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Real wages and productivity: a lesson from Italy, 1980-2023

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ABSTRACT

The recent surge in prices has resulted in a reduction in real wages due to the failure to adjust wages to the increase in the cost of living. This can bring to a reduction in aggregate demand, but can also lead to negative structural consequences. In fact, as theorized by Sylos Labini, the reduction in real wages can serve as an incentive for businesses to invest in labor-intensive technologies, often with low technological content. Italy has, in the last decades (with few exceptions), been directed towards a path of reducing workers' rights. Consequently, Italy runs the risk of being a model where low wages, high inequality, and poor competitiveness in new technologies coexist. In this paper, we use a panel SVAR methodology to evaluate Sylos Labini's hypothesis from an econometric perspective in the context of the Italian economy. The results of the analysis confirm the validity of Sylos Labini's theory.

1. Introduction

The neoclassical literature on economic growth identifies what it considers to be the main drivers of productivity. This body of work famously originates from Solow's (1957) analysis, which showed that a substantial portion of the increase in output per worker could not be explained by the rise in capital per worker. The unexplained portion—commonly referred to as the Solow residual—has been the focus of literature on so-called Total Factor Productivity (TFP) or Multi-Factor Productivity (MFP).

Over time, numerous studies—mostly within the neoclassical framework—have investigated the determinants of TFP growth. Among these, particular attention has been paid to investment in research and development, digitalisation, human capital, public infrastructure, the process of globalisation, the development of financial systems, and institutions (for an extensive literature review, see OECD/APO, 2022).

In heterodox approaches, especially in the Keynesian tradition, explanations of productivity—conceived primarily as labour productivity—are linked to a different set of variables. The analyses of Kaldor and Verdoorn, for example, focus on the positive effects of aggregate demand growth on productivity growth. Another line of inquiry, however, emphasises the relationship between productivity growth and the growth of real wages.

According to Sylos Labini, the prevalence of low wages could potentially drive firms to adopt labor-intensive technologies. While such arrangements may initially appear economically advantageous due to lower costs, Sylos Labini argued that they often come at the expense of overall productivity. Labor-intensive methods, inherently tied to lower wages, tend to be characterized by diminished efficiency and technological advancements. In this view, the adoption of such technologies as a response to low wages could lead to a structural impediment, hindering the economy's potential for sustained growth and innovation. Thus, Sylos Labini's perspective underscores how a prolonged period of low real wages, extending beyond immediate market dynamics, can shape the very structure and efficiency of the economic system of a country.

This line of research gains particular relevance in periods such as the post-Covid era and in countries like Italy, where real wages have been especially affected by high inflation. Different inflationary contexts, in fact, will have varying effects on real wages depending on the characteristics of labour markets and wage bargaining institutions. The negative effects of rising inflation on real wages—and, in Sylos Labini's hypothesis, on productivity—tend to be more pronounced in contexts where workers and trade unions, due to institutional and structural features of the labour market, are unable to secure wage increases that keep pace with price growth.

In this paper, we will analyze the consequences that, according to the theory we have just outlined, low wages could have on productivity, focusing particularly on the Italian case. To accomplish this, we employ a panel SVAR approach to assess Sylos Labini's theory through an

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econometric lens within the framework of the Italian economy.

In Section 1, we will briefly recap some of the most recent data on inflation, wages, and purchasing power trends in advanced economies. In Section 2, we will illustrate the hypothesis proposed by Sylos Labini and conduct a thorough review of the theoretical and empirical literature regarding it. Subsequently (Section 3), we will examine some data concerning the Italian economy over the past decades, highlighting how the Italian economic system is notably vulnerable to the aforementioned phenomenon. In Section 4, we will assess Sylos Labini's hypothesis from an econometric perspective. Finally, in Section 5, we will present the conclusions and discuss some policy implications.

2. The context: inflation and wages after the pandemic and the war in Ukraine

The Covid-19 pandemic has not only brought about profound implications for public health but has also led to an abnormal surge in inflation in the immediate post-pandemic years. In Europe, for instance, there has been a remarkable annual percentage increase in the Consumer Price Index (CPI), approaching 10 %. Similarly, in the United States, the CPI has exhibited an uptick reaching double-digit percentages (Fig. 1).

Among the primary explanations for post-pandemic inflation, a predominant factor is the pivotal role played by bottlenecks that have emerged in global supply chains. These bottlenecks, disruptions, and constraints within the supply networks have impeded the smooth flow of goods and services, resulting in a restricted supply of various commodities. The constrained supply, coupled with sustained post-pandemic demand, has created an environment conducive to inflationary pressures. These supply chain disruptions, exacerbated by the complexities of the post-Covid-19 economic landscape, have played a significant role in driving up prices across various sectors, thereby contributing to the overall inflationary trend observed in the aftermath of the pandemic.

In many countries, the pandemic-induced lockdowns and restrictions initially led to a slowdown in production, causing disruptions in the supply of raw materials and components. As global demand began to recover, especially in exporting countries there was a surge in orders and an attempt to ramp up production. Factors such as transportation constraints, labor shortages, and logistical challenges contributed to delays and inefficiencies in the production and distribution processes. These disruptions, coupled with heightened global demand, played a role in driving up prices of traded goods (Chakraborty, 2023; Di Giovanni et al., 2022; LaBelle and Santacreu, 2022; Panwar et al., 2022; Xu et al., 2020).

As the global economy was already contending with the challenges of inflation, a new and potentially more impactful event introduced an additional source of heightened inflationary pressures—the war in Ukraine. The conflict not only escalated geopolitical tensions but also significantly disrupted key supply chains, particularly in the energy and agricultural sectors. The ensuing uncertainties and disruptions, coupled with increased costs associated with geopolitical instability, further exacerbated the existing inflationary trends (Caldara et al., 2022; Liadze et al., 2023; Maurya et al., 2023; Ozili, 2022).

The spike in inflation in the aftermath of the COVID-19 pandemic has brought renewed focus on the role of wages in driving inflation dynamics. Blanchard and Bernanke (2023) highlight that, contrary to

