors with dynamic world demand in total export.
Note: Centre–North = solid line; Mezzogiorno = dashed line.
Sources: ISTAT, BES (Benessere Equo e Sostenibile is an ISTAT project on equitable and sustainable well-being. For more information, see https://www.istat.it/it/benessere-e-sostenibilit%C3%A0/la-misurazione-del-benessere-(bes)).

the way Italian regions respond to public expenditures shocks. To this end, we split our sample in two – Centre–North versus Mezzogiorno – estimating macro-areas' fiscal multipliers, and disentangling the role that green, digital and knowledge-related public investments may play in promoting regional growth and structural change.[16]

All macroeconomic variables are expressed as a share of the trend of real GDP (as in Gordon & Krenn, 2010) while specialisation in exports (xd_i) and high-tech (ht_i) enter the estimations in levels. In the literature, SVAR models are often estimated using natural logarithms to compute elasticities, which are then transformed into euro-equivalent multipliers relying on an ex-post conversion factor, usually the sample average of the ratio of GDP to government spending (Y/G) as, for example, in Deleidi et al. (2021). However, the ratio of GDP to our variable for total public spending shows great regional heterogeneity, and the problem worsens even more when using more disaggregated measures. Using Gordon and Krenn's (2010) ex-ante transformation, in contrast, allows us to compute multipliers directly from impulse response functions (IRFs), as they are already expressed in euro equivalents. Both Lucidi (2022) and Destefanis et al. (2022), who adopt the same strategy for their baseline models, report a similar issue, the former with respect to revenues, and for the revolving funds (which tend to be destined in underdeveloped regions) by the latter.[17] Finally, the panel unit root test shows that all variables are $I(1)$, and so they enter estimations in first differences (which are stationary).

Table 1 reports the descriptive statistics of our variables.

We start estimating a reduced-form P-VAR(n) as in (1):

$$y_{i,t} = A_i(L)y_{i,t-n} + \varepsilon_{i,t} \tag{1}$$

where $y_{i,t}$ is the vector of endogenous variables, $A_i(L)$ is the polynomial of lagged coefficients and $\varepsilon_{i,t}$ is the error term. We also include region-specific fixed effects, omitted from the notation for convenience. Given the results of the lag-length tests (the results are reported in Table A2 in Appendix A in the supplemental data online), we introduce two lags.

To obtain a P-SVAR, we need to impose an identification strategy to the reduced-form P-VAR(n), which allows to retrieve a structural model as in (2):

$$B_{0i}y_{i,t} = B_i(L)y_{i,t-n} + w_{i,t} \tag{2}$$

where B_{0i} is the matrix of contemporaneous coefficients, B_i is the matrix of lagged coefficients and $w_{i,t}$ is the vector of serially uncorrelated structural shocks. To identify the structural model, one needs to impose theory-driven

Table 1. Descriptive statistics.

	(a + b + c) g_i^T	(a) g_i^D	(b) g_i^G	(c) g_i^K	i_i	gdp_i	xd_i	ht_i
				All regions				
Mean	3182.27	272.84	431.85	2477.58	14,701.25	85,233.47	31.60	35.73
Median	2514.25	161.25	364.60	1685.92	7890.15	46,240.65	26.89	34.98
Maximum	9148.99	1630.79	1532.67	7676.78	74,472.20	386,065.0	89.57	64.26
Minimum	117.88	0.08	21.62	87.78	685.70	4573.00	4.40	6.64
SD	2298.38	275.62	309.01	1849.52	14,771.98	84,138.89	17.19	11.50
Observations	400	400	400	400	400	400	400	400
				Centre–North				
Mean	3242.17	330.95	361.37	2549.85	19,081.66	108,986.0	28.45	36.74
Median	2805.23	234.67	325.19	2186.64	12,520.45	81,713.70	24.89	35.46
Maximum	9148.99	1630.79	1128.88	7676.78	74,472.20	386,065.0	73.63	59.10
Minimum	117.88	0.08	21.62	87.78	685.70	4573.00	9.01	15.96
SD	2336.54	320.47	234.84	1882.92	17,130.20	97,714.78	14.15	10.58
Observations	240	240	240	240	240	240	240	240
				Mezzogiorno				
Mean	3092.41	185.66	537.57	2369.18	8130.63	49,604.70	36.32	34.20
Median	2514.25	146.31	553.09	1681.95	6682.40	34,511.95	34.04	34.45
Maximum	7966.71	816.26	1532.67	6283.48	24,371.60	119,147.1	89.57	64.26
Minimum	316.07	9.46	55.85	247.41	917.80	5937.40	4.40	6.64
SD	2244.17	153.33	371.45	1798.66	5838.72	35,831.40	20.08	12.64
Observations	160	160	160	160	160	160	160	160

Note: Public expenditures, investment and gross domestic product (GDP) are expressed in real (2015) prices.
Sources: ISTAT, BES, CPT, authors' own elaboration.

restrictions on the matrix of contemporaneous coefficients $B_{0i,j}$, which allows to obtain exogenous fiscal policy shocks (Kilian & Lütkepohl, 2017).

We test two models that share the first three variables – public demand[18] (g_i^j), private investment (i_i) and output (gdp_i) – with the fourth one being one of our structural variables (xd_i or ht_i). Both are recursively identified through a Choleski factorisation (Bachmann & Sims, 2012). This assumes that $B_{0i,j}$ is lower triangular, and that structural shocks are uncorrelated. 'Basically it is a story about a given endogenous variable being determined by those *higher up* in the system but not those *lower down*' (Ouliaris et al., 2016, pp. 92–93). It is worth noting, however, that after the initial period variables in the system are allowed to interact freely. The identification is thus as in (3):

$$B_{0i}y_{it} = \begin{bmatrix} - & 0 & 0 & 0 \\ - & - & 0 & 0 \\ - & - & - & 0 \\ - & - & - & - \end{bmatrix} \begin{bmatrix} xd_i \\ g_i^j \\ i_i \\ gdp_i \end{bmatrix} \quad (3)$$

where 0 represents a zero restriction; and '–' indicates an unrestricted parameter.

