Breaking the divide: Can public spending on social infrastructure boost female employment in Italy?[☆]

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ABSTRACT

This study investigates the impact of public spending on social infrastructure — including education, healthcare, childcare and social assistance — on the gender employment gap in Italian regions over the last two decades. Using a Panel Structural Vector Autoregressive (P-SVAR) model, we assess how these investments, while not explicitly targeting women, may plausibly support female employment—potentially by reducing the extent of unpaid care work and by creating jobs in care sectors that predominantly employ women. Our findings show that social infrastructure spending has a positive and long-lasting effect on private investment, GDP and employment across all regions. However, a reduction in the gender employment gap is detected only in Southern Italy and is limited to high-skilled women. These results highlight the need for targeted policies to address regional disparities and promote a more inclusive labour market, particularly in the South, where underinvestment is most severe.

1. Introduction

The financial crisis and, more recently, the COVID-19 pandemic have had devastating effects on living and working conditions in Europe, particularly in the southern periphery (Portugal, Italy, Greece and Spain). Following the 2008 crisis, these countries turned to austerity agendas, which led to significant cuts in social spending (Piacentini et al., 2016; Zezza, 2020), along with further deregulation of the labour market (Cirillo et al., 2017; d'Agostino et al., 2018). However, instead of delivering the hoped-for effects in terms of growth, these polices have exacerbated the existing core-periphery divides, both between and within EU countries (Celi et al., 2018, 2019).

Women have been particularly penalised by social spending cuts (Oyvat and Onaran, 2022). The social sector, which includes education,

healthcare, childcare and social assistance — and employs more women than men — has been crippling as a consequence of fiscal consolidation, thereby limiting employment opportunities for women (León and Pavolini, 2014; Pavolini et al., 2015). At the same time, the unequal distribution of unpaid care work, which disproportionately falls on women, (Mussida and Patimo, 2021; Simonazzi, 2008), combined with inadequate provision of public care services has put additional burden on female participation in the labour market (González et al., 2022; Pacelli et al., 2013). The pandemic has only intensified these enduring gender disparities (Cetrulo et al., 2022; Corsi and Ilkkaracan, 2023; De Henau and Himmelweit, 2021).

Italy presents a particularly compelling case for investigation in this context. The country ranks among the worst in the EU in terms of gender parity, with female employment and inactivity rates at 51.1 per cent and

43.6 per cent, respectively, in 2022. These national averages, however, mask significant regional heterogeneities. At the NUTS-2 level, six of the ten regions with the lowest female employment rates are in Italy, all located in the South (see Fig. 1). The disparity is especially stark in regions like Sicily, Calabria and Campania, where virtually less than one in three women are employed. This pattern is even more pronounced among young women with pre-school children, whose employment rates are over 25 per cent lower than those of young women without children (Cassa Depositi e Prestiti, 2023).

The North-South gender divide has long been a structural issue in Italy. The regional gap in female employment rates increased dramatically from 13.2 percentage points in the late 1970s to nearly 20 percentage points by 1993 (Andreotti et al., 2013).[1]

The underrepresentation of women in Italian labour market, particularly in the South, can be attributed to a combination of social and cultural norms about gender roles that assign care duties primarily to women, alongside structural barriers such as the lack (or inadequate) provision of public early childcare services (Simonazzi, 2008). Italy's coverage rate for children aged 0–2 years is just 27 per cent, far below Spain's 57.4 per cent and France's 50.8 per cent. In the South, coverage is even lower, at below 15 per cent.[2] The low female employment rates in the Italian Mezzogiorno[3] can also be ascribed to its broader structural weaknesses, persistent long-term unemployment and generally depressed labour market conditions.

Addressing these well-documented investment gaps in social infrastructure is essential for overcoming the North-South divide and brining Italy closer to its EU peers. Therefore, it is both crucial and timely to examine the impact of public spending on social infrastructure on female labour market outcomes, especially as gender inequalities risk being aggravated by ongoing demographic changes (i.e., an ageing population), which place additional burdens on women (Bettio et al., 2006; Simonazzi, 2008).

The role of government spending in shaping female labour market outcomes has been examined at micro, sectoral and macro level, with substantial evidence coming from impact evaluation studies. A relatively unexplored aspect of this nexus is its territorial dimension, which is particularly relevant in countries like Italy, with marked regional inequalities.

We address this research gap by bringing together two literature strands: macroeconomic analyses of the employment impact of public spending on social infrastructure (Onaran et al., 2022; Onaran and Oyvat, 2023; Oyvat and Onaran, 2022) and studies focusing on core-periphery divides (Celi et al., 2018; Gräbner et al., 2020). Specifically, we employ a panel structural vector autoregressive (P-SVAR) model on Italian regional data from 2000 to 2019 (Akitoby et al., 2022; Onaran and Oyvat, 2022, 2023), to address the following research questions: *i)* Can public spending on social infrastructure boost investment, enhance output and reduce the gender employment gap in Italy? *ii)* Can such spending break the persistent North-South divide in gender disparities? and *iii)* Does public spending on social infrastructure lead to different employment outcomes across skill distribution? Our findings reveal a positive and long-lasting impact of social expenditure on private investment, GDP and employment. While the employment effect is similar across regions, despite their structural differences, the magnitude varies. The impact on the gender employment gap is favourable only in the South – regions characterised by a lower quality of public

services, chronic underinvestment in social infrastructures and a more disadvantaged labour market conditions – but only for high-skilled women. However, these positive outcomes tend to diminish over time, as (prevalently low-skill) male employment is stimulated relatively more in subsequent periods. This, in turn, increases the gender employment gap, suggesting that structural weaknesses prevail in the medium to long term. The rest of the paper is organised as follows. Section 2 reviews the literature on fiscal policy and its impact on women in the labour market, as well as on fiscal multipliers. Section 3 presents the data used in the analysis and outlines the empirical strategy adopted. The results are presented and discussed in Section 4. Section 5 concludes with a policy discussion.

2. Literature review

2.1. Fiscal multipliers

In recent years, fiscal research has experienced a "Renaissance" (Ramey, 2019), particularly in the analysis of the macroeconomic effects of government spending. This research largely relies on macro econometric models such as SVAR or Local Projections,[4] employing various identification methods (Caldara and Kamps, 2017). Meta-analyses of this extensive literature show that fiscal multipliers for government spending are positive, typically ranging from 0.5 to 1. The investment component tends to yield the highest multipliers, followed by public purchases and transfers (Gechert, 2015; Gechert and Rannenberg, 2018; Ramey, 2019). However, the magnitude of these multipliers varies depending on factors such as the model used, the specific country under study, the time frame considered and the data used to define fiscal variables.[5] Furthermore, the structural characteristics of the economy — including industrial development, exchange rate regimes, trade openness and levels of public debt — can also influence the size and persistence of fiscal multipliers (Ilzetzki et al., 2013). Labour market institutions are also relevant. Studies by Cole and Ohanian (2004) and Gorodnichenko et al. (2012) suggest that more rigid labour markets lead to larger fiscal multipliers, as rigid wages tend to amplify the output response to demand shocks.

We contribute to the existing literature by focusing on Italian regions and employing a SVAR model within a panel framework. Recent years have seen a notable increase in studies estimating fiscal multipliers for the Italian economy, both at national and regional levels, providing valuable insights into the effectiveness of fiscal policy.

At the national level, an early study by Giordano et al. (2007), using a SVAR model on quarterly data from 1982 to 2004, show that shocks to government purchases of goods and services significantly impact economic activity, employment, private investment and consumption. Building on this, Cimadomo and D'Agostino (2016), reveal that the fiscal multiplier follow a U-shaped pattern: peaking at around 1.5 in the late 1980s, stabilising between 0.8 and 0.9 from the mid-1990s to the late 2000s and rising above unity during the recent crisis. Further exploration by Deleidi (2022) examined the different components of government spending. Using a SVAR model on quarterly data from 1995 to 2019, his analysis shows that government investment has the largest impact on GDP, followed by government consumption, while tax

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[1] These adverse dynamics can be attributed, at least in part, to the growing economic divergence between the two macro-areas, with southern Italy increasingly falling behind the Centre-North since the 1970s (see Celi et al., 2024; Cirillo and Reljic, 2024, among others).

[2] https://www.istat.it/it/files/2021/11/REPORT_ASILI-NIDO-2019-2020.pdf.

[3] Mezzogiorno and South are used interchangeably. It is made of Abruzzo, Molise, Campania, Apulia, Basilicata, Calabria, Sicily, and Sardinia.

[4] Fiscal multipliers can also be retrieved from large-scale models, computing the changes with respect to a baseline of a shock to a fiscal variable. Fiscal multipliers estimated via this method are usually found to be larger, as models of this sort can have additional and richer transmission channels, albeit at the cost of increasing complexity. See Batini et al. (2014) for a review.