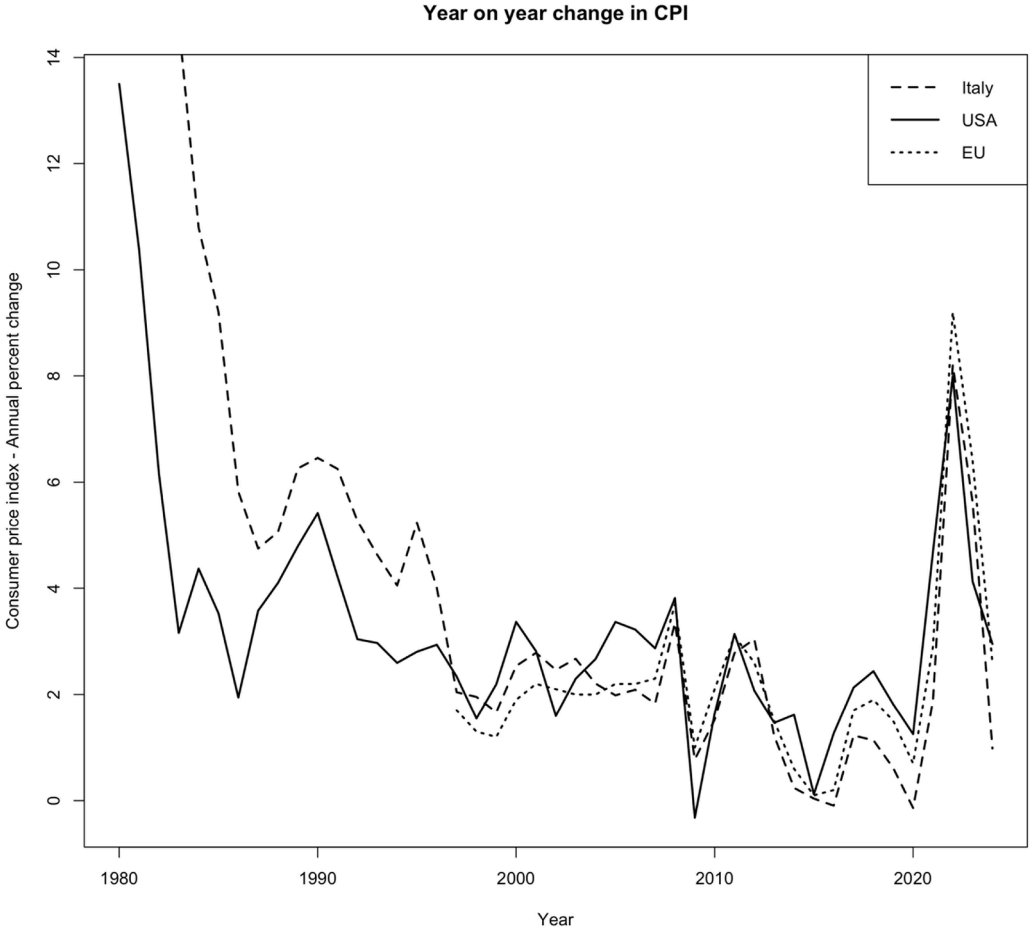

Fig. 1. Consumer Price Index in Italy, the European Union, and the United States (1980-2023).
Source: Authors' elaboration on ECB and FED data. For the EU: https://www.ecb.europa.eu/stats/macroeconomic_and_sectoral/hicp/html/index.en.html, For the US: https://fred.stlouisfed.org/series/CPIAUCSL, For Italy: https://fred.stlouisfed.org/series/ITACPIALLAINMEI.

initial concerns, the surge in US inflation beginning in 2021 was predominantly driven by price shocks rather than overheated labor markets. These shocks, including commodity price increases and sectoral supply-demand mismatches, spurred inflation independently of nominal wage pressures. Nevertheless, the persistence of wage-driven inflation suggests that rebalancing labor supply and demand will be critical for long-term inflation control.

Expanding this analysis to the euro area, Arce et al., 2024 identify similar patterns. Their application of a semi-structural model underscores that inflation in the euro area has been largely influenced by supply-side shocks, such as energy price surges and global supply chain disruptions, rather than tight labor markets. However, their findings also reveal that labor market conditions contribute to wage inflation, which indirectly affects price inflation over time.

Depalo and Lo Bello, (2024) further corroborate the subdued role of labor markets in driving price inflation within the euro area. Their research emphasizes the weak pass-through of wage inflation to prices, contrasting with the significant impact of input cost shocks. Together, these studies suggest that while labor markets contribute to inflationary dynamics, their role is secondary to supply-side factors in recent episodes.

The inflationary pressures that have resulted from the dynamics we have just described have significantly impacted the purchasing power of workers. Without corresponding increases in nominal wages, workers would have found themselves (as indeed happened in some cases) earning a real wage that is considerably lower than what they received prior to the crisis. The dynamics of collective bargaining and nominal wages, therefore, have led to different outcomes in various geographical areas regarding the purchasing power of workers and their families. In certain regions, these effects have been more pronounced, while in others they have been somewhat mitigated, depending on the strength of labor negotiations and the responsiveness of wage adjustments to inflationary trends. Overall, the disparity between nominal wage growth and inflation has created uneven conditions across different sectors and regions, shaping the financial well-being of households in diverse ways.

In the EU, nominal wages have not kept pace with inflation uniformly across all countries, resulting in a significant reduction in real wages and the purchasing power of households in some nations. As highlighted by the OECD (2024), in several Eurozone countries, real wages have yet to regain the ground lost since the end of 2019 due to rising inflation. The Czech Republic, Italy, Finland, Spain, Germany, Estonia, and Belgium are still reporting, at the beginning of 2024 (with the comparison being made between the fourth quarter of 2019 and the first quarter of 2024), lower real wages than those seen in 2019. This disparity illustrates the uneven impact of inflation across different economies, with certain nations continuing to struggle in restoring the purchasing power of their citizens even as nominal wages show some signs of recovery in other parts of the region.

In Italy, this reduction has been particularly severe. Among the Eurozone countries considered in the OECD's analysis, Italy ranks second in terms of the worst performance, with a real wage reduction of 6.9 %.

The reasons behind such a negative outcome for Italian workers are a matter of debate (see, for instance, Brunetti, 2024 and Romaniello and Stirati, 2024) and fall outside the scope of this paper. What we aim to analyze here is the relationship between the reduction in real wages and the decline in productivity. To this end, we draw on a theoretical framework, often traced back to the work of Paolo Sylos Labini, which seeks to explain why lower real wages can lead to a decrease in productivity.

3. From low wages to low productivity: Sylos Labini's explanation and other theoretical nexuses

Sylos Labini (1984, 1993, 1999) proposed a theoretical explanation in which labor productivity growth essentially depends on three factors: investments, changes in real wages, and aggregate demand. This approach has come to be known in the literature as the "productivity equation." For our analysis, the key transmission channels are the second and third.

Specifically, the transmission channel from real wages to productivity operates through incentives for investments and the choice of production techniques by firms. In Sylos Labini's explanation, an increase in wages (and thus labor costs) would lead firms to adopt less labor-intensive production techniques. In particular, if wage increases occur relative to the general price level, firms are incentivized to reduce the amount of labor per unit of product; if wage increases occur relative to the cost of capital (e.g., machinery), firms will have an incentive to adjust the labor-to-machinery ratio in order to lower it.

As for aggregate demand, Sylos Labini argues that the so-called Kaldor-Verdoorn law (Kaldor, 1957, 1966; Verdoorn, 1949) should be considered valid, according to which increases in aggregate demand, through processes of specialization, learning-by-doing, and increasing returns to scale, lead to a rise in worker productivity.