Following the standard scheme of Blanchard and Perotti (2002) and the recent surveyed empirical literature on Italian regions, the fiscal variable (g_i^j) is ordered first among our macroeconomic variables. This identification builds upon the idea that government expenditures are not contemporaneously affected by changes in GDP because of both the delay in the release of GDP figures and due to the discretionary nature of fiscal policies. Although Blanchard and Perotti's story underlines the importance of these lags when using quarterly data, in our case – where we employ regional data at annual frequency – these are even more important, since: (1) regional macroeconomic data are released at annual frequency with a two-year delay – against the half-year of official quarterly national statistics – which implies that local policymakers need to rely on projections, which are usually heavily revised; and (2) further delay in responding to changes to economic cycle, in the regional context, also arise from state–region coordination issues, as investment plans are usually partly funded by the central authority.

Furthermore, this also follows the supermultiplier literature, where output growth is determined by the growth rate of the exogenous components of demand (particularly public expenditures) in both the short and long runs (Freitas & Serrano, 2015).

As in Deleidi and Mazzucato (2021) and Destefanis et al. (2022), we assume that private investment is contemporaneously affected by changes in public expenditures but not to changes in output, and so it is ordered second. In this setting, some of the output fluctuations are considered transitory. Consequently, instead of fully adapting productive capacity to effective demand, firms' adjustments occur by a flexible accelerator process. Moreover, as firms operate with a flexible degree of capacity utilisation, all expected peaks of demand are met with the current installed capacity (Ciccone, 1986).

In model 1, we add to our baseline specification the degree of export specialisation, for example, the share in export of sectors with dynamic demand. Our intention here is to investigate the ability of public expenditures directed at key sectors, such as green, digital and education/knowledge, to increase trade competitiveness, for example, to generate a positive change in the ratio. In model 2, we add a variable capturing the degree of specialisation in high-technology manufacturing sectors, for example, the share of high- and medium-high technology sectors in manufacturing value added, so that our vector of endogenous variables becomes: $[ht_i, g_i^j, i_i, gdp_i]$. In both models the structural variable is ordered first, since it represents a proxy of the regional economic structure and thus can be assumed to only slowly adapt to changes in other variables.[19]

Expanding on the approach proposed by Deleidi and Mazzucato (2019, 2021), models 1 and 2 allow us to investigate the 'transformative' potential of public demand, assessing the impact that the latter may have on regions' structural upgrading. Given the relevance of exports as a driver of growth and innovativeness (Guarascio et al., 2017), model 1 focuses on the ability of public demand to increase regions' exporting capabilities. This test is particularly important for the analysis of regional convergence in Italy. As argued, Northern regions' export performance is one of the fundamental elements explaining their ability to outperform their Southern peers in terms of growth and employment. Therefore, one of the main objectives of the NRRP, as a way to narrow the North–South gap, is to strengthen the Mezzogiorno's export capacity. On the other hand, the ability to grow is strictly related to regions' innovation capabilities (Castellacci et al., 2020; Rodríguez-Pose & Crescenzi, 2008). Accordingly, model 2 allows us to explore the linkage between public demand and share of medium-high- and high-tech manufacturing. In this way, we are able to identify the capacity of public demand and, more specifically, of components that are explicitly directed at promoting structural change, to strengthen regions' innovation potential.

Finally, it is important to stress that our scheme does not address the non-fundamentalness of fiscal shocks, for example, agents in the economy may anticipate the effects of any future public intervention for which there is available information (Kilian & Lütkepohl, 2017). Thus, even though the annual frequency of our data mitigates this effect, including expectations into the analysis may possibly change the results. However, this effect was found to be negligible in our Italian regional setting, as shown by both Deleidi et al. (2021) and Lucidi (2022).

4.2. Results

In what follows, we first illustrate the main results of the P-SVAR model reporting, the test on all regions, and second, we provide the results of the separate analysis on Centre–North and Mezzogiorno regions.

4.2.1. All regions

Figure 4 shows the IRFs, which trace the effects of a shock to one endogenous variable on to the other variables in the