[5] The last point is particularly important for VAR models, where one of the main issues stems from the potential endogeneity of public spending due to automatic stabilisers. This problem makes the identification of shocks harder, inevitably influences the values of the estimated multipliers, and questions the robustness of results.
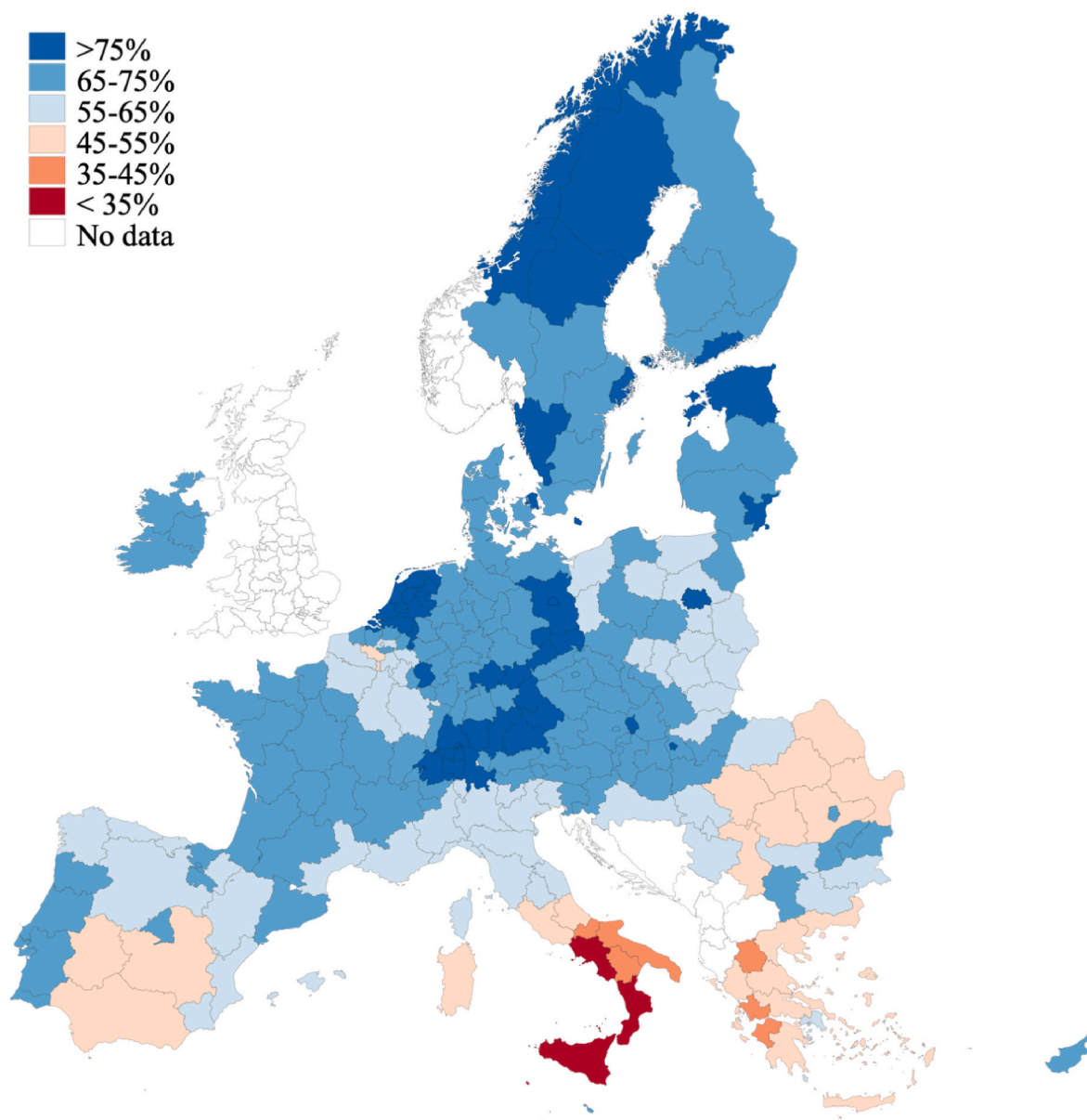
Fig. 1. Female employment rate across NUTS-2 regions, 2022
Source: Authors' elaboration based on Eurostat data

multipliers are below 1, suggesting that tax-based policies are less effective in stimulating GDP than expenditure-based ones.

Moreover, recent research has explored the role of the State in directing development through mission-oriented policies (Mazzucato, 2018). In this regard, Ciaffi et al. (2024) combine the Local Projection with SVAR approach to analyse a panel of 15 OECD countries from 1981 to 2017. Their findings indicate that public investment in R&D generates significantly larger impact on GDP (with multipliers at impact ranging from 5.3 to 8.3 across different models) compared to more generic expenditure (with multipliers at impact between 0.8 and 1.1). Likewise, mission-oriented fiscal policies have a stronger long-run crowding-in effect on private sector R&D, as opposed to generic ones.

Another stream of research looked instead at the territorial effects of fiscal policy, as reducing the North-South divide is among the priorities of the National Recovery and Resilience Plan (NRRP). Among others, Deleidi et al. (2021) distinguish between current and investment spending, revealing investment multipliers of 4 in the Centre-North and 2.3 in Mezzogiorno. Zezza and Guarascio (2024) concentrate on mission-oriented public expenditures in green, digital and knowledge-related areas, showing that different spending categories yield varying cumulative multipliers. While knowledge-related expenditures generate the highest effects, digital spending crowds out private investment in the South, due to its import reliance on intermediate and capital goods, along with a specialisation in low-tech sectors. De Stefanis et al. (2022), focusing on EU structural funds, government investment and government consumption, find that the former yields the highest positive multipliers, with these effects being more pronounced in Mezzogiorno. In contrast, Lucidi (2022) highlights how shocks to public expenditures, investment and deficits reveal disparities in fiscal multipliers, which are notably higher in the Centre-North. However, the empirical evidence so far, focusing on Italian regions, has left research gap regarding persisting gender inequalities in the labour market that we aim to address with our study.

2.2. Fiscal policy and female labour market outcomes

Despite significant global progress in female labour force participation over the last four decades, gender disparities continue to persist. The gender employment gap remains pronounced, even in some of the most egalitarian regions in the world. For instance, in 2022, the female employment rate in the EU was over 10 percentage points lower than that of men. Additionally, women continue to earn, on average, 13 per cent less than men—a gender pay gap that has remained relatively stable over time (Castagnetti and Giorgetti, 2019). When factoring in the higher likelihood of part-time work and more unstable careers among women, this pay gap widens significantly, often tripling. This inequality extends into retirement, where women's pensions are, on average, 36 per cent less than men's, with disparities ranging from 3 per cent in Estonia to 46 per cent in Malta (Dessimirova and Bustamante, 2019).

Parenthood is one of the primary factor behind female inactivity and the gender employment gap (Ferragina, 2020), with traditional gender norms continuing to assign the primary responsibility of housework, childcare and elder care to women (González et al., 2022). According to the World Bank (2011), women daily spend up to ten times more on caregiving activities and up to 4 h less on market activities than men —a trend particularly pronounced in Southern Europe (Simonazzi, 2008), where informal elder care constitutes 80 per cent of total care (Sepulveda Carmona, 2014). This reflects the inadequate provision of public care services, which, coupled with the uneven distribution of unpaid care, places a significant burden on women, contributing to high inactivity rates and weak labour attachment.

Moreover, sectors traditionally employing women — like healthcare and education — are often the first to experience budget cuts, reducing employment opportunities (Pavolini et al., 2015). Not less relevant are working conditions in these sectors. Low wages and instability characterise most occupations within these sectors, further diminishing work attractiveness (Perez-Arce and Prados, 2021).

In this context, many countries have implemented a range of policies to increase female labour force participation and employment, including tax reforms to eliminate work disincentives for secondary earners, targeted payroll tax cuts, public childcare subsidies, paid parental leave and gender quotas in management positions (Ernst et al., 2024). But how effective are public policies in lifting the barriers women face and improving their labour market attachment?

The literature has evolved along different lines to examine the role of fiscal policy in shaping female labour market outcomes. In terms of policy measures, studies either emphasised the role of specific policies, typically in isolation, or they focused on more general fiscal stimulus (see Ernst et al., 2024 for a comprehensive review).

The empirical evidence is vast and has, so far, predominantly focused on the labour supply side. Research consistently shows how public early childcare services positively impact female participation and employment rates (Asai et al., 2023; Grigoli et al., 2018; Olivetti and Petrongolo, 2017; Sikirić, 2021). Paid parental leave also has positive effects, although its relationship with female employment rates is complex, as longer leaves can weaken labour market attachment if they exceed a certain threshold (Ferragina, 2020; Olivetti and Petrongolo, 2017). Taxation represents another policy in the toolkit that governments often resort to. While labour supply responses to after-tax wages and transfers are generally small (Keane, 2011), they are higher for women, particularly those married or with young children (Kalíšková, 2020). Whether taxes apply at the individual or household level is particularly relevant, as the latter often results in higher marginal tax rates for secondary earners, mostly women, discouraging their participation (Coelho et al., 2022; Colonna and Marcassa, 2015). Targeted taxation is another important policy area. Gender-based taxation, as proposed by Alesina et al. (2011), suggests that by raising tax rates for men and lowering them for women—while maintaining revenue neutrality—could increase female supply due to their higher responsiveness to wage changes. This approach could also enhance women's bargaining power within households and reduce workplace discrimination by making the hiring and promotion of women more attractive to employers. Recent evidence from Italy supports the effectiveness of female-targeted tax cuts in increasing female employment, particularly in regions with more pronounced gender gaps (Rubolino, 2023). Tax policy design, therefore, plays an important role in addressing gender inequalities in the labour market. However, most studies have focused solely on labour supply responses, often overlooking demand-side effects and indirect (undesired) consequences, which represents a significant limitation (Ernst et al., 2024).

In contrast, macroeconomic analyses, such as those discussed in Section 2.1, are better equipped to account for net aggregate effects, although rarely focusing on gender issues, with some notable exceptions (Akitoby et al., 2022; Asai et al., 2023; Kovalenko and Töpfer, 2021; Onaran and Oyvat, 2023; Oyvat and Onaran, 2022). Akitoby et al. (2022), for example, examine whether countercyclical fiscal policy improves the gender employment gap during economic downturns by analysing data from G7 countries between 1980 and 2017, using SVAR and Local Projection methods. Their findings suggest that while positive fiscal spending shocks promote gender equality during recessions, their impact during economic expansions is less pronounced.

Our research follows a similar methodology but adopts a regional perspective. While Akitoby and co-authors concentrate on the impact of total fiscal expenditures, our study narrows the scope to public spending

on the social sector, borrowing from another important research strand, which builds on a concept of social infrastructure (Himmelweit, 2016; Onaran and Oyvat, 2023; Seguino, 2019), encompassing a wider array of public services and facilities aimed at meeting social needs and generating long-term collective benefits. This includes not only early child-care support, as discussed above, but also healthcare, education and elder care, among others. Importantly, this body of research highlights not only the impact of social investment on labour supply — by reducing the time women allocate to unpaid care work — but also on labour demand, as most workers in the care sector are women. Given its labour-intensive nature, the care sector — which often suffers from underinvestment — has enormous potential with respect to other sectors (Ilkkaracan et al., 2021), making such investment a strategic choice for fostering employment growth and addressing the unmet social needs, especially in the face of an ageing population (Cresti and Virgilito, 2022).

These studies typically employ input-output tables to evaluate the impact of government spending on social infrastructure or they use structural macro models (De Henau and Himmelweit, 2021; Ilkkaracan et al., 2021; Kim et al., 2019). The empirical evidence is encouraging, pointing out that an increase in public spending on the care economy boosts total employment, notably for women, reducing unpaid labour and gender employment disparities (Ilkkaracan et al., 2021; Onaran and Oyvat, 2023). We introduce a novelty with respect to earlier studies by exploring the regional and qualitative dimension, distinguishing not only between male and female employment but also across different skill levels.