We would add that this point can be linked to the issue of functional distribution and wage reduction. If an economy were characterized by a "wage-led" productive structure (where aggregate demand and growth increase as real wages or the wage share increase), then a situation like that of the Italian economy, and many other advanced economies, where real wages are stagnant or even declining, would risk leading to a reduction in productivity through the functional distribution channel as well.[1]

From an econometric perspective, the effect of wages on productivity has been analyzed by several authors using a variety of quantitative and theoretical approaches. For instance, one line of research has focused on estimating Sylos Labini's productivity equation (Corsi and D'Ippoliti, 2013; Carnevali et al., 2020; Fontanari and Palumbo, 2023; Lucarelli and Romano, 2016; Lucidi and Kleinknecht, 2010). Guarini (2007) adopts a regional approach, which will also be used in the econometric analysis of this paper. Lastly, some papers (e.g., Hein and Tarassow, 2010) have analyzed the effect of wages on productivity mediated by the effect of wages on aggregate demand.

More specifically, Kleinknecht (2020) reviews the empirical evidence on the impact of labor market reforms that have weakened workers' bargaining power on productivity. The paper considers the various explanations commonly proposed in the literature—ranging from the notion of a systematic mismeasurement of productivity, to the hypothesis that innovation is becoming less effective, to the structural shift towards the service sector—critically assessing their weaknesses and highlighting the need for alternative accounts. The author argues that a credible alternative explanation lies in the erosion of workers' bargaining power, showing that such reforms have had a negative effect on innovation and labor productivity, particularly in high-tech sectors.

Adopting a similar point of view, a paper by Pianta and Reljic (2022) proposes an integrated view of productivity, innovation, and employment, emphasizing the joint role of high-quality labour and capital. Departing from mainstream approaches that treat labour as a cost, the study shows that improvements in job quality—wages, skills, and employment stability—are both a condition for and an outcome of sustained innovation. Empirical findings confirm the importance of what the authors refer to as the "good jobs–high innovation" virtuous circle: better working conditions foster R&D and innovation, which drive productivity and support higher wages, reinforcing employment quality. The analysis also revives the new-Keynsian efficiency wage theories, highlighting how higher pay correlates with lower non-standard employment and greater skill intensity. The findings show that labour market deregulation has weakened innovation dynamics and

[1] The literature on growth regimes is rooted in Kaleckian economics and is primarily attributed to the contributions of Rowthorn (1981), Bhaduri and Marglin (1990), and Marglin and Bhaduri (1990).

slowed productivity growth. In the view of the authors, reversing wage compression and flexibilisation, and adopting coordinated policies for innovation, employment, and income distribution, is essential to restore long-term economic growth in Europe.

4. What happened in Italy in the last decades

Over the past four decades, numerous advanced economies have undergone significant transformations in their productive structures and industrial strategies. Specifically, there has been a consistent decline in the proportion of workers employed in the manufacturing sector, accompanied by a transition towards the services sector. Italy, in reference to these dynamics, is no exception.

Structural change can pose a threat to labor productivity dynamics, especially if emerging sectors lack strong labor specialization, a propensity for innovation, and technological progress. This is notably applicable to sectors such as tourism, food, and hospitality (hotels and restaurants).

Many service industries exhibit limited potential for productivity gains and are characterized by labor-intensive production processes. Even other service sectors that may emerge, such as finance and real estate, theoretically have high labor productivity and sustained capital accumulation. However, these sectors employ relatively fewer people and contribute minimally to technological innovation.

This issue intersects with another phenomenon that has characterized recent decades, namely financialization. Companies and their management are more inclined to maximize shareholder dividends (shareholder value orientation) than to pursue investment strategies geared towards productive activities. Significant financial assets and capital are "wasted" on financial speculation and short-term strategies instead of being utilized for real investment expansions, innovation improvements, and labor productivity gains.

Simultaneously, the Italian labor market has undergone profound changes legislatively, structurally, and socially during the same period. The origin of this transformation can be traced back to events in Italy from 1993 onwards, when the country, following the economic recession of 1992 and the signing of the Maastricht Treaty, aimed to promptly join the Economic and Monetary Union. This involved primarily adhering to Maastricht criteria, with a focus on reducing the inflation rate.

As part of this process, greater labor flexibility was introduced into the Italian labor market through various reforms (Fig. 2),[2] incorporating radical innovations in contractual forms and the labor market in general. Consequently, as observed in most OECD member countries, Italy experienced increased labor flexibility, measured by the reduction of certain labor market rigidity indices, along with modest employment growth. These gains in labor flexibility were often accompanied by reduced labor costs and, consequently, wage flexibility. As a result, the newly created jobs were characterized by dissatisfaction and low work efficiency, stemming from wage pressure, perceived job instability, and limited social contributions.

In conclusion, Italy has faced a triple negative combination: low productivity with respect to its main trading partners in the EU (Fig. 3), low employment, and low GDP dynamics. Today, following the surge in inflation, the country finds itself with low real wages and inadequate innovation and technological investments.

Sylos Labini, as we have seen, has argued that investment strategies are also influenced by labor costs. If a country pursues a low-wage policy, investments will primarily be labor-intensive and consequently exhibit low labor productivity. Conversely, if wages are high, corporate investments, driven by cost-saving considerations, will tend to be capital-intensive, leading to significant labor productivity gains. Labor market reforms in Italy, oriented towards entry and exit flexibility, have contributed to a negative dynamic in labor productivity (as suggested, among others, by Lucidi and Kleinknecht, 2010).

5. Data, methodology and results

For our econometric analysis, we have limited data availability at the national level. Data on productivity, output, investment, and wages are simultaneously available only for the period from 1980 to 2023. This gives us a total of 44 observations. Given this limitation, it suggests that using a VAR model might not be suitable. In fact, for a VAR, the number of parameters to be estimated is given by the formula $K + Kp^2$, where K represents the number of endogenous variables, and p represents the number of lags. In our case, with four endogenous variables and assuming one lag (following the rule of thumb for annual data), we would have to estimate 20 parameters, which would reduce our degrees of freedom to just 24 (even less, if we consider that some variables will need to be differenced to ensure their stationarity). This reduction in degrees of freedom would likely result in an over-parameterized model with insufficient data for reliable estimation.

For the same reason, even estimating a more parsimonious ARDL (AutoRegressive Distributed Lag) model, with productivity as the dependent variable in our analysis, would yield results that are not satisfactory in terms of robustness. For this reason and to broaden our investigation, we will use regional-level data. Specifically, we will rely on data from the 20 Italian regions (effectively giving us 21 statistical units, since the region of Trentino-Alto Adige is divided into the two autonomous provinces of Trento and Bolzano). This dataset will allow us to estimate an SVAR (Structural Vector Autoregression) model, leveraging the larger pool of observations across regions to address the constraints posed by the limited national-level data.

5.1. Data

For our analysis, we rely on data from the ARDECO database, the Annual Regional Database of the European Commission's Directorate General for Regional and Urban Policy. Although these data are primarily used for regional-level analysis (as in the case of our SVAR analysis, discussed in section 4.2), the same dataset contains identical data at the national aggregation level.