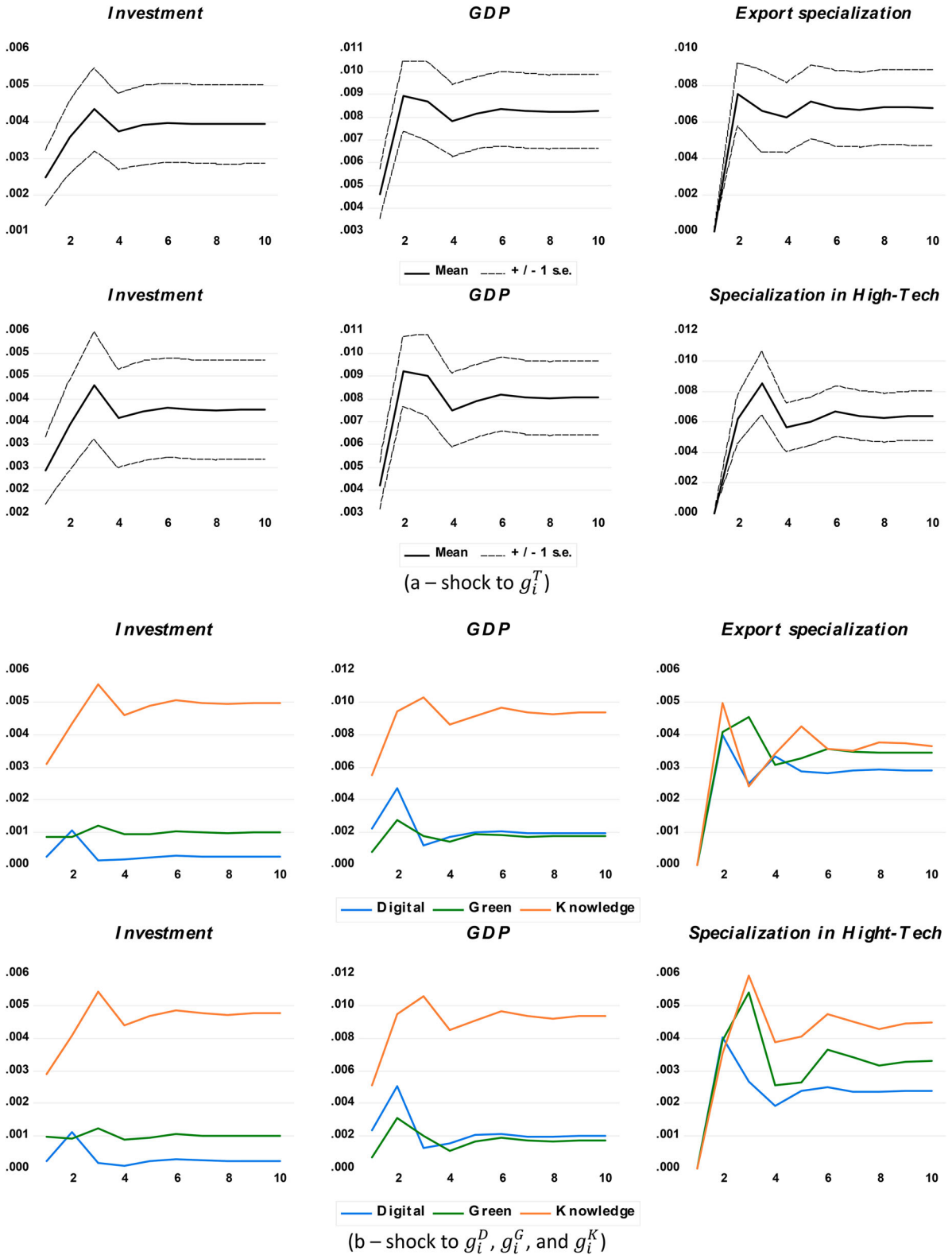

Figure 4. Impulse response functions (IRFs) from models 1 and 2 elasticities for all regions: (a) shock to g_i^T; and (b) shock to g_i^D, g_i^G, and g_i^K
Note: Confidence bands = dotted lines.
Source: Authors' own elaboration.

Table 2. Cumulative fiscal multipliers: all regions.

Horizon	Model 1												Model 2									
	All sectors			Digital			Green			Knowledge			All sectors			Digital			Green			Knowledge		
	Inv	GDP	XD	Inv	GDP	XD	Inv	GDP	XD	Inv	GDP	XD	Inv	GDP	HT	Inv	GDP	HT	Inv	GDP	HT	Inv	GDP	HT
1	**1.0**	**1.9**	**0.0**	0.4	**3.9**	**0.0**	**0.5**	0.5	**0.0**	**2.0**	**3.6**	**0.0**	**1.0**	**1.7**	**0.0**	0.4	**4.1**	**0.0**	**0.6**	0.4	**0.0**	**1.9**	**3.3**	**0.0**
3	**2.2**	**4.4**	**3.3**	0.3	2.3	1.3	**1.3**	**1.9**	**2.3**	**4.6**	**8.4**	1.2	**2.0**	**4.3**	**4.1**	0.3	2.5	**1.3**	**1.3**	**2.1**	**2.6**	**4.3**	**8.4**	**2.8**
5	**2.0**	**4.2**	**3.6**	0.5	**4.3**	1.5	**0.9**	**1.7**	**1.7**	**4.1**	**7.6**	**2.2**	**1.9**	**3.9**	**3.0**	0.5	**4.4**	**1.2**	**0.9**	**1.6**	**1.3**	**3.7**	**7.2**	**2.0**
10	**2.0**	**4.2**	**3.4**	0.5	**4.2**	1.5	**0.9**	**1.7**	**1.7**	**4.1**	**7.8**	**1.8**	**1.9**	**4.0**	**3.2**	0.5	**4.3**	**1.2**	**0.9**	**1.6**	**1.6**	**3.8**	**7.5**	**2.2**
Peak	**2.2**	**5.4**	**4.5**	2.6	**11.7**	**2.4**	**1.3**	**2.4**	**2.4**	**4.8**	**10.5**	**3.0**	**2.0**	**5.2**	**4.1**	2.7	**12.6**	**2.3**	**1.3**	**2.7**	**2.6**	**4.3**	**9.9**	**2.8**
Mean	1.9	4.1	3.2	0.7	4.7	1.4	0.9	1.6	1.7	4.0	7.6	1.7	1.8	3.9	2.9	0.7	4.8	1.2	0.9	1.6	1.6	3.7	7.3	2.0

Note: Public expenditure multipliers for shocks to (g_i^T). Multipliers for private investment (i_t) and output (gdp_t) are reported in euro-equivalent, for example, they display the euro-change in the variable due to a euro-change in fiscal expenditure. Statistically significant estimates are reported in bold and highlighted in dark grey/light grey if positive/negative.
Source: Authors' own calculations on ISTAT, BES and CPT data.