3. Data and methodology

3.1. Data and descriptive evidence

Our study builds on the concept of 'social infrastructure', which encompasses the provision of education, healthcare, social assistance and childcare (Onaran and Oyvat, 2023; Oyvat and Onaran, 2022).

The international System of National Accounts (SNA) classification fails to acknowledge the contribution of social infrastructure spending to the creation and accumulation of human and social capital. According to the SNA, the management and staffing of educational, healthcare and childcare facilities, is not considered an investment but falls under the government's annual current expenditure. This is one of the primary reasons why fiscal consolidation policies often target spending on social infrastructure, neglecting the fact that the benefits derived from today's investments in health, education and childcare will extend well into the future, yielding societal benefits through a more educated and healthier population and supportive systems. Feminist economists have redefined public expenditures in the social sector as 'investment' or 'infrastructure', acknowledging instead their role in creating durable human and social capital with long-term public benefits (Himmelweit, 2016; Seguino, 2019), which is the definition that we adopt in this work.

To construct a fiscal variable, we rely on the Public Territorial Accounts (CPT) database. Unlike more aggregated data sources such as Eurostat, which provides country-level data on social sector spending and broadly classifies public expenditure by COFOG's 10-sector classification, the CPT database offers a more granular breakdown of public spending by type, economic sector and institutional level (Zezza and Guarascio, 2024). Specifically, our fiscal variable (g_i) is constructed as the sum of "wages and salaries paid", "goods and services bought", "current transfers to households and firms" and "investment in fixed capital" (i.e., machineries and infrastructure), within the "education", "healthcare" and "social assistance" sectors.

This granularity allows to exclude components of public spending highly endogenous to the business cycle, such as interest expenditures and automatic stabilisers, facilitating the identification of exogenous fiscal shocks. For example, current transfers to households in the education sector only include items such as after-school services, book

vouchers and subsidies for school transport, canteens and boarding schools). In the social assistance sector, these include benefits in cash and in kind, provided they are financed by general taxation. Thus, given our focus on social infrastructure, we exclude all other current transfers made by the public administration recorded in other sectors, some of which are highly endogenous to economic conditions, like unemployment benefits. Likewise, we exclude interest payments on debt of both central and local authorities. A detailed account of our fiscal variable components is provided in Table A1.[6]

The upper-left panel of Fig. 2 shows the evolution of real public spending on the social sector by region.[7] While there is some disparity between the two macro-regions, with the Centre-North maintaining a higher level of spending per capita, this difference is not as pronounced as in other economic indicators, suggesting some degree of redistribution.[8] Notably, the 2008 crisis appears to have initiated a downturn in social sector spending in both macro-regions, reflecting austerity measures and budgetary constraints that have only recently been reversed following the Covid-19 pandemic (Storm, 2023). In contrast to the social sector spending patterns, the North-South divide is more pronounced in other economic aspects such as private investment, GDP and the gender employment gap, with the Centre-North regions exhibiting a stronger economic base and lower gender employment gap. Moreover, there is no evidence of convergence over the observed period, suggesting a deep structural divide across Italian regions.[9]

Fig. 3 provides a detailed breakdown of social infrastructure expenditures over time, revealing relatively similar patterns within the Centre-North and Mezzogiorno. At the beginning of the period, both macro-regions allocated a significant portion of their social infrastructure budgets to wages. We observe, however, a noticeable shift in spending patterns, characterised by a growing allocation towards goods and services (i.e., public procurement). This is consistent across both macro-regions, indicating a broader change rather than a regional-specific phenomenon. This trend may reflect the privatisation of the social sector, whereby the public sector undergoes downsizing by contracting out public services (e.g., healthcare and education) to private providers (Buzelli and Boyce, 2021; Storm, 2023).

The list of variables and sources is provided in Table A2, while Table A3 shows the summary statistics for our variables of interest, for the whole sample and across macro-areas.

3.2. Methodology

As discussed earlier, our objective is to investigate whether public spending on social infrastructure: (i) stimulates investment, boosts

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[6] As robustness checks, we estimated Model 1 excluding alternatively net current transfers (Model 1A), public wages (Model 1B) and public investment (Model 1C). Results, which are qualitatively similar, are reported in Appendix B.

[7] Data inspection showed that the two alpine regions Trentino Alto Adige and Valle d'Aosta display values for social infrastructure spending systematically higher than all other regions and were, therefore, dropped from the empirical analysis. Nevertheless, results including all regions are qualitatively similar.

[8] We use the Tukey HSD test to check for pairwise differences in social infrastructure spending across all 18 regions, after performing a one-way ANOVA, which confirms significant differences in spending across regions (F-statistic 19.46, p = 0.000). The Tukey HSD test shows 64 significant pairwise differences out of 153. As an example, regions such as Lazio or Friuli Venezia-Giulia consistently show significant differences with other regions.

[9] We conduct a one-way Analysis of Variance (ANOVA) to compare the means between two macro regions (South and Center-North) across all variables. Since we are comparing only two groups, the F-statistic from the ANOVA is equivalent to the result of a *t*-test, and both indicate statistically significant differences across all variables (GDP, investment, employment, public spending on social infrastructure, and female employment), formally confirming the regional disparities depicted in Fig. 2.
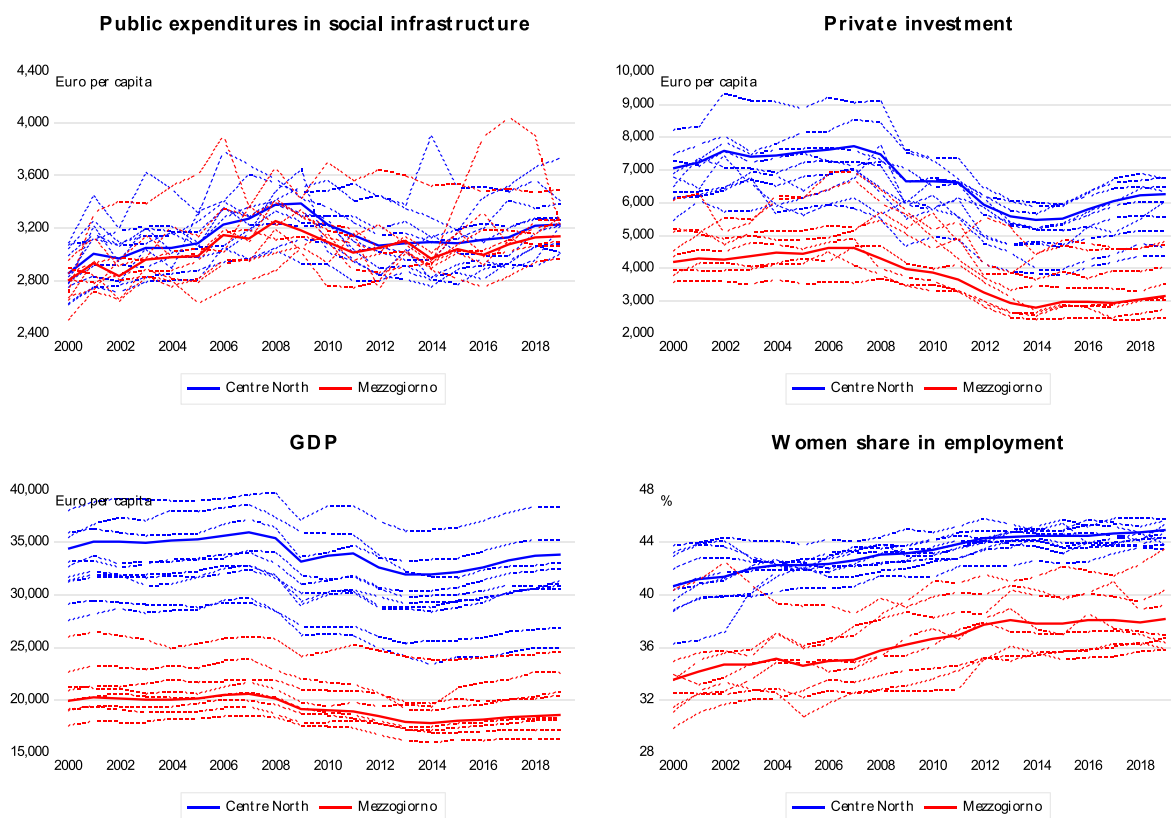
Fig. 2. Selected macroeconomic variables by region, 2000–2019.
Source: Authors' own elaboration based on ISTAT and CPT data. *Notes*: spending in the social sector, private investment and GDP are reported in thousand euro per capita, in constant (2015) prices; the share of women in employment is reported in percent.

Fig. 3. Public expenditures in the Social Sector. Components. Macro-areas, 2000–2019.
Source: Authors' own elaboration based on CPT data.

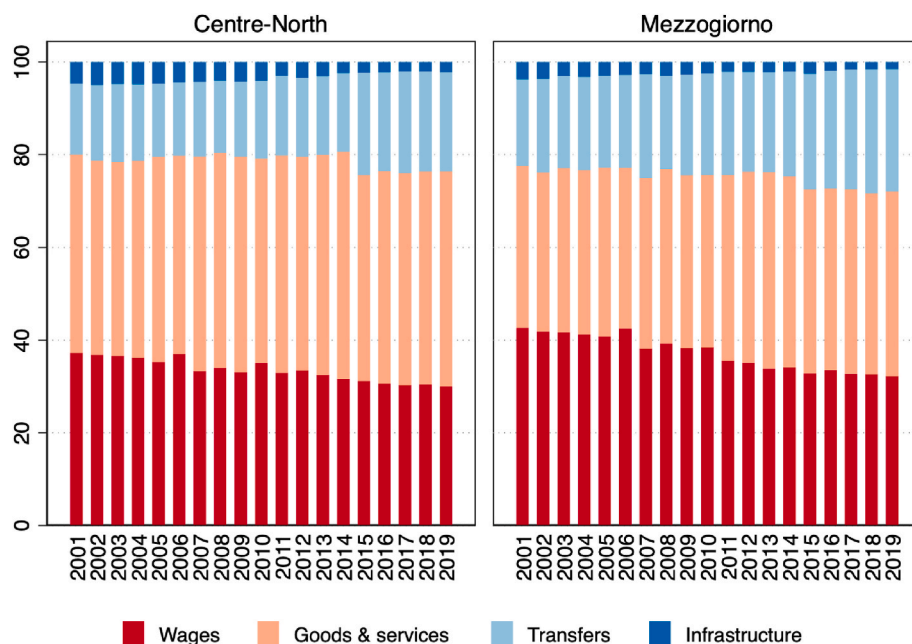output and reduces the gender employment gap in Italy; (ii) breaks the regional North-South divide in terms of gender gaps; and (iii) has heterogeneous employment response along the skill distribution. We do this by estimating a five-variable panel structural vector autoregressive (P-SVAR) model, following a four-step procedure (Ramey, 2016).[10] Firstly, we estimate a reduced-form P-VAR(n):

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

where $y_{i,t}$ represents the vector of variables in region i in year t, $A_i(L)$ is a polynomial of lagged coefficients, μ_i denotes regional fixed effects and $\varepsilon_{i,t}$ is the reduced-form error term.