The variables considered are four, representing productivity, output, wages, and investments (Table 1 summarizes the characteristics of these variables). In terms of productivity, the variable used is the real labour productivity per hour worked. Output is measured by GDP at constant prices. Wages are represented by the real compensation per hour worked. Finally, the investment variable is the gross fixed capital formation at constant prices. All data are available from 1980 to 2023. Fig. 4 displays the time series of the variables included in the econometric analysis, measured at the national level. The data on output and investment are represented as growth rates, while those on compensation per hour worked and productivity per hour worked are shown in levels.

While our analysis adopts a long-period perspective by using a dataset that spans several decades, the use of a Panel Structural VAR model allows us to investigate the dynamic responses of key economic variables to structural shocks typically interpreted as short-term disturbances. This does not constitute a contradiction. On the contrary, the extended time span enhances the reliability of the estimated impulse

[2] Regularly updated time series for the various EPL indicators are available for Italy in the OECD data only from 2000 onwards. However, some fragmentary data can be found in various OECD publications. The *Employment Outlook* of 1999 (OECD, 1999, p. 66) includes data for the late 1980s and the late 1990s. The aggregates concerning the different types of contracts or dismissals are not fully comparable. The overall EPL strictness index decreases from 4.1 in the late 1980s to 3.4 in the late 1990s. As for fixed-term contracts, the index falls from 5.4 in the late 1980s to 3.8 in the late 1990s. In 2000, the starting year of the time series, the value is 3.25. Regarding collective dismissals, the index stands at 4.1 in the late 1990s.

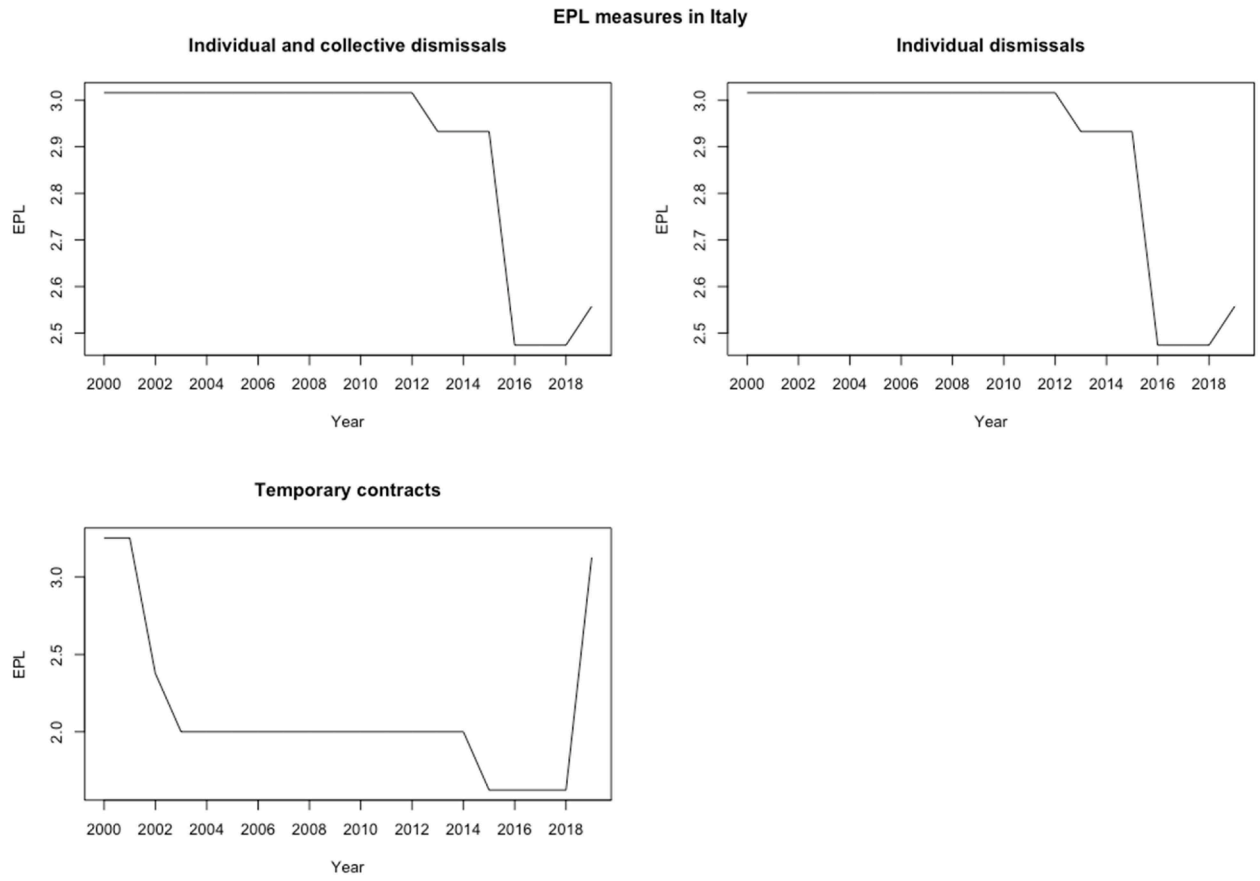

Fig. 2. EPL in Italy (1980-2019).
Source: Authors' elaboration on OECD data. https://stats.oecd.org/Index.aspx?DataSetCode=EPL_OV.

Fig. 3. Productivity per hour worked, Selected countries (1980-2023).
Source: Authors' elaboration on ARDECO data.

responses by providing a rich temporal dimension and a wide range of shock realizations. Short-term shocks — such as those related to demand fluctuations, productivity innovations, or policy interventions — can have persistent and cumulative effects, especially in systems characterized by institutional rigidities or adjustment frictions. The long-period dataset enables us to trace out these dynamic effects across heterogeneous units, thus allowing us to assess not only the immediate reactions but also the medium-term propagation of shocks. In this sense,

Table 1
Variables used in the econometric analysis.

Variable	Symbol	ARDECO code	Definition
Productivity	P	SOVGDH	Real labour productivity per hour worked. EUR2015
Output	Y	SOVGD	GDP at constant prices. Million EUR2015
Wages	w	ROWCDH	Real hourly wage. EUR2015
Investment	I	ROIGT	Gross fixed capital formation. Million EUR2015

Source: ARDECO
Years: 1980 – 2023 (44 obs. per statistical unit)
Number of observations: 21 per year, regional level (NUTS2, Italy); 924 total obs.

the long-time horizon serves to reinforce, rather than undermine, the short-term focus of the model by enabling the identification and estimation of responses that unfold over time.

5.2. Panel SVAR analysis

In the following analysis we adopt Structural Vector Autoregression (SVAR) instead of a simple VAR model for several reasons. The SVAR framework extends the standard VAR model by incorporating restrictions based on economic theory or prior knowledge, allowing for the identification of structural shocks. These restrictions often take the form of zero constraints, sign constraints, or other relationships that reflect causal assumptions among variables. In practice, the SVAR model decomposes the observed correlations between variables into structural components, enabling the disentanglement of shocks with distinct economic interpretations. For instance, it can separate demand-side from supply-side shocks in an inflation-output analysis. This identification is crucial for understanding the channels through which economic policies or exogenous events influence key outcomes.