VAR; while Table 2 reports the cumulative fiscal multipliers for models 1 and 2, respectively.

Shocks to total public expenditure (g_i^T) have similar effects in models 1 and 2:

- Crowd-in private investment, with a significant average multiplier ranging between 1.9 and 1.8 for models 1 and 2, respectively.
- Have positive, significant and persistent effects on output, which tend to increase over time, reaching an average multiplier of 4.1 and 3.9 for models 1 and 2, respectively.
- Contribute to structural upgrading, leading to a 3.4% long-run increase in export specialisation and a 3.2% increase in specialisation in high-tech manufacturing.

The variance decomposition (Figure 5) provides information about the relative importance of each random innovation in affecting the variables in the VAR, separating the variation in an endogenous variable into the component shocks to the VAR. In both models 1 and 2, total government expenditures (shock 2, orange bar) determine 8.5–9.5% of the variation in GDP at the 10th horizon, 4.9% of the variation in export competitiveness both in the medium and long runs, and 4.7% of the variation in specialisation in high-tech manufacturing.

When the role of green, digital and education/knowledge-related public investments is explicitly accounted for, significant heterogeneity emerges (Figure 4b, lower panels).

Looking at the crowding-in effects on private investment, these are large (positive and significant) for shocks to spending in education/knowledge – with multipliers ranging between 2.0 and 1.9 at impact for models 1 and 2, respectively – while are below unity (and not significant) for digital spending. A potential explanation regards the relatively weak productive and technological capabilities of Italian regions as regards the ICT sector (Guarascio & Stöllinger, 2022). Such a relative backwardness may easily translate into 'import dependency', particularly concerning the purchase of electronic equipment and, more broadly, intermediate goods, possibly obliterating the crowding-in effect of public investments directed towards these industries.

Concerning the effects on output, in contrast, shock to digital public expenditures displays a larger (and significant) effect on impact, ranging between 3.9 and 4.1 in models 1 and 2, respectively (against 3.6 and 3.3 for knowledge and 0.5 and 0.4, but not significant, for green investments). The positive effects on output tend to increase over time, particularly for shocks to knowledge and digital spending, which display long-run multipliers of 7.8 and 7.5 and 4.2 and 4.3 respectively.

Looking at the effects on our structural variables, our results point to some heterogeneity among different sectoral expenditures. The largest long-run structural effects are reported for shocks to knowledge expenditures, leading to a (statistically significant) increase in both the degree of export specialisation (+1.7%) and the specialisation in