All variables are log-transformed first, with the exception of female employment share, and then first differenced, thereby mitigating concerns about non-stationarity.[11] The choice of two lags is based on information criteria tests (AIC, SIC). Next, we derive a structural model (P-SVAR) as in Equation (2) by imposing restrictions on the matrix of contemporaneous coefficients $\left(B_{0i}y_{i,t}\right)$ using the recursive Choleski approach as commonly found in the literature (Barbieri Góes and Deleidi, 2022; Caldara and Kamps, 2017; Jawadi et al., 2016; Kumar et al., 2021).

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

B_{0i} is the matrix of contemporaneous coefficients with "-" denoting 'free' parameters and 0s indicating restrictions (see Equation (3)). The Choleski decomposition is guided by economic theory, which determines the ordering of variables based on the assumption that some variables are contemporaneously exogenous relative to others (Ouliaris et al., 2016, pp. 92–93).

$$B_{0i}y_{i,t} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ - & 1 & 0 & 0 & 0 \\ - & - & 1 & 0 & 0 \\ - & - & - & 1 & 0 \\ - & - & - & - & 1 \end{pmatrix} \begin{bmatrix} g_{i,t} \\ i_{i,t} \\ y_{i,t} \\ e_{i,t} \\ w_{i,t} \end{bmatrix} \tag{3}$$

After imposing these restrictions and estimating structural shocks, impulse response functions (IRFs) are calculated to illustrate the dynamic effects of a fiscal shock on the other variables included in the model. Standard errors are computed using the Monte Carlo method (1000 repetitions) and IRFs are presented with a 68% confidence

interval.[12] As variables are log-transformed, IRFs can be interpreted as elasticities. To estimate fiscal multipliers, elasticities need to be multiplied by the corresponding ex-post conversion factors – i.e., equal to the average value of the variable of interest divided by fiscal expenditures – to obtain euro-change in response to euro increases in the public expenditure.[13] Additionally, we estimate cumulative multipliers, which show the cumulative response to a one-euro increase in spending over time (Ramey and Zubairy, 2018). Specifically, the cumulative effects are obtained by dividing the cumulative response of the variable of interest by the cumulative government expenditure change that occurred during the observed period. Importantly, this measure allows for studying the persistence of fiscal policy shocks in evaluating the effects on private economic activity (Caggiano et al., 2015; Ciaffi et al., 2024; Woodford, 2011).

This methodology is applied in estimating three models. In model 1, we include public expenditures in social infrastructure per capita (g_i), private investment per capita (i_i), Gross Domestic Product per capita (y_i), total employment (e_i) and the female share in total employment (w_i). In line with literature, government spending is ordered first (Blanchard and Perotti, 2002). The rationale behind the zero-restriction imposed in the contemporaneous relationship from output to social infrastructure expenditure is due to information delay in releasing GDP data – typically two years after the reference period at the regional level – and implementation lags – as a local discretionary fiscal policy takes more than one year to be decided, approved and implemented. This is especially true in our case, as decision processes depend on multiple authorities. Following the Keynesian investment accelerator principle (Arestis et al., 2012), private investment comes second – as in Deleidi and Mazzucato (2019) or Barbieri Góes and Deleidi (2022). Labour market variables, employment (e) and the female employment share (w) enter the VAR next, as in Akitoby et al. (2022), to explore the effects of fiscal shocks on labour force composition.

It is worth noting that most workers in the social sector, both paid and unpaid, are women. Consequently, while spending on social infrastructure may not explicitly target women, it has the potential to alleviate gender inequalities and enhance inclusiveness in the labour market by increasing both labour supply and pro-women labour demand (Huidrom et al., 2020; Ngai and Petrongolo, 2017), especially if implemented along women-targeted measure (e.g., paid parental leave, gender quotas).Thus, a shock to social infrastructure may positively influence w, thereby reducing the gender employment gap, although outcomes may be affected by the structural characteristics of the examined regions.

Furthermore, acknowledging criticisms regarding the use of female employment share by some (Onaran and Oyvat, 2023), we also examine the employment effects for men and women separately in Model 2, as movements in the share of women in employment may hide important dynamics at work.

While existing studies have concentrated on quantitative aspects of employment, our research broadens the scope to explore qualitative dimensions as well. In Model 3, by splitting employment between high- and low-skill workers, we investigate whether an increase in social

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[10] Another widely adopted methodology is the Local Projections (LP) approach, pioneered by Jordà (2005) and integrated into SVAR analysis (Auerbach and Gorodnichenko, 2017). The LP is usually perceived as more flexible in cases where the relationships among variables are highly non-linear or vary over time. However, to ensure comparability with Akitoby et al. (2022) and Onaran and Oyvat (2022; 2023), and as we have strong theoretical priors for our identification strategy coming from the extensive literature reviewed, we preferred the SVAR approach. Moreover, Plagborg-Møller and Wolf (2021) show that the two methodologies produce the same IRFs, and are equally robust to non-linearities.

[11] This was confirmed through Fisher-type Augmented Dickey-Fuller panel unit root tests, which we conducted to ensure the robustness of our analysis. The tests indicate that all variables are stationary at first difference. Furthermore, considering the primary focus of our research on short-term dynamics and the mixed and inconclusive evidence from cointegration tests, we decided to proceed with a standard SVAR model, thereby avoiding the complexities and potential over-specification that could arise in a panel setting from incorporating long-term relationships. Test results are available upon request.

[12] It is common to find 68% error bands in the SVAR literature (e.g., Blanchard and Perotti, 2002; Caldara and Kamps, 2017). Moreover, it has been showed that error bands corresponding to 0.68 probability is often more useful than 0.95 bands since they provide a more precise estimate of the true coverage probability (Giordano et al., 2007; Sims and Zha, 1999).

[13] There are various ways of converting IRFs into monetary multipliers. An alternative method employs an ex-ante conversion – dividing all variables by potential output (usually adopting the HP filter on real GDP), as in Gordon and Krenn (2010) or Ramey and Zubairy (2018). Results using this latter methodology are qualitatively similar.

Table 1

Cumulative multipliers relative to a shock to social infrastructure.

Horizon	Model 1				Model 2				Model 3			
	i	*y*	*e*	*w*	*i*	*y*	*em*	*ew*	*emH*	*emL*	*ewH*	*ewL*
All regions												
1	**0.4**	**0.5**	**12.9**	**1.0**	**0.4**	**0.5**	**4.1**	**9.5**	**1.9**	**2.1**	**8.4**	0.4
5	**1.3**	**2.0**	**57.1**	−2.2	**1.3**	**2.0**	**42.3**	**14.5**	**4.8**	**39.6**	**14.9**	0.2
10	**1.3**	**2.0**	**55.8**	−2.4	**1.3**	**2.0**	**42.3**	**13.1**	**4.7**	**39.9**	**14.5**	−0.4
Centre-North												
1	**0.6**	**0.9**	**19.0**	0.0	**0.6**	**0.9**	**10.9**	**7.7**	**4.0**	**3.6**	**10.5**	−2.7
5	**1.9**	**2.5**	**91.0**	−0.8	**1.8**	**2.5**	**55.5**	**35.5**	3.6	**48.1**	**21.4**	**20.1**
10	**1.9**	**2.6**	**92.7**	−0.8	**1.9**	**2.6**	**56.7**	**36.2**	2.9	**51.9**	**21.3**	**21.8**
Mezzogiorno												
1	**0.2**	**0.2**	8.7	**1.8**	**0.2**	**0.2**	1.1	**7.1**	0.7	1.9	**5.4**	1.4
5	**0.9**	**1.5**	**34.2**	−3.5	**0.9**	**1.5**	**31.3**	3.6	**6.5**	**29.0**	**10.1**	−5.7
10	**0.8**	**1.5**	**31.2**	−3.8	**0.8**	**1.5**	**30.2**	1.9	**5.8**	**29.0**	**9.6**	−7.1