In other words, the SVAR model allows for clearer economic interpretation of shocks, since, by imposing theoretical restrictions, the model can differentiate between types of shocks. SVAR also enhances the interpretation of impulse response functions, making it possible to analyze how economic variables respond to different structural shocks in a more meaningful way. SVAR also accounts for contemporaneous relationships between variables, while standard VAR models often miss this aspect. SVAR models are also flexible, since they allow for the imposition of various types of restrictions (short-run, long-run, or contemporaneous). Finally, SVAR helps address the issue of endogeneity, effectively dealing with simultaneity problems.

Delving deeper into the details, the estimation of a SVAR model involves several interrelated steps. First, the process begins with specifying a standard reduced-form VAR model, where each variable in the system is regressed on its own lags and the lags of other variables. This model captures the interdependencies among variables but does not provide a structural interpretation of the shocks driving the system. Next, the residuals from the reduced-form VAR are analyzed to identify the structural shocks. Since these residuals are correlated, identifying the structural shocks requires imposing additional restrictions based on economic theory or prior knowledge. Once the restrictions are defined, the model is estimated, and the structural shocks are recovered. This step involves solving the system of equations under the imposed constraints to separate the residuals into the identified structural shocks. These shocks are then used to examine the dynamic responses of the variables, often visualized through impulse response functions, which trace the effect of a one-time shock to one variable on the others over

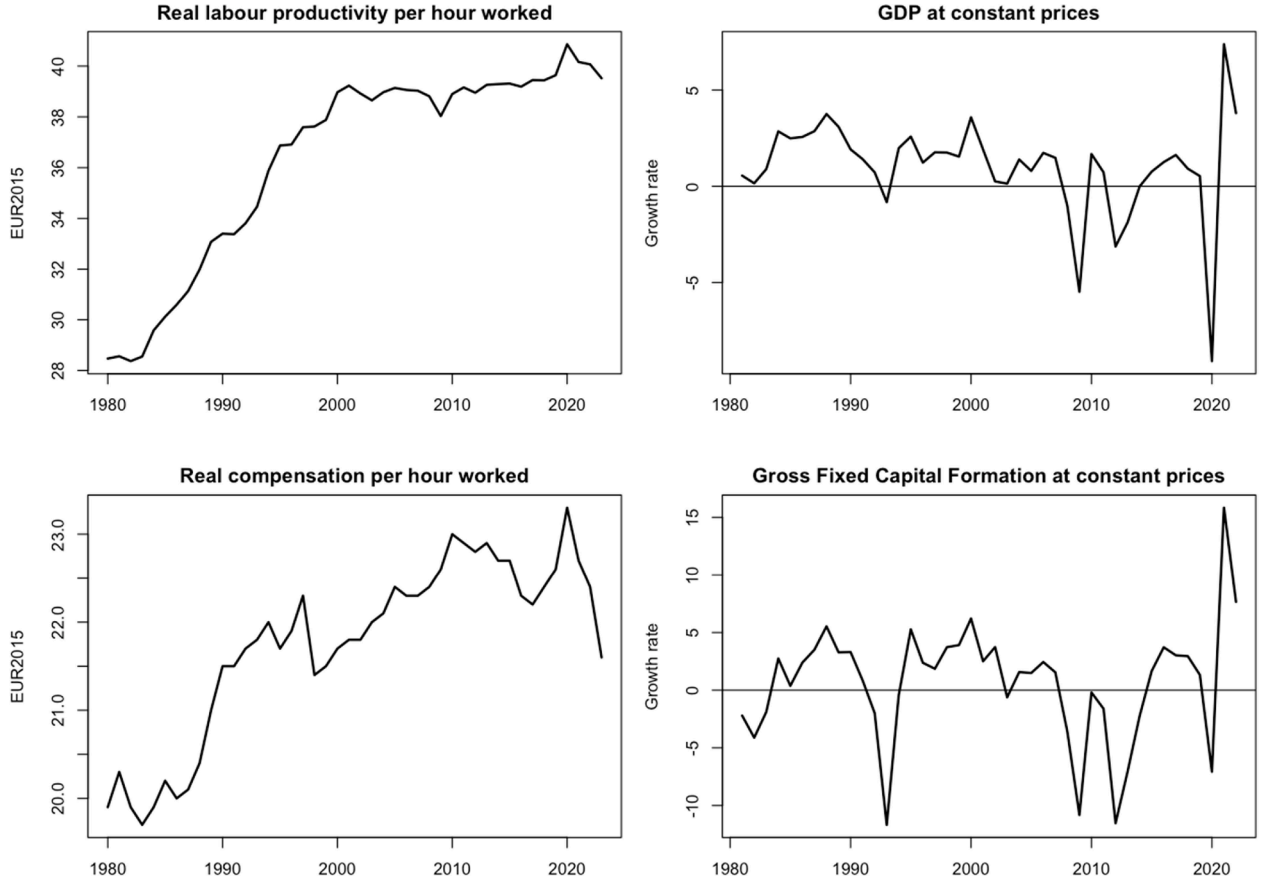

Fig. 4. Productivity, wages, GDP growth and Fixed investment growth in Italy (1980-2023).
Source: Authors' elaboration on ARDECO data.

time.

In the context of regional data, such as our analysis of Italian regions, Panel SVAR (P-SVAR; Pedroni, 2013) is particularly useful for identifying how shocks impact key variables like productivity.

As previously mentioned, SVAR requires restrictions on parameters to achieve identification of the structural shocks and their causal relationships. These restrictions, based on economic theory or empirical evidence, are essential because the model's reduced form is underidentified, meaning that without them, it is impossible to distinguish between different shocks. Imposing restrictions helps isolate individual shocks, ensuring that the model's results are economically meaningful and interpretable within the context of the variables being studied.

Initially, we estimate a reduced-form VAR(n) model for panel data as follows:

$$x_{i,t} = A_i(L)x_{i,t-n} + u_{i,t} \tag{2}$$

In this equation, $x_{i,t-n}$ represents the vector of variables under investigation, while $A_i(L)$ is a matrix polynomial capturing the lagged coefficients. The term $u_{i,t}$ denotes the error term in the reduced form model. Based on the general-to-specific (GTOS) approach (Pedroni, 2013), we employ a one-year lag structure in our analysis.