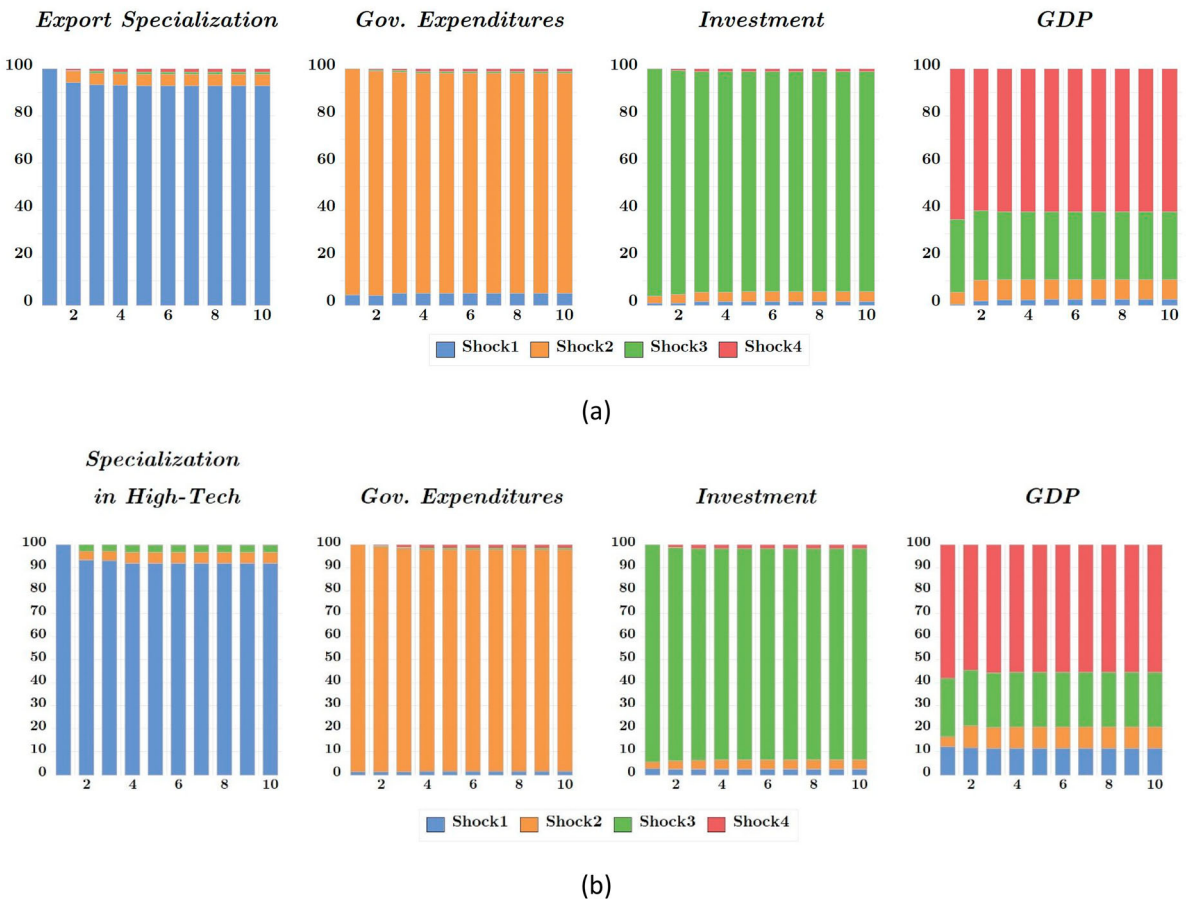

Figure 5. Variance decomposition using structural vector autoregressive (SVAR) factors: models 1 and 2 for all regions.
Note: Shown is the percentage of the forecast variance due to each innovation at every horizon, with each column adding up to 100%.
Source: Authors' own elaboration.

high-tech manufacturing (+2%). In contrast, shocks to digital spending display the smallest effect, positive on high-tech specialisation (ht_i, +1.2% at the 10th horizon), and non-significant on export competitiveness.

This heterogeneity deserves some discussion. The comparatively lower magnitude of model 2's multipliers can be explained by the long-term, slow and complex processes that must take place to determine an increase of the regional share of high-tech manufacturing productions. The relatively lower impact of digital investments should be, again, linked to import dependency (see the discussion above). Green investments turn out to have a remarkable impact on both export and high and medium-high technology manufacturing specialisation, which is relevant from a policy point of view. By carrying out green investments the Italian government seems capable of pursuing a threefold aim: accelerating the ecological transition, increasing regions' external competitiveness and reinforcing their industrial structure.

4.2.2. Centre–North versus Mezzogiorno

We now split the sample between the Centre–North and Mezzogiorno to verify whether the territorial divide documented in section 3 affects the relationship between public demand, GDP, private investments and the structural dynamics of Italian regions. This test matters since convergence and, more specifically, reinforcing the Mezzogiorno's economy is one of the key objectives of the NRRP. Second, public investments are the fundamental tool put forth to achieve such a goal.

Figure 6 shows the IRFs relative to shocks to total public demand in models 1 and 2 in the two macro-areas, whereas Table 3 reports the cumulative multipliers.

Our results are in line with the existing literature addressing territorial differences in fiscal multipliers in Italy. GDP multipliers are higher in the Centre–North at impact, but the effects tend to converge to a higher value (the mean is around 4 for each area, in both models).[20] Multipliers are larger in the Centre–North also when we look at crowding-in effects on private investment. In this case, however, the territorial gap persists mirroring the structural divide between the two areas illustrated in section 3.[21] Moving to the effects on our structural variables, some interesting results stands out.

Shocks to total public expenditure are found to have structural positive and significant effects only in the South, with little to no effects in Northern regions: despite the existing structural divide, public investments may thus

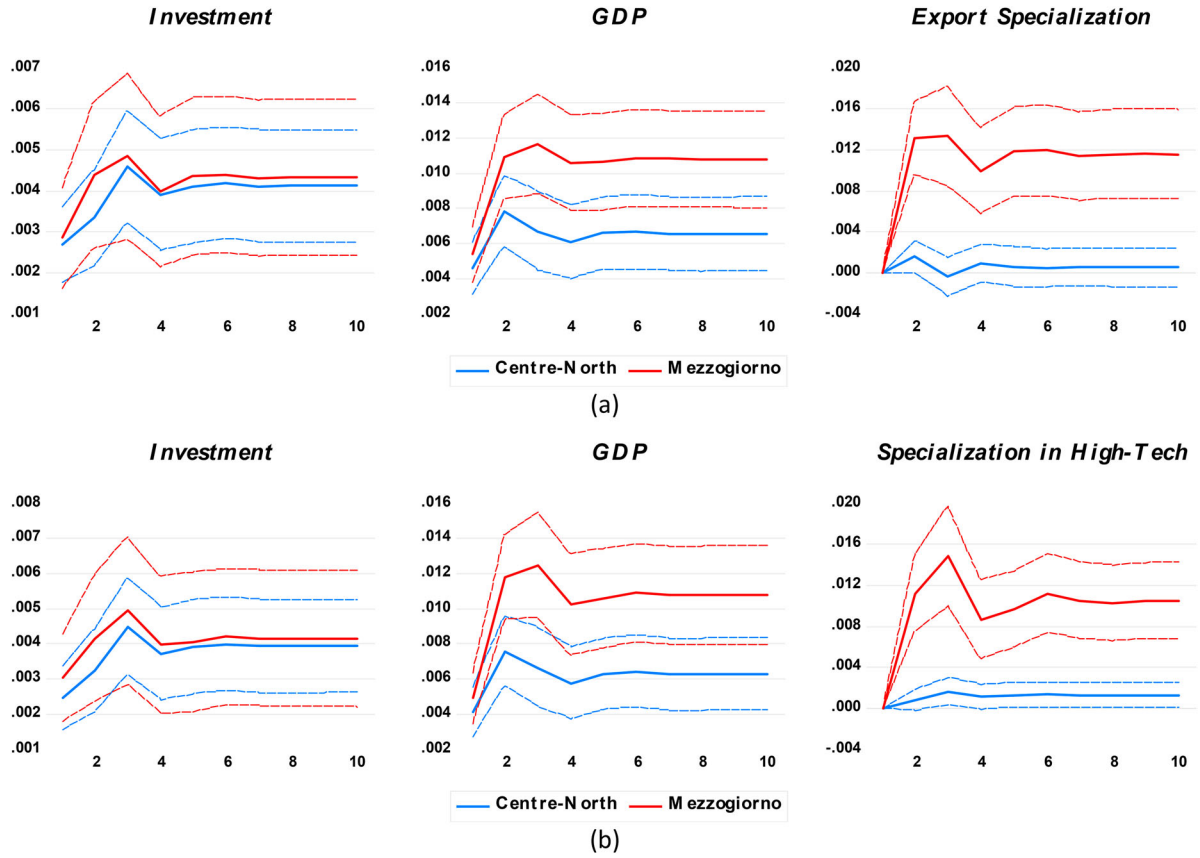

Figure 6. Impulse response functions (IRFs) from models 1 and 2 for macro-areas: elasticities.
Note: Confidence bands = dotted lines.
Source: Authors' own elaboration.