Source: Authors' own elaboration. *Notes:* Table reports the cumulative multipliers relative to a shock to per-capita Public Expenditures in social infrastructure. Multipliers for investment (i) and GDP (y) are expressed euro-on-euro. The response of the share of women in employment (w) is expressed in percentage points. Responses of employment variables (e, em, ew, emH, emL, ewH, ewL) are expressed in thousand units. Statistically significant values are reported in bold (68% confidence intervals).
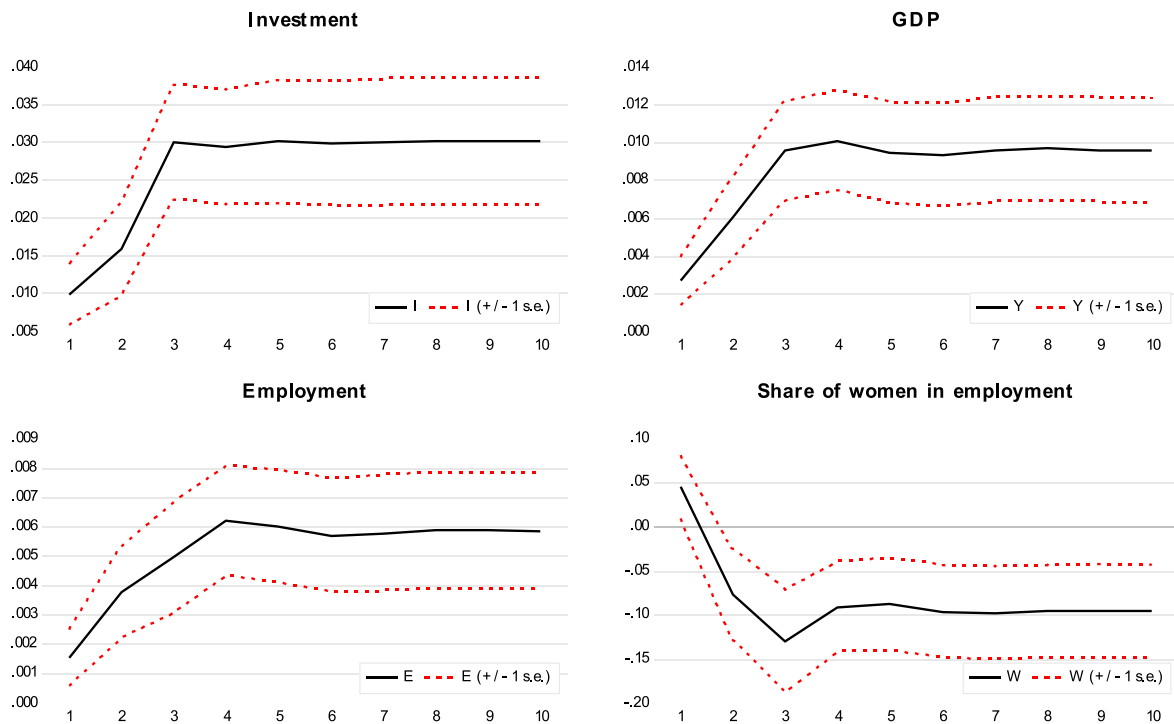
Fig. 4. Impulse response functions (IRFs) from baseline model: elasticities. All regions.

Source: Authors' own elaboration. *Notes*: solid lines = mean response = ; dotted lines = 68% confidence bands. Standard errors computed with Monte Carlo method (1000 repetitions).
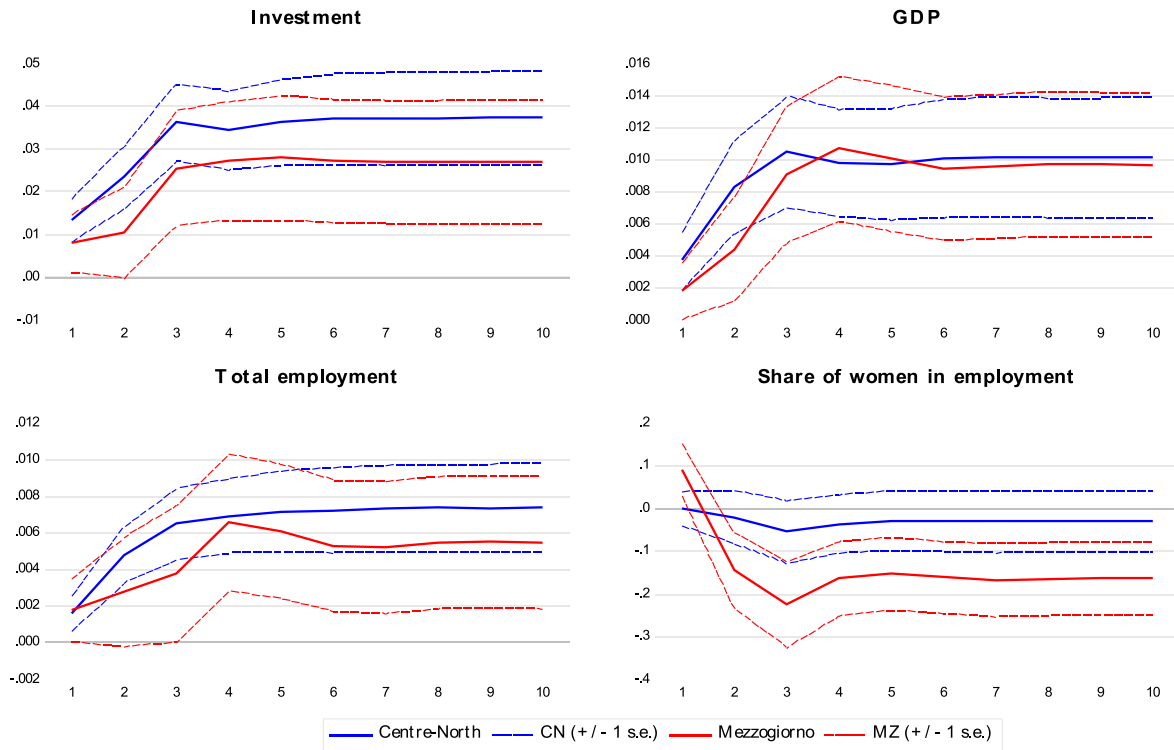
infrastructure expenditure leads to skill upgrading or downgrading.[14]

To assess the possible heterogeneous effects of social spending across regions, all models are first estimated on the whole sample and then separately for Centre-North and Mezzogiorno. The results are reported in Table 1.

4. Results

In this section, we report the findings of the estimated P-SVAR using IRFs (Figs. 4–6) and cumulative multipliers (Table 1). We begin by examining the results of our baseline model 1, focusing on the effects of social infrastructure spending on the female employment share. Acknowledging the limitations of this relative measure, we further analyse the effects on male versus female employment in absolute terms, which constitutes our second model. Additionally, we extend beyond current research to explore the qualitative effects along the skill distribution and to assess whether investment in social infrastructure can lead to the much-needed upgrading, particularly in the South. Lastly, we check the robustness of our findings through alternative specifications.

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[14] For model 2, the vector of endogenous variables becomes $[g_i, i_i, y_i, em_i, ew_i]$ where *em* and *ew* stand for male and female employment, respectively. Model 3 has seven variables, with the vector of endogenous variables being $[g_i, i_i, y_i, em_i^H, em_i^L, ew_i^H, ew_i^L]$, where the superscripts H and L stand for high (ISCED 5–8) and low skill (ISCED 0–4), respectively. In general, we specified our models by ordering men before women, and high-skill before low-skill workers. However, changing the order of employment variables does not affect the overall results.

Investment

GDP

Total employment

Share of women in employment

Centre-North — CN (+ / - 1 s.e.) — Mezzogiorno — MZ (+ / - 1 s.e.)

Fig. 5. Impulse response functions (IRFs) from baseline model: elasticities by macro-areas.
Source: Authors' own elaboration. *Notes*: solid lines = mean response = ; dotted lines = 68% confidence bands. Standard errors computed with Monte Carlo method (1000 repetitions).

Men — Men (+ / - 1 s.e.)
Women — Women (+ / - 1 s.e.)
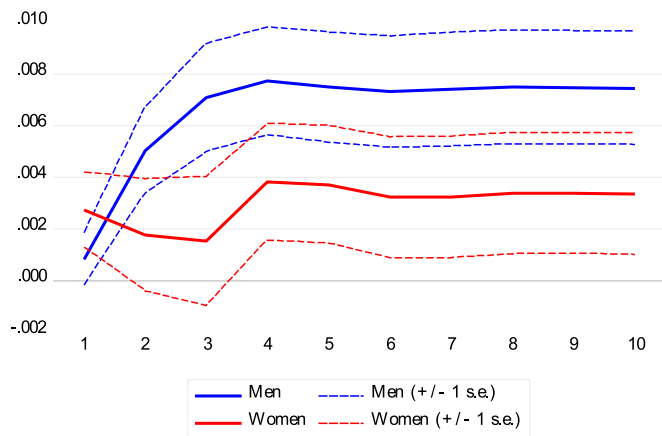
Fig. 6. IRFs from Model 2. Employment elasticities (by sex). All regions.
Source: Authors' own elaboration. *Notes*: solid lines = mean response = ; dotted lines = 68% confidence bands. Standard errors computed with Monte Carlo method (1000 repetitions).

4.1. Main findings

Fig. 4 reports IRFs, illustrating the dynamic response of variables to an expansionary fiscal spending shock - based on model 1 when all Italian regions are considered. IRFs show that a one standard deviation shock to social infrastructure spending – specifically, about €260 per capita – generates positive and lasting impacts on investment, GDP and employment, highlighting its self-financing potential (Alexandri et al., 2024; Seguino, 2019). This finding is corroborated by IRFs estimated separately for the regions of Centre-North and Mezzogiorno, as shown in Fig. 5. A fiscal stimulus in social infrastructure spending yields a positive output response, crowds in private investment and boosts total

Men — Women
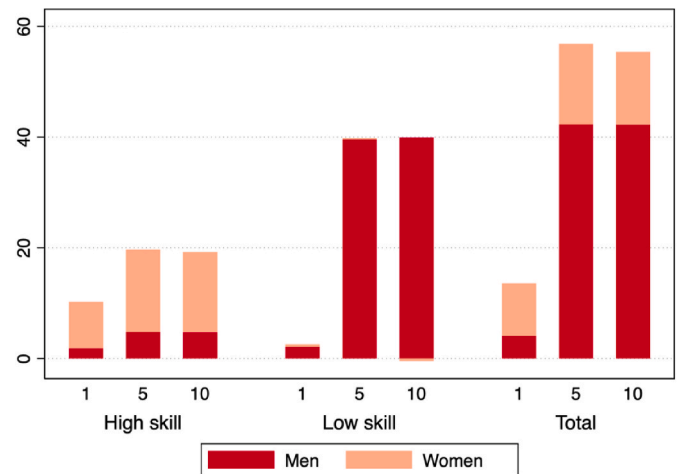
Fig. 7. Skill-upgrading effects of shocks to social infrastructure. All regions. Thousand employees.
Source: Authors' own elaboration. *Notes:* The Figure reports the cumulative multipliers relative to a shock to per-capita public expenditures in social infrastructure.

employment in both macro-areas. However, concerning the gender employment gap, while an expansionary fiscal policy initially narrows it, this effect is only short-lived and subsequently tends to exacerbate it. This pattern referring to the entire sample, is predominantly influenced by dynamics in the South, as depicted in Fig. 5.