Next, we impose an identification strategy on the Eq. (2), in order to get a structural model which can be represented as follows:

$$B_{0i}x_{i,t} = B_i(L)x_{i,t-n} + e_{i,t} \tag{3}$$

B_0 represents the matrix of contemporary relationships between variables, B_i is the matrix of autoregressive coefficients, and $e_{i,t}$ is the vector of structural shocks, assumed to be serially uncorrelated.

$$B_{0i}x_{it} = \begin{bmatrix} - & 0 & 0 & 0 \\ - & - & 0 & 0 \\ - & - & - & 0 \\ - & - & - & - \end{bmatrix} \begin{bmatrix} \dot{w} \\ \dot{I} \\ \dot{Y} \\ \dot{p} \end{bmatrix} \tag{6}$$

The restrictions imposed on the matrix of contemporaneous relationships are derived from economic theory. In the column represented by x, as previously mentioned, the endogenous variables are represented. The ordering of the variables is such that, from top to bottom, the variables progress—from the most "exogenous" to the most "endogenous," to use the terminology common in these analyses. A "more exogenous" variable means that it is not influenced contemporaneously by any of the other variables, but at most with a lag. The second variable from the top is contemporaneously influenced by the first, but not by the others. The third is contemporaneously influenced by the first and second, but not by the fourth. The fourth has a contemporaneous relationship with the three preceding variables.

In this case, we use wages as the most exogenous variable. This choice is drawn from economic theory and is an assumption that permeates various schools of thought, both mainstream and heterodox. In all these cases, the actual wage is not influenced by changes in factor productivity but by other elements, which impart strong exogenous characteristics to it. To give some examples from mainstream theory, we can cite institutional elements such as efficiency wages (Shapiro and Stiglitz, 1984) and various theories in which the wage level is primarily dictated by social norms (see, to cite some examples, McDonald and Solow, 1981, and Akerlof's theory on "gift exchange"; Akerlof, 1982) and various other forms of rigidity, not least the fact that wage bargaining in many countries does not take place continuously and in a decentralized manner but proceeds in waves of contract renewals and wage adjustments managed by labor unions and employer associations. This system of renewing collective contracts inevitably leads to a form of time inconsistency: wages are negotiated under certain macroeconomic conditions and remain the same (barring forms of indexation) for the entire duration of the collective contract, regardless of changes in those conditions (this is the starting point of the theory of staggered contracts; see Taylor, 1979).

From the perspective of heterodox theories, and in particular classical-Keynesian – or Sraffian – ones (see Garegnani, 1984; Stirati, 1992, 1994), the forces determining wages are considered exogenous. In the various theoretical conceptualizations that constitute this approach, functional distribution is influenced by various factors, such as social norms, customs, and above all, the relative strength of social classes (Levrero and Stirati, 2006; Levrero, 2013). More precisely, distribution is not endogenous to the economic system in the neoclassical sense but is instead determined by external social and institutional factors. Moreover, since our objective is to explain the effects of wages on productivity, it is natural to use wages as the *primus movens*.[3]

The next variable is investment. This step is also motivated by the theory we are aiming to analyze. Indeed, we have seen that Sylos Labini's theory predicts that a rise in wages can positively influence investments by encouraging the adoption of more capital-intensive techniques.[4]

The role of investments in influencing GDP, on the other hand, stems from the traditional theory of the multiplier (Kahn, 1931; Keynes, 1936; Samuelson, 1939, proposed an integration of the theory of the multiplier with that of the so-called accelerator of investments; Harrod, 1939, adopted the multiplier in his growth model) and the more modern theory of the so-called "Sraffian" supermultiplier. (Bortis, 1997; Serrano, 1995).

Finally, the effect of GDP on productivity derives from the aforementioned framework of Kaldor and Verdoorn.

5.3. Results

The results of the analysis confirm the existence of a direct relationship between real wages and labor productivity. As shown by the IRFs (Fig. 5), the effect is significant and persistent across all periods (10) following the shock.

More specifically, focusing on the main topic of the paper, we observe (Table 2) that the results show a positive and persistent elasticity of productivity with respect to changes in real wages throughout the entire period under consideration (up to ten years after the shock). As expected, this elasticity is higher in the initial period (2.84) and gradually declines as the time since the shock increases. On average, the effect over the whole period is equal to 1.84.

The IRFs also confirm two of the effects we hypothesized based on economic theory. Specifically, the effect of investment on GDP, and therefore the multiplier effect, is confirmed. Furthermore, it is possible to verify the functioning of the mechanism hypothesized by Kaldor and Verdoorn: the increase in GDP positively affects labor productivity. Investment also appears to respond in a consistent, positive, and persistent manner to changes in gross domestic product, in line with the accelerator theory (Clark, 1917). What the data, however, do not seem to confirm is the effect of wage increases on investment, through the mechanism of capital-for-labor substitution hypothesized by Sylos Labini.

[3] It should be emphasized here that there are other heterodox and post-Keynesian strands of analysis in which wages are determined endogenously. This is the case, for example, in the views of Kaldor (1956, 1957), Robinson (1956), and Pasinetti (1962), and thus in the so-called "Cambridge equation" models. In the Marxist field, the Goodwin (1967) model is characterized by the cyclical interaction between the wage share and the employment rate.

[4] Also in this case, it is important to recall that within the broad Post-Keynesian framework, at least two other theoretical approaches propose a different relationship between wages and investment. On the one hand, there are the neo-Kaleckian and post-Kaleckian models, already mentioned (see footnote 1), in which investment is viewed as a variable that negatively depends on some measure of wages (for a critical perspective and a comprehensive review of the literature, see Trezzini & Salvati, 2024). On the other hand, the models based on the Cambridge equation (see footnote 2) should again be mentioned, as they posit a relationship that runs from investment to functional distribution.