accelerate the convergence process, by strengthening both the Mezzogiorno's export competitiveness and manufacturing capabilities.

The higher importance of public demand for the Southern economy is reflected in the variance decomposition (see Figures A8 and A9 in Appendix A in the supplemental data online). Total government expenditures in the Mezzogiorno (shock 2, orange bar, lower panels) determines 13.7% and 17.15% of the variation in GDP at the 10th horizon in models 1 and 2, respectively, against 6.5% to 6.0% in the Centre–North. Furthermore, it explains 9.1% of the variation in export competitiveness and 7.4% of the variation in specialisation in high-tech, against a mere 1.3% and 0.7% for Northern regions.

Focusing on NRRP-related public investments, a significant heterogeneity can be observed (see Figures A6 and A7 in Appendix A in the supplemental data online). First, although it stimulates output in both areas, public investments in the digital sector crowd out the Mezzogiorno's private investments, while the crowding-in effects in the Centre–North are the largest across sectors. Such a result might be driven by the poorer productive and technological capabilities of Southern regions, which may very well translate into international and interregional trade imbalances with obvious negative implications for local private investments, particularly in the case of a technologically complex and path-dependent domain as the digital one. Along similar lines, the structural effects are only present in the Mezzogiorno, with shocks to education/knowledge expenditure leading to a 3.5% long-run increase in export competitiveness and a 3.1% increase in high-tech specialisation.

To confirm the soundness of our empirical strategy, we run a series of robustness checks. First, it is well known that altering the ordering of the variables in the VAR can lead to dramatic changes in the results for models identified through a Cholesky scheme. To this end, we estimated models 1 and 2 by trying different variable orderings. Second, we also tested if and how our results are robust to different variable choices, and thus switched real GDP with real value added. Results for both exercises (available from the authors upon request) are qualitatively similar to the ones reported. Finally, we split our sample along the lines of Table A3 in Appendix A in the supplemental data online, for example, net importer/exporter and manufacturer/traditional. Again, GDP multipliers and the crowding-in effects on investment tend to be larger in exporting and manufacturer regions, while the opposite is true with respect to the structural effects on export and high-tech specialisation, thus further confirming our results on regional divide and on the heterogeneous effectiveness of public policy in the two macro-areas.

Table 3. Cumulative fiscal multipliers: macro-areas.

	Model 1												Model 2											
	All sectors			Digital			Green			Knowledge			All sectors			Digital			Green			Knowledge		
	Inv	GDP	XD	Inv	GDP	XD	Inv	GDP	XD	Inv	GDP	XD	Inv	GDP	HT	Inv	GDP	HT	Inv	GDP	HT	Inv	GDP	HT
Centre–North																								
1	**1.7**	**2.8**	**0.0**	**3.0**	**4.3**	**0.0**	0.5	0.5	0.0	**2.6**	**4.8**	0.0	**1.5**	**2.6**	0.0	**3.3**	4.7	**0.0**	0.3	0.2	0.0	**2.4**	**4.4**	**0.0**
3	**2.9**	**4.2**	–0.3	**6.8**	**1.6**	0.5	**1.8**	2.0	0.0	**4.9**	**8.0**	**–1.2**	**2.9**	**4.3**	1.1	**7.0**	**2.2**	0.9	1.5	1.8	0.1	**4.9**	**8.2**	**1.2**
5	**2.6**	**4.2**	0.4	**6.5**	**5.9**	0.9	**1.6**	1.9	0.2	**4.0**	**7.3**	–0.5	**2.6**	**4.1**	0.8	**6.8**	**6.3**	**1.0**	1.3	**1.4**	–0.1	**3.9**	**7.0**	**0.9**
10	**2.6**	**4.1**	0.3	**6.3**	**4.9**	0.9	**1.7**	2.0	0.2	**4.1**	**7.4**	–0.6	**2.6**	**4.1**	0.8	**6.6**	**5.3**	**0.9**	1.4	**1.6**	–0.1	**4.0**	**7.2**	**0.9**
Peak	**2.9**	**5.6**	**1.1**	**8.8**	**15.1**	**1.3**	**2.5**	4.1	0.3	**4.9**	**9.2**	0.4	**2.9**	**5.5**	1.1	**9.5**	**16.1**	**1.7**	**2.2**	**3.6**	0.1	**4.9**	**8.8**	**1.2**
Mean	2.5	4.1	0.3	6.2	5.4	0.8	1.7	2.0	0.1	3.9	7.3	–0.4	2.5	4.1	0.7	6.5	5.9	0.9	1.3	1.6	–0.1	3.8	7.1	0.8
Mezzogiorno																								
1	**0.9**	**1.7**	**0.0**	–0.3	**4.4**	**0.0**	0.5	0.3	**0.0**	**2.1**	**3.3**	**0.0**	**0.9**	**1.5**	**0.0**	–0.8	**3.9**	**0.0**	0.7	0.4	**0.0**	**2.0**	**2.9**	**0.0**
3	**2.0**	**4.7**	**5.4**	–2.3	**4.5**	**2.3**	1.4	1.9	**3.4**	**4.7**	**9.1**	**3.0**	**1.8**	**4.6**	**5.5**	–2.5	**3.8**	**1.8**	**1.5**	2.5	**3.6**	**4.4**	**9.1**	**3.9**
5	**1.8**	**4.4**	**4.9**	–2.1	**5.1**	**1.9**	0.8	**1.7**	**1.9**	**4.2**	**8.1**	**4.0**	**1.6**	**4.1**	**3.8**	–2.5	**3.8**	**1.3**	**1.0**	1.7	**1.7**	**3.7**	**7.7**	**2.7**
10	**1.7**	**4.4**	**4.7**	–2.1	**5.3**	**2.0**	0.9	**1.6**	**2.2**	**4.3**	**8.4**	**3.5**	**1.6**	**4.1**	**4.0**	–2.4	**4.2**	**1.4**	**1.0**	1.7	**2.3**	**3.9**	**8.1**	**3.1**
Peak	**2.2**	**5.6**	**6.7**	0.2	**11.9**	**3.7**	1.4	1.9	**3.4**	**6.5**	**12.1**	**4.9**	**1.9**	**5.4**	**5.5**	–0.1	**11.5**	**2.9**	**1.5**	**2.5**	**3.6**	**5.5**	**11.3**	**3.9**
Mean	1.7	4.2	4.4	–1.7	5.8	2.0	0.8	1.5	2.2	4.3	8.2	3.3	1.6	4.0	3.8	–2.1	4.8	1.4	1.0	1.7	2.2	3.8	7.9	2.7