Table 1 presents the cumulative multipliers derived from IRFs, both based on the entire sample as well as for two macro-areas independently. The impact multipliers for private investment and GDP stand at 0.4 and 0.5, respectively, increasing to 1.3 and 2 in the long run. Employment rises by 12.9 thousand units at impact, with a peak of 60.8

thousand in the fourth year. The effect on the female employment share, initially positive with a 1 percentage point increase, turns negative, peaking at −3.3 p.p. in the third year.

What underpins this unexpected adverse impact of social infrastructure expenditure on gender inequalities? It is important to stress that this outcome does not imply a decrease in female employment due to a fiscal stimulus. Instead, it indicates that employment of women does not increase as much as that of men. This is confirmed in an alternative specification (Model 2) illustrated in Fig. 6. Female employment rises by 9.5 thousand at impact, while the increase for men is less than half this amount (4.1 thousand and statistically insignificant). Nonetheless, from the second year after the shock, the growth in economic activity disproportionally favours male employment, which by the fifth year stabilises at around three times that of women: 42.3 thousand against 14.5 thousand.

Consistent with the existing research on Italian regional multipliers (Deleidi et al., 2021; Lucidi, 2022; Zezza and Guarascio, 2024), our findings suggest that, although shocks to public spending on social infrastructure lead to positive outcomes in output growth, stimulate private investment and increase total employment nationwide, the impact is more sizeable in the Centre-North. This is likely due to the region's superior industrial and infrastructural base, lower reliance on imports and the higher quality of public institutions vis-à-vis Mezzogiorno.

In terms of labour market outcomes, when splitting the sample along territorial lines, the effect on gender employment gap is present (and significant) solely in the South. Here too, the favourable effect on female employment – +1.8 p.p. in the share of women in employment – is only transitory, while the dysfunctional characteristics of the Italian labour market seem to prevail in the medium-to-long term. Indeed, the positive effect on female employment share turns negative and statistically significant over time in the South, peaking at −5.1 p.p. three years after the shock. Again, this is due to a larger increase in male employment rather than a decrease in female employment.

We further investigate these results by estimating our baseline model across different skill groups (Model 3): high-skilled versus medium- and low-skilled (i.e., ISCED levels 5–8 and 0–4, respectively). Fig. 7 documents the remarkable differences between men and women along the skill distribution. A shock to social infrastructure spending generates a jump in high-skill employment at impact (+11 thousand employees), mostly women, hinting at an upgrading process towards more skilled occupations. However, while men generally see a greater increase in employment than women, in line with Models 1 and 2, this is primarily within low-skilled positions. Overall, while the gender gap shows improvement among the high-skill cohort, it widens among the low-skilled workforce.

Continuing our analysis, we re-estimate also Model 3 by splitting the sample between two macro-areas, to assess whether and to what extent regional structural characteristics affect these results. Our primary findings – skill upgrading at impact that narrows the gender gap among high-skilled workers – hold true across both regions. These findings are reported in the right section of Table 1. The key distinction between the North-Centre and South stems from the dynamics in low-skill employment: while in the South female employment gains are concentrated in high-skilled occupations, in the North there is a sustained increase also among low-skilled. This could be interpreted through two complementary factors: one related to labour demand and the other to labour supply. The more diversified and dynamic economy of the Centre-North has a greater capacity to create jobs across all skill levels, unlike the South, where public spending tends to generate opportunities mainly for high-skilled women, often within the public sector (e.g. universities, schools, hospitals). On the labour supply side, the persistence of traditional gender norms, coupled with a lack of supportive infrastructure in the South, may limit the participation of women, particularly those with lower skills, even in the face of increased public spending. In contrast, the North benefits from more supportive infrastructure and fewer

cultural barriers, making public spending more effective in boosting employment for women across all skill levels. Given the poor economic performance of southern regions over the last three decades, the relative backwardness of their industrial structure, fragmented labour markets and inadequate public services - including both infrastructure and the quality of public administration - we argue that temporary/one-off or isolated measures are insufficient. Instead, structural and farsighted policy actions are necessary to reverse trend of persistent gender and territorial divides. The effectiveness of social infrastructure spending is influenced by a range of factors, including the modality of implementation - such as the nature of spending and duration - and its interplay with other policy measures (e.g., parental leave) and labour market institutions (e.g., minimum wages, employment protection legislation). The composition and allocation of spending are critical too. Our analysis in Section 3 highlights that the recent decades have seen a shift towards privatisation in the social sector, with an increasing trend of outsourcing public services. Constructing new childcare facilities is paramount, particularly given Italy's backwardness relative to EU benchmarks, a gap that is even more pronounced in the South (ISTAT, 2021). Such capital investments can stimulate employment in the construction sector, traditionally dominated by low-skilled men and simultaneously encourage women's participation in the workforce. However, without a comprehensive, long-term national strategy for recruitment and the generation of quality jobs in the social sector (Cresti and Virgilito, 2022), these investments may fail to break the gender and regional divides and, instead, could exacerbate current conditions through reliance on insecure and temporary jobs (d'Agostino et al., 2018).

Another crucial consideration is whether standalone policies can achieve gender parity objectives—in this instance, through social infrastructure—or whether a more systematic approach is needed to ensure not only equitable employment opportunities for men and women but also access to good jobs.

4.2. Robustness checks

In line with standard practice in fiscal research, we conduct a series of robustness checks.

First, we estimate Model 1 using alternative specifications for our fiscal variable, to verify if results are sensible to changes in its composition. We thus alternatively exclude from public expenditures in social infrastructure: (i) current public transfers to household and firms (Model 1B); (ii) public wages and salaries (Model 1C); and (iii) public investment (Model 1D).

The reasons to run these further experiments are following. To address possible endogeneity concerns about the inclusion of current transfers, notwithstanding the exclusion of highly endogenous components like unemployment benefits (as discussed in Section 3.1), we excluded them from our fiscal variable. Likewise, it could be argued that public salaries may partly respond to the business cycle. However, in the public sector permanent contracts prevail and hiring decisions are lengthy and involve a plurality of entities – e.g., the central government for the education sector, the regional government and the local health authorities (ASL) for the healthcare sector.[15] Finally, we exclude investment in physical infrastructure, as estimates net of this more male-oriented investment, might reveal a different impact on the gender employment gap. The robustness check results are reported in Appendix B, in Figure B2 along with the IRFs from Model 1 to ease comparison.

It is noteworthy that our main results are robust across all specifications: a positive and long-lasting impact of social infrastructure expenditure on private investment, GDP and employment, with

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[15] ASLs are medical corporations, defined as institutions with public legal entity and entrepreneurial autonomy that operates within the framework of the national health service (S.S.N.).

transitory reduction of the gender employment gap. The only exception is Model 1C, where we exclude public wages. Here the positive effect on total employment is less pronounced (and not statistically significant), possibly due to the absence of direct public-employment creation. Se Appendix B for further details.

Second, a well-known limitation of VARs, particularly those identified using a Choleski scheme, is the potential influence of variable ordering on the results. Therefore, we first re-estimate Model 1 altering the order of variables, such as positioning GDP before investment and changing the order of female with male employment. Second, the selection of variables can also affect results. Thus, we alternatively use private sector value added instead of GDP. Our main findings are confirmed also in these two cases. The results for these robustness checks are available upon request.

Furthermore, as the territorial division in two macro-areas – North-Centre and South – splits the sample in two unequal parts, we also divide the sample using additional indicators that reflect women's conditions in the labour market and the diffusion of early childcare facilities and enrolment rates, known to affect female participation. Specifically, we divide the sample in two equal parts according to: (i) the degree of structural female unemployment rate; (ii) the rate of territorial coverage of early childhood services; and (iii) enrolment rates It should be noted that these divides largely coincide with the North-Centre and South dichotomy, meaning that regions with more favourable labour market conditions and higher prevalence of childcare services tend to be located in the Centre-North (see Table B2). Consequently, the results of these robustness checks unsurprisingly mimic those observed for the macro-areas (see Figure B2).

5. Concluding remarks

We contribute to the debate on the Italian North–South divide from a gender labour market perspective by estimating a P-SVAR model based on regional data from 2000 to 2019. To the best of our knowledge, this is the first attempt to estimate the effect of public spending on social infrastructure—including education, healthcare, childcare and social assistance—at the regional level in Italy.

Our findings indicate that fiscal spending on social infrastructure not only delivers long-term collective benefits—fulfilling social needs and accumulating human and social capital—but also stimulates output growth, encourages private investment and boosts employment in both macro-areas, highlighting its self-financing potential. However, despite a favourable yet transitory effect on the gender employment gap, the dysfunctional characteristics of the Italian labour market appear to prevail in the medium to long term. Indeed, the positive effect of social spending on the female employment share turns negative after three years.

While the expansion of the social sector is crucial to strengthening female labour market attachment, the scarcity of good (and well-paid) jobs remains a significant obstacle to female participation in the workforce, particularly in the southern regions. To create a more inclusive labour market in the South, it is also necessary to break the vicious circle of non-standard work, low wages, limited productive capacity, low productivity and depressed demand (Cirillo and Reljic, 2024; Fanti et al., 2023; Pianta and Reljic, 2022). Therefore, more structural policy

actions, such as long-term investment in social infrastructure aimed at closing regional investment gaps, rather than one-off measures, are necessary to overcome the barriers women face in the labour market, ultimately supporting regional convergence.

Our findings carry important policy implications, especially in the context of the National Recovery and Resilience Plan (NRRP). On one hand, the evidence that public spending on social infrastructure can sustain private investment, employment and output suggests that allocating 40 per cent of NRRP resources to the Mezzogiorno could help mitigate the longstanding core-periphery economic divide. On the other hand, the NRRP efforts to reduce gender disparities may fall short. The goal of creating 152,000 new places in childcare facilities by 2026 is ambitious (CDP, 2023) and much needed, given the significant difference in employment rates between women with and without pre-school children. However, without a complementary long-term national strategy for the permanent recruitment of personnel—which cannot be funded by the NRRP—there is a risk that these facilities will remain underutilised or, at best, continue to rely on low-paid and temporary workers.