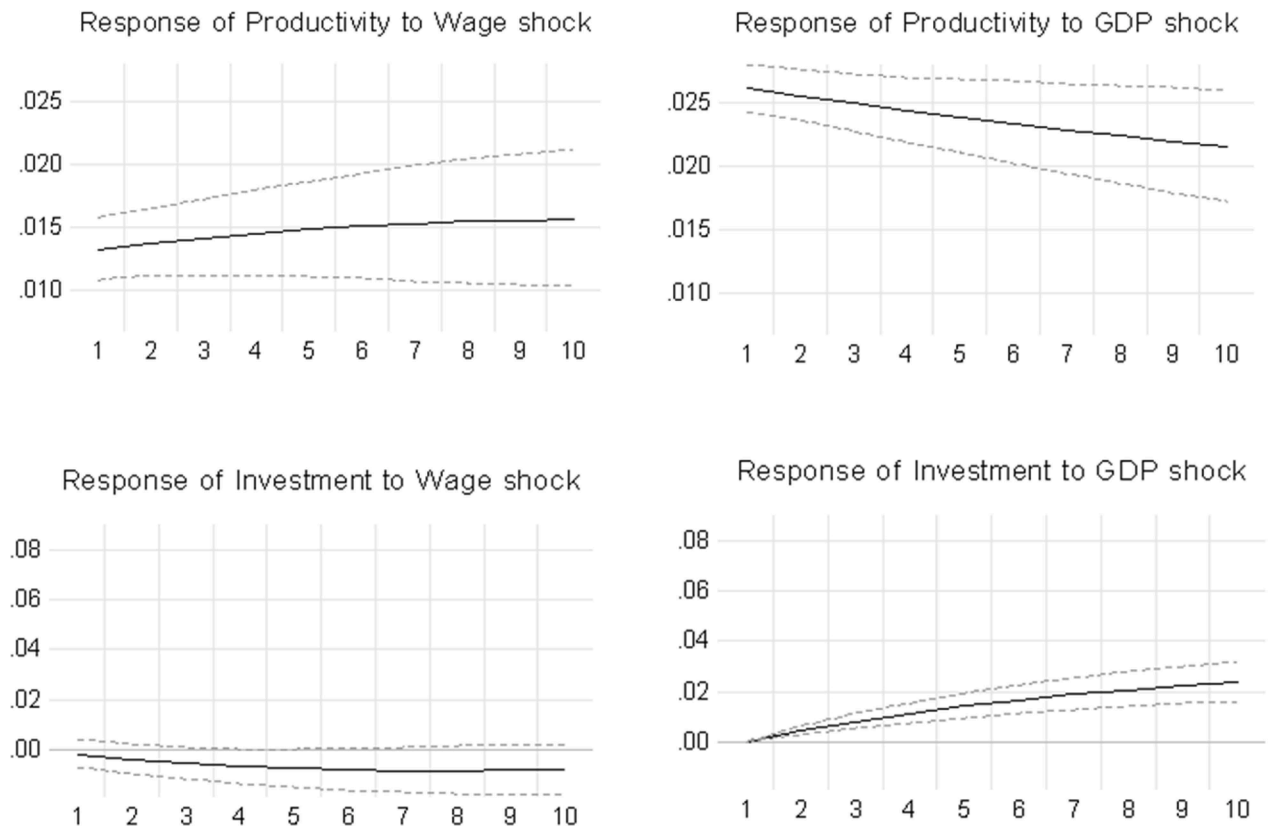

Fig. 5. Impulse response functions for the whole sample.
Responses to structural shocks ae reported with 2 standard error bounds (95 % confidence interval).

Table 2
Elasticity of productivity over real wages. SVAR estimations.

Period after wage shock	Elasticity of productivity
1	2.840
2	2.517
3	2.246
4	2.016
5	1.820
6	1.652
7	1.506
8	1.379
9	1.269
10	1.173
Average	**1.842**

The use of regional-level data to conduct national-level analyses requires that the phenomenon be distributed sufficiently homogeneously among the various groups of regions. To assess the robustness of the panel data investigation, we estimate the model, in the spirit of Deleidi et al. (2021), four times, each time removing the regions of the northwest, northeast, center, and Mezzogiorno (south and islands), respectively. The results, summarized by the IRFs shown in Figs. 6,7,8,9, prove robust across all four specifications, maintaining the previously observed results on the relationships of interest.

6. Conclusions and policy implications

In this paper, we focused in particular on the effects of changes in real wages on productivity, drawing inspiration from Sylos-Labini's productivity equation. The results support the validity of this perspective, which identifies real wage growth as a key variable in explaining productivity growth. These findings highlight the need to promote productivity growth also through policies aimed at supporting wages. On the contrary, the weakening of workers' position and the reduction in real wages have translated into lower productivity. In the view suggested by our results, labor market reforms, by reducing the bargaining power of workers, seem to have negatively affected long-term economic growth through changes in investment incentives, technology adoption, and organizational efficiency, in line with other recent works such as Kleinknecht (2020) and Pianta & Reljic (2022).

The policy conclusions suggested by our analysis point toward strengthening the bargaining power of workers to reverse the stagnation trend we have described in previous sections. As we have indicated, this would have positive effects not only on wages (see, for a recent analysis on the negative effects of labour market flexibilization on the wage share, Liotti at al., 2023) and on the quality of life for working families but also on key indicators such as aggregate demand, investment, technological progress, and productivity. While our conclusions refer specifically to the Italian case, the proposed policies can naturally be applied to other countries facing similar conditions.

From a structural standpoint, one policy suggestion relates to labor market reforms. As seen in recent decades, labor market protection (as measured by EPL indices) has trended towards less job security and more flexibility. The 2015 labor market reform, known as the "Jobs Act," marked a peak in the reduction of job security, especially through the introduction of the so-called "contract with increasing protections." At the same time, the use of fixed-term contracts increased, along with the phenomenon of involuntary part-time work (for a summary of the changes in the Italian labor market, see Deleidi et al., 2023). A minimum program that would move in the opposite direction (see, for example, Bianchi et al., 2017, and Levrero, 2023) should at least reintroduce reasons for using fixed-term contracts and discourage the excessive use of such contracts. Additionally, tools should be reinstated to reflect the framework of the 1970 Workers' Statute, dismantled by the Jobs Act reforms.

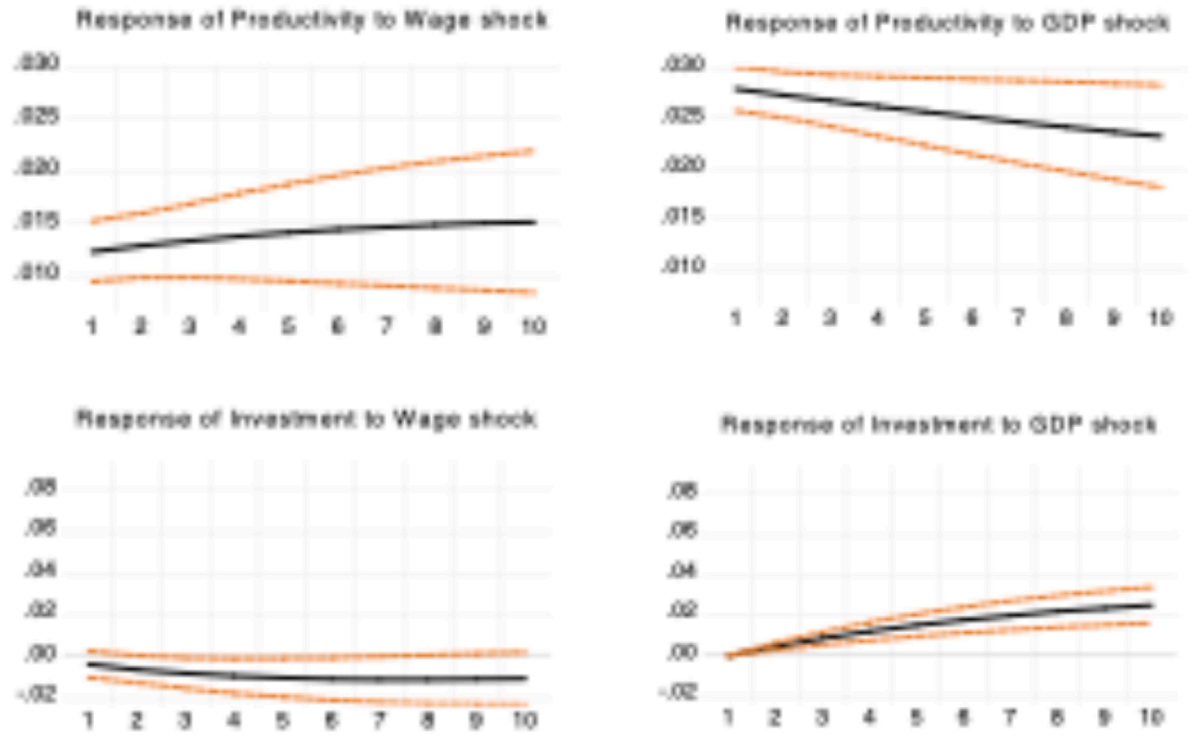

Fig. 6. Impulse response functions without North-West.