Note: Public expenditure multipliers for shocks to (g_i^j). Multipliers for private investment (i_i) and output (gdp_i) are reported in euro-equivalent, for example, they display the euro-change in the variable due to a euro-change in fiscal expenditure. Statistically significant estimates are reported in bold and highlighted in dark grey/light grey if positive/negative.
Source: Authors' own calculations on ISTAT, BES and CPT data.

5. POLICY IMPLICATIONS

The role of the state and of local governments as a driver of structural upgrading as well as a means to catalyse private sector investments has been increasingly acknowledged (e.g., Klein et al., 2010; Deleidi et al., 2020b). From a regional viewpoint, a key role played by place-based industrial strategies involves tailoring policies to local conditions and specific industrial foundations (Bailey et al., 2020, 2023). These strategies, however, can also lead to unintended consequences, as industrial policies may end-up favouring those regions that already possess strong advantages – in terms of productive capabilities, infrastructures, quality of institutions, etc. – exacerbating rather than reducing regional inequalities. It is thus crucial to identify the conditions under which the combination of fiscal and industrial policy may promote regional convergence and structural upgrading.

Against this background, our evidence provides at least three major policy implications, which go beyond the Italian regional context and speak to the debate on regional divides and place-based policies.

First, public expenditure stands out as crucial driver of growth and structural change. After years of austerity, our results confirm the need to get rid of the pro-cyclical approach that has hegemonised the post-2008 phase allowing public demand to sustain incomes, reduce uncertainty and increase overall economic dynamism. Second, public investments are not all alike concerning their capacity to promote growth and structural upgrading. The poor performance of digital investments in stimulating growth, private investments, external competitiveness and innovativeness highlights how difficult the task of strengthening regional capabilities in this sector may be. The relative digital backwardness of certain regions may translate into a poor crowding-in effect and growing import dependency. In the Italian case, this may dwarf the potential of the NRRP as regards its 'digital missions', asking for additional and targeted industrial policies efforts aimed at filling the existing productive and technological gaps. On the other hand, green investments turn out to have a remarkable impact on both export and medium- and high-tech manufacturing specialisation. This result is relevant from a policy perspective, as carrying out green investments may help pursuing a threefold aim: accelerating the ecological transition, increasing regions' external competitiveness and reinforcing their industrial structure. Finally, in terms of structural upgrading (proxied by export and medium- and high-tech manufacturing specialisation) public investments turn out to have a stronger effect in underdeveloped regions, suggesting – in line with Vasilakos et al. (2023) – that industrial policy might be effective in closing regional gaps. Nothing can be said about the magnitude of such a differentiated effect or, said differently, to the actual capacity of a public investment programme, as the one included in the NRRP, to substantially narrow the gap dividing Italy's North and South. Nevertheless, showing that public demand is capable of reigniting convergence among regions represents, as such, a policy-relevant result. This calls for further empirical research and lends support to Keynesian and industrial policy agendas aiming at 'creating new markets', increasing innovativeness and supporting growth in a stable way.

6. CONCLUSIONS

The NRRP represents an unprecedented effort to promote growth, structural change and territorial convergence by implementing a massive seven-year-long public investment programme. In so doing, the Italian government aims at pursuing two 'grand challenges' (i.e., green transition and digitalisation) strengthening, in the meantime, crucial domains such as the education/research as well as the health sector. However, the structural context the Italian government is going to face is one of significant productive and technological backwardness vis-à-vis the major European economies (e.g., Germany) and of substantial regional divides. The latter have widened following the recent crises, burdening Italy's growth prospects for the years to come.

Taking advantage of regional-level (years 2000–19) information on public demand and investments, this work provides fresh evidence on the role that both central government and regions can play in sustaining growth and promoting structural change. We have also documented how the long-lasting structural weaknesses of the Italian economy and the persistent North–South divide may hamper the capacity of public investment (and thus potentially of the NRRP) to pursue their very objectives. Of course, the actual impact of the NRRP cannot yet be tested since the programme is at its very inception. The evidence provided here, however, represents a significant test bed allowing one to foresee (and discuss) the regional impact of NRRP-related investments, as well as to identify factors that may scale down their potential.