Furthermore, the NRRP has already been scaled down due to inflationary pressures and changes in government priorities. In late 2023, the plan was revised, reallocating 11.8 billion euro to RePower EU at the expense of other missions. Notably, "strengthening the supply of educational services: from kindergartens to universities" and "social infrastructure, families, communities and the third sector" have seen the largest cuts, with a budget reduction of 360 million and 2.85 billion euro, respectively.[16]

Equally important, the NRRP could have negative indirect effects on gender equality in the Italian labour market, as most of its resources are directed towards sectors involved in the green and digital transitions, which are traditionally male-dominated. In particular, the construction sector, which predominantly employs men, has benefited the most so far, potentially undermining the plan's cross-cutting objective of reducing gender disparities.

In addition, the newly agreed EU fiscal framework could further jeopardise public efforts to address gender gaps in the labour market. As discussed, fiscal austerity over the last twenty years has led to large cuts in social infrastructure spending, a trend likely to persist – and even worsen – in the coming years, as Italy is expected to pursue structural primary surpluses of at least 3% of GDP until the end of the decade to make its public debt 'sustainable' (Darvas et al., 2023). Given that austerity measures are not gender-neutral (Pavolini et al., 2015; Picchio, 2015), such policies risk widening gender disparities rather than closing them.

This work provides a conceptual framework that could be adapted to other countries with marked territorial and gender disparities. Moreover, this analysis could be extended in several ways. As employment gaps are rather heterogenous across economic sectors and social infrastructure spending is usually directed towards gender-segregated ones, it would be valuable to explore if outcomes differ across different industries or contract types.

Declaration of competing interest

None.

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[16] For more information, see: https://temi.camera.it/leg19/pnrr/pnrrItalia/OCD57-2/il-pnrr-italiano-quadro-sintesi.html#:~:text=Il%20nuovo%20PNRR%20modificato%20con,piano%20originario%2C%20e%20150%20investimenti.

Appendix A. Tables

Table A1
Spending in Social Infrastructure

Variable	Name	Units	Notes	CPT Sector description (*)
G_i^E	Public Expenditure in Education	Thousand-euro, constant prices (2015), per capita	CPT sector: • Education (005) CPT category: • S06 (wages and salaries) • S12 (goods and services) • S15 (current transfers to households) • S16 (current transfers to firms) • S43 (investment in machineries) • S45 (investment in infrastructure)	Includes the administration, operation and management of public schools and universities (excluding expenditure by the latter explicitly earmarked for scientific research); expenditure on school and university buildings; auxiliary education services (transport, provision of board and lodging, after-school services, health and dental care); the expenditure for the education authorities; expenditure to support the right to education (book vouchers, school transport subsidies, canteens, boarding schools) of the various local authorities; the promotion of educational and scientific cooperation initiatives, for the implementation of exchanges, research, educational trips, studies and twinning of schools.
G_i^H	Public Expenditure in Healthcare	Thousand-euro, constant prices (2015), per capita	CPT sector: • Healthcare (0010) CPT category: • S06 (wages and salaries) • S12 (goods and services) • S15 (current transfers to households) • S16 (current transfers to firms) • S43 (investment in machineries) • S45 (investment in infrastructure)	Includes expenditure on prevention, protection and healthcare in a general sense (medical and hospital general-purpose services, specialist services, paramedical) and related facilities; public healthcare services (disease detection services, preventive services, blood banks) and related facilities; the management of pharmacies and the provision of pharmaceutical products, equipment and services; the management of social/health centres and zoo-prophylactic institutes; expenditure on the support and financing of health activities (e.g. transfers to the National Health Fund); the formulation and administration of government policy in the health sector; the preparation and enforcement of regulations for medical and paramedical personnel and for hospitals, clinics and medical practices; the work of health commissions. It also includes expenditure on thermal facilities.
G_i^S	Public Expenditure in Social Protection	Thousand-euro, constant prices (2015), per capita	CPT sector: • Social Protection (0011) CPT category: • S06 (wages and salaries) • S12 (goods and services) • S15 (current transfers to households) • S16 (current transfers to firms) • S43 (investment in machineries) • S45 (investment in infrastructure)	Includes activities related to the administration, governance, implementation of social protection interventions related to insufficient economic resources or hardship situations (sickness and disability, old age and survivors); interventions in favour of the family, employment, housing, social exclusion and the provision in this context of benefits in cash and in kind, provided they are financed by general taxation. It also includes expenditure on retirement homes and other residential facilities.

Source: Own elaboration. *Notes:* (*) based on the CPT manual, available at:
https://www.agenziacoesione.gov.
it/wp-content/uploads/2020/11/Guida_CPT.pdf

Table A2
Model variables and sources

Variable	Name	Source	Units	Notes
$g_i = G_i^E +$ $G_i^H + G_i^S$	Public expenditures in social infrastructure	Own elaboration based on CPT and Istat Territorial accounts	Thousand-euro, constant prices (2015), per capita	Series are transformed into constant (2015) prices using the regional GDP deflator, and are expressed in per capita terms using regional population data from Istat Territorial Accounts
i_i	Private sector gross fixed investment	Own elaboration based on Istat territorial accounts	Thousand-euro, constant prices (2015), per capita	Series are expressed in per capita terms using regional population data from Istat Territorial Accounts
y_i	Gross Domestic Product	Own elaboration based on Istat territorial accounts	Thousand-euro, constant prices (2015), per capita	Series are expressed in per capita terms using regional population data from Istat Territorial Accounts
$e_i; em_i; ew_i$	Employment (by sex)	Istat territorial accounts	Thousand employees	
w_i	Share of women in employment	Own elaboration on Istat Territorial accounts	Percent	
$e_i^H; e_i^L;$ $em_i^H; em_i^L;$ $ew_i^H; ew_i^L$	Employment (by ISCED)	Eurostat, LFS (extraction)	Thousand employees	We use the EU LFS data to calculate employment shares by sex and ISCED level. We then use these shares to construct employment sub-groups from Istat aggregate data

Source: Own elaboration

Table A3
Descriptive Statistics.

	g_i	i_i	y_i	e_i	w_i	em_i	em_i^H	em_i^L	ew_i	ew_i^H	ew_i^L
All regions											
Mean	3.1	5.3	26.6	1202.0	40.2	710.6	104.5	606.1	491.5	111.3	380.1
Median	3.1	5.3	26.9	885.1	41.6	564.1	72.9	487.8	322.3	73.8	263.4
Maximum	4.0	9.3	39.8	4372.3	45.9	2456.7	480.4	2082.5	1915.7	561.0	1449.3
Minimum	2.6	2.4	15.8	97.3	30.6	58.0	6.6	49.7	37.7	5.6	27.6
Std. Dev.	0.3	1.5	6.7	967.8	4.1	556.4	92.1	469.8	417.3	100.3	326.0
Observations	342	342	342	342	342	342	342	342	342	342	342
Centre-North											
Mean	3.2	6.2	31.8	1550.1	43.2	881.5	136.5	745.0	668.7	147.4	521.2
Median	3.1	6.2	31.7	1628.3	43.6	908.5	122.4	772.5	711.6	122.8	546.9
Maximum	3.9	9.3	39.8	4372.3	45.9	2456.7	480.4	2082.5	1915.7	561.0	1449.3
Minimum	2.7	3.7	23.4	326.1	36.6	186.0	18.9	154.8	139.9	18.0	107.6
Std. Dev.	0.2	1.2	3.7	1089.1	1.6	623.3	105.3	525.2	467.1	115.7	364.5
Observations	190	190	190	190	190	190	190	190	190	190	190
Mezzogiorno											
Mean	3.1	4.2	20.1	766.9	36.4	496.9	64.4	432.5	269.9	66.2	203.7
Median	3.1	4.1	19.7	572.5	36.1	348.8	46.9	305.1	209.0	53.1	167.2
Maximum	4.0	6.9	26.4	1750.5	43.6	1178.8	174.7	1048.9	577.6	190.5	461.6
Minimum	2.6	2.4	15.8	97.3	30.6	58.0	6.6	49.7	37.7	5.6	27.6
Std. Dev.	0.3	1.1	2.5	536.1	2.9	360.6	48.5	314.1	176.9	47.7	132.0
Observations	152	152	152	152	152	152	152	152	152	152	152

Legend: g_i = public expenditure in social infrastructure; i_i = private investment; y_i = GDP; e_i = employment (total); w_i = share of women in total employment; em_i = employment (men); em_i^H = high-skill employment (men); em_i^L = low-skill employment (men); ew_i = employment (women); ew_i^H = high-skill employment (women); ew_i^L = low-skill employment (women).

Source: Own elaboration based on CPT and ISTAT data. *Notes*: Public expenditures in social infrastructure, private investment and GDP are expressed in constant (2015) thousand euro per capita. Share of women in employment is expressed in percentage point. Employment variables are expressed in thousand units.

Appendix B. Robustness checks

We estimate Model 1 using alternative specifications for our fiscal variable, to verify if results are sensible to changes in its composition. We thus alternatively exclude from public expenditures in social infrastructure: (i) current public transfers to household and firms (Model 1B); (ii) public wages and salaries (Model 1C); and (iii) public investment (Model 1D).

We perform the same methodological steps as for the baseline model:

1) Run all appropriate preliminary statistical tests (Lag-length, ADF, Pedroni).
2) Estimate a reduced-form P-VAR(n) as in Equation (1) in the main text.
3) Derive a structural model (P-SVAR) as in Equation (2), by imposing the same set of restrictions on the matrix of contemporaneous coefficients as reported in the main text.
4) Calculate impulse response functions (IRFs) to show the dynamic effects produced by a shock to the fiscal variable on the remaining variables included in the model. We compute standard errors using the Monte Carlo method (1000 repetitions), and report IRFs with one-standard error band, namely a 68% confidence interval.

Table B1 reports the descriptive statistics for the variables included in the models. The results from robustness checks are reported in Figure B1,

along the IRFs from Model 1, to ease comparison The cumulative multipliers using these alternative specifications, as well as for the two macro-areas, are similar to the ones reported in the main text, and available upon request.

We also re-estimate Model 1 by splitting the sample using additional indicators that reflect women's conditions in the labour market and the diffusion of early childcare facilities and enrolment rates, known to affect female participation. Specifically, we divide the sample in two equal parts according to: (i) the degree of structural female unemployment rate; (ii) the rate of territorial coverage of early childhood services; and (iii) enrolment rates (see Figure B2).
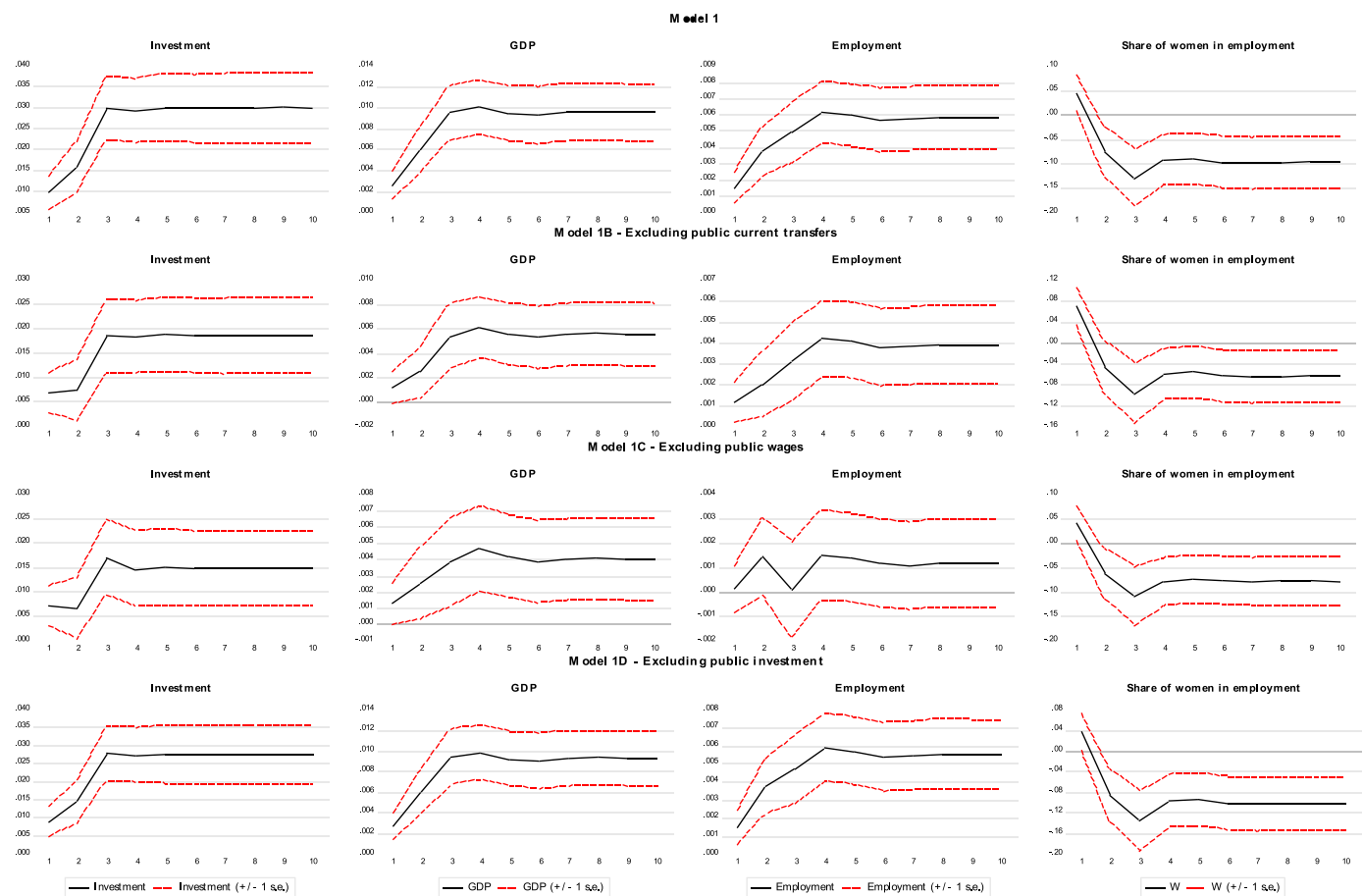
Table B1

Descriptive statistics

	Gov. Expenditure in S.I.	- Excluding current transfers	- Excluding wages	- Excluding investment	Investment	GDP	Employment	Women share in employment
Mean	3.13	2.51	2.01	3.03	5.3	26.6	1202.0	40.2
Median	3.10	2.50	2.00	3.01	5.3	26.9	885.1	41.6
Maximum	4.05	3.28	3.02	3.98	9.3	39.8	4372.3	45.9
Minimum	2.62	2.03	1.33	2.53	2.4	15.8	97.3	30.6
Std. Dev.	0.25	0.21	0.26	0.25	1.5	6.7	967.8	4.1
Observations	342	342	342	342	342	342	342	342

Notes: Public expenditures in social infrastructure, private investment and GDP are expressed in constant (2015) thousand euro per capita. Employment is expressed in thousand units. Share of women in employment is expressed in percentage points.

Source: Own elaboration based on CPT and ISTAT data.

Fig. B1. IRFs from Model 1, 1B, 1C and 1D: elasticities. All regions

Notes: solid lines = mean response = ; dotted lines = 68% confidence bands. Standard errors computed with Monte Carlo method (1000 repetitions).

Source: Authors' own elaboration.

Table B2

Childcare services, structural unemployment, and the North/South divide

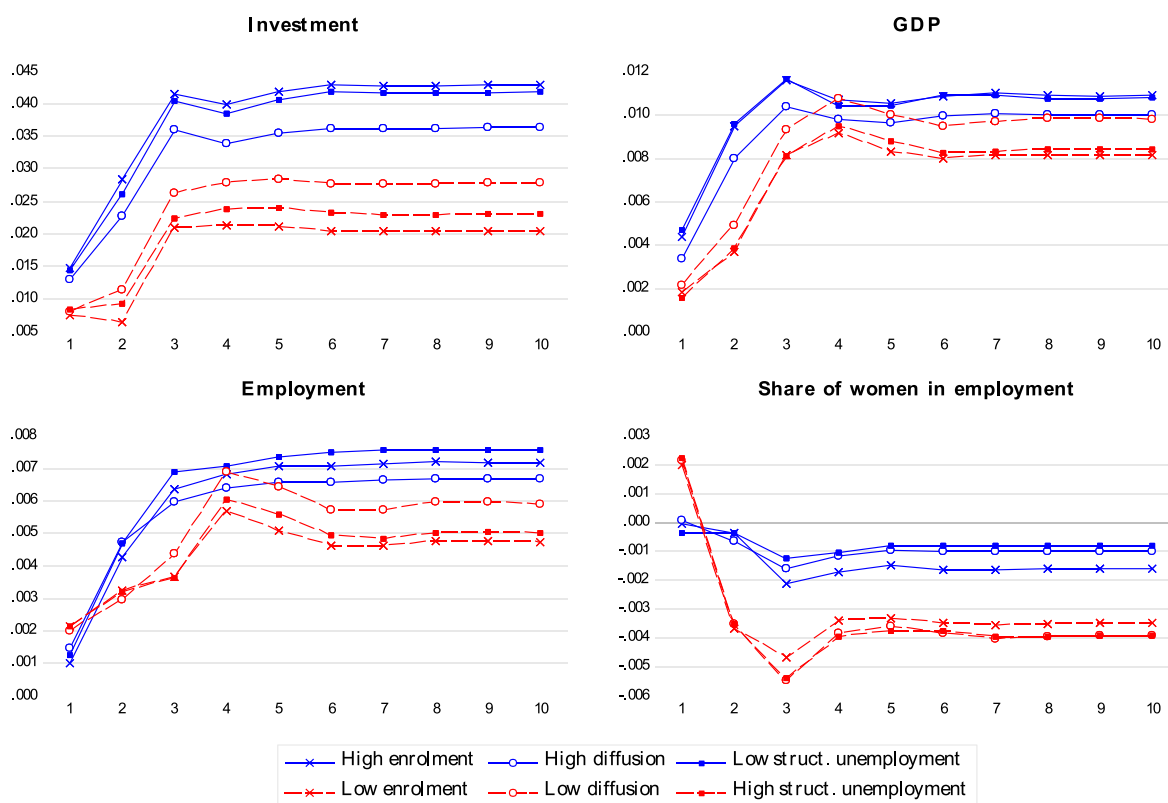|	Region	Territorial diffusion of childcare services	Enrolment rate in childcare services	Degree of women structural unemployment
Centre-North	Piemonte	31.3	13.9	47.6
	Liguria	59.4	16.1	46.4
	Lombardia	75.6	16.5	45.0
	Veneto	71.3	11.5	38.8

Table B2 (*continued*)

	Region	Territorial diffusion of childcare services	Enrolment rate in childcare services	Degree of women structural unemployment
	Friuli-Venezia Giulia	88.9	18.8	36.2
	Emilia-Romagna	85.6	27.5	36.4
	Toscana	77.9	22.3	46.7
	Umbria	55.8	18.0	42.8
	Marche	51.9	16.8	43.9
	Lazio	33.6	15.1	52.7
Mezzogiorno	Abruzzo	48.5	9.0	54.5
	Molise	23.1	8.4	60.9
	Campania	47.2	2.8	64.2
	Puglia	48.8	5.6	59.2
	Basilicata	29.0	6.7	62.5
	Calabria	13.8	2.3	59.6
	Sicilia	36.7	5.5	68.0
	Sardegna	27.1	11.4	54.0

Notes: The Table shows the average values over the period 2001–2019 for: (i) the territorial diffusion of childcare services, defined as municipalities that have activated services for children (nursery schools, micro-nurseries or integrative and innovative services) out of the total number of municipalities in the region (in percentage points); (ii) the enrolment rate in childcare services, defined as children 0–3 years old who have used childcare services (nursery schools, micro-nurseries or integrative and innovative services) out of the total population aged 0–2 years (in percentage points); and (iii) the degree of women structural unemployment, defined as the number of women aged 15–64, unemployed by more than 12 months, over the number of total unemployed women in the same age cohort.
Legend: Gray shade denotes values below the median.
Source: Own elaboration based on Istat data.

Fig. B2. IRFs from model 1. Sample split according to (i) enrolment rate and (ii) territorial diffusion of childcare services, (iii) level of structural female unemployment. Elasticities.
Note: mean responses; solid lines = high enrolment rate/territorial diffusion; dotted lines = low enrolment rate/territorial diffusion. Source: Authors' own elaboration.

Data availability

Data and replication files have been uploaded on Mendeley Data Repository.

Breaking the Divide: Can Public Spending on Social Infrastructure Boost Female Employment in Italy? (Original data) (Mendeley Data)

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