This study adds to the growing literature focusing on the heterogeneous impact of fiscal policy in the context of territorial divides and structural divergence. In this respect, Italy is a relevant case in point as the North–South divide plagues the economy since the early stages of its unification, constraining the effectiveness of public policies. Our key contribution concerns the joint consideration of shock to public demand and structural dimensions including export and manufacturing specialisation. This allowed capturing the structural impact of demand considering regional heterogeneities and opening the way for further research.

First, our approach could be extended to other cases, at both the national and territorial levels. This could be particularly relevant in the European context, as most of the member states are characterised by strong territorial divergence. Second, given the availability of long enough time series providing information on different types of public demand, even more sophisticated and granular analysis can be carried out.

Some caveats need to be mentioned, though. In this study, we do not explicitly account for different phases of the business cycle or for the role of expectations which, in turn, may affect the magnitude of multipliers. Moreover, the degree of regional detail of our analysis is limited by both the relatively short time span of our data as well as by the low volumes of sectoral expenditures as far as individual regions (or small clusters) are considered. Further research may continue investigating the heterogeneous impact of public demand across regions trying to go beyond data constraints and providing comparative cross-country evidence.

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NOTES

1. See Ministry of Economy and Finance (https://www.mef.gov.it/en/focus/The-Recovery-and-Resilience-Plan-Next-Generation-Italia/).
2. See Presidenza del Consiglio dei Ministri (https://italiadomani.gov.it/it/home.html).
3. For a comprehensive review of fiscal multipliers and their use for policy analysis, see Ramey (2011, 2019), Batini et al. (2014) and Castelnuovo and Lim (2019).
4. Other purely empirical methods include the local projections approach pioneered by Jordà (2005) and later integrated in SVAR models (Auerbach & Gorodnichenko, 2017). Recent studies show that SVAR and LP models produce the same IRF, and are equally robust to non-linearities (Plagborg-Møller & Wolf, 2021).
5. See Caldara and Kamps (2017) for a discussion of identification schemes in SVARs.
6. For model-based estimates see, among others, Piacentini et al. (2016) and Canelli et al. (2022).
7. As in Marrocu and Paci (2010) and Piacentini et al. (2016).
8. In the Centre–North, the investment multiplier at impact ranges between 7.8 for Trentino and 1.3 for Tuscany.
9. In contrast to models following the real business cycle and NK tradition, the SMM extends the 'Keynesian hypothesis' to the long run (Garegnani, 1992). Output growth is driven by the growth rate of the autonomous non-capacity-creating components of aggregate demand (such as public expenditures, export or credit-financed consumption), while the Keynesian multiplier effect is combined with an investment function grounded on the flexible accelerator principle (e.g., Girardi & Pariboni, 2019).
10. In ISTAT REA, public consumption follows the COFOG definition. However, it is not possible to distinguish between categories of expenditures. Investment spending is instead broken down in three sectors only (education, healthcare, other), so the matching between public consumption and investment for each economic sector is not possible.
11. See https://www.contipubbliciterritoriali.it/CPTDE/catalogo/CPTDE_CatalogoCPT.html.
12. Figures A1–A5 in Appendix A in the supplemental data online show the individual cross section of government expenditures (g_i^j), private investment (i_i) and GDP (gdp_i), and the degree of export ($spec_i^{XD}$) and high-tech ($spec_i^{HT}$) specialisation.
13. For a detailed analysis, see Celi et al. (2018).
14. From 2009, with the adoption of the new ATECO 2007 classification, sectors with dynamic world demand are CE, CF, CI, CJ, CL, M, R and S.
15. See Canova and Ciccarelli (2013) and Pedroni (2013) for a review of SVARs in a panel setting.
16. Table A3 in Appendix A in the supplemental data online shows the sample average for (A) economic dependency – defined as the ratio of net imports to GDP – and (B) the specialisation in manufacturing – defined as the share of manufacturing VA in total VA. Looking at the distribution of regions across groups (North/South, exporter/importer and manufacturer/traditional), a strong overlap is detected, with Northern regions being either a net exporter or running a balanced CAB, and Mezzogiorno regions mostly specialised in traditional sectors.
17. Lucidi (2022) shows how computing multipliers with the standard methodology would bias upward the results. We performed the same exercise, reaching similar conclusions. The results are available from the authors upon request.
18. Notice that: j ε {total public expenditure in green, digital, and knowledge-related sectors, excluding current and capital transfers}. This means that we estimate a separate model for each public expenditure aggregate.
19. It is well known that altering the ordering of the variables in the VAR can lead to dramatic changes in the results. However, our results are robust to different variable orderings.

20. While our results are on the upper bound in terms of magnitude, macro-areas GDP multipliers display similar dynamics to other studies in the literature on Italian regions. In Lucidi (2022), the government consumption multiplier at impact is equal to 1.7 in the North and 1.3 in the South, but converges to 1.2 and 1.1, respectively, at the eighth horizon. Similarly, the government investment multiplier is equal to 2.5 in the North and 1.5 in the South, but increases over time, even though a regional gap persists.
21. The evidence in Destefanis et al. (2022), which is the only other study in a regional setting that includes private investment, points to rather different results. Crowding-out effects on private investment due to shocks to government investment are reported for all but five regions, while government consumption shocks crowds-in private investment in all but seven regions, mostly located in the North.

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