Fig. 7. Impulse response functions without North-East.

One of the tools that affect the bargaining power of workers is the guaranteed minimum income. In Italy, the introduction of such instruments reached its peak with the introduction in 2019 of the "Citizenship Income" (RdC, "Reddito di Cittadinanza). In 2024, the RdC was replaced by the "Inclusion Allowance" (ADI, "Assegno di Inclusione"), a measure that significantly reduced the number of beneficiaries. Thus, the latest legislative changes have represented a step backward in expanding and strengthening the guaranteed minimum income. From the perspective of our article, this recent reform moves in the opposite direction from what is needed to support the bargaining power of workers and protect their purchasing power.

Similarly, the failure to introduce a minimum wage in Italy represents a missed opportunity to reverse course. The various bills presented during the XVIII legislature (2018–2022) stalled multiple times and

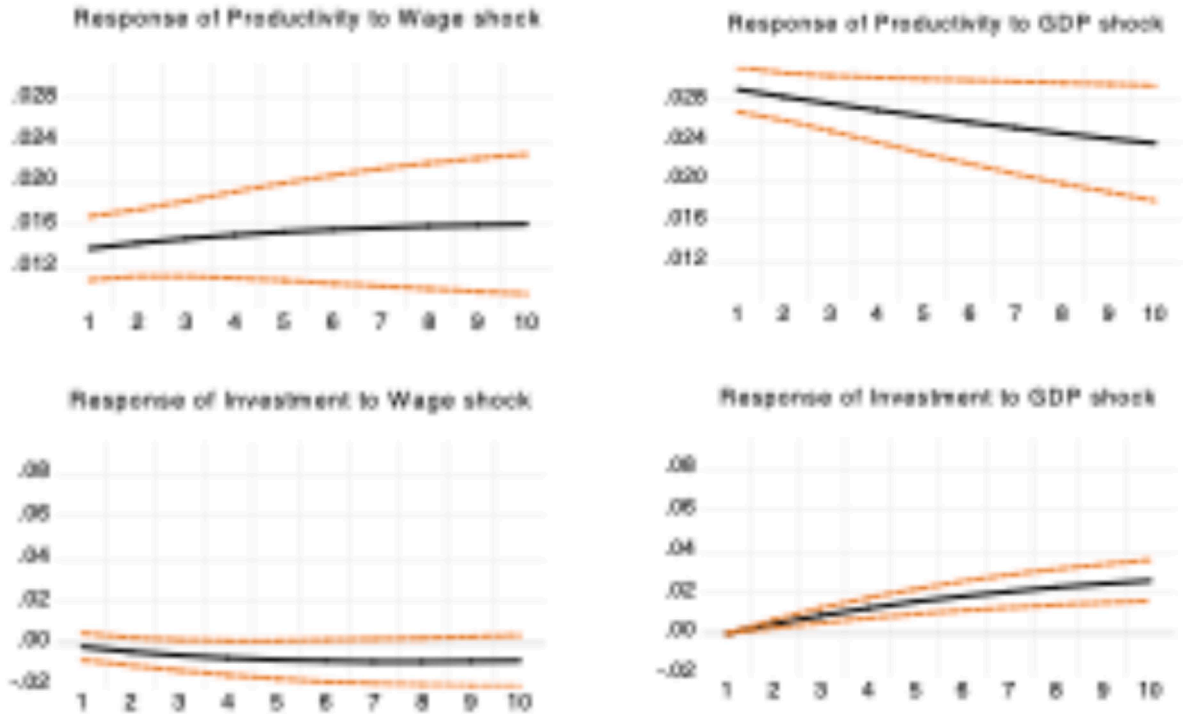

Fig. 8. Impulse response functions without Center.

Fig. 9. Impulse response functions without South and Islands.

never came to fruition. The agenda of the subsequent government does not seem to consider the possibility of introducing a minimum wage at all.

It is important to emphasize that the reasons labor market reforms can negatively impact the labor market are not limited to the mechanism suggested by Sylos Labini (Lucidi and Kleinknecht, 2010). As we have outlined, these reforms have severely weakened the bargaining position of workers. This has been a key factor in the reduction of real wages, partly driven by the phenomenon of "decoupling" between wages and productivity. The result has been a gradual erosion of the purchasing power of households, with significant negative consequences for aggregate demand. In addition to this, the uncertainty surrounding job security can lead workers to postpone their spending, particularly on durable goods, which further depresses aggregate demand.

Moreover, it is worth noting that the weakening of labor protections, combined with wage stagnation, has not only affected short-term

consumption but has also contributed to a broader economic slowdown. By undermining the financial stability of households, these reforms have triggered a vicious cycle where lower consumption leads to lower demand, which in turn discourages investment and innovation, ultimately slowing down productivity growth.

Another important aspect to consider is the effect—also confirmed by the econometric analysis—of GDP growth on productivity growth. This effect, known in economic theory as the "Kaldor-Verdoorn Law," suggests that, in addition to supporting wages, it is necessary to revive policies aimed at boosting aggregate demand in order to foster sustained GDP growth. From a policy perspective, this implies the need to reconsider recent measures aimed at curbing public spending and reducing deficits. Such policies, by slowing the growth of aggregate demand, also act as a brake on productivity growth. Moreover, supporting wages can represent a way to support aggregate demand through the increase of consumption.

Regarding potential future prospects, several prominent officials from various central banks have suggested that real wages may eventually realign with their pre-2022 trend, and this would potentially mitigate the crisis's effects on productivity.

Such an expectation remains to be fully verified. European Central Bank (ECB) officials have acknowledged that real wages in the euro area have declined in recent years due to high inflation, particularly following the energy crisis. In a speech from March 2024, an ECB Executive Board member highlighted that real wages remained below their pre-pandemic levels, while unit profit growth had been relatively high. The official noted that as profits normalize and negative supply shocks reverse, there is room for a catch-up in real wages, which would support economic recovery and align with the ECB's inflation target.[5] Furthermore, the ECB's Economic Bulletin from April 2024 indicated that job creation had been supported by real wages falling more than productivity.[6] The ECB wage tracker also shows that the most recent expectations indicate the possibility that the growth of negotiated wages is expected to ease in 2025.[7]

However, even granting credibility to the hypothesis that wages are regaining ground and could return to pre-crisis levels, the structural characteristics of the Italian economy—such as limited wage indexation mechanisms, pronounced labor market segmentation, and the predominance of low-productivity sectors—suggest that this adjustment may be incomplete and uneven. Thus, while a partial recovery in real wages is plausible, structural constraints are likely to impede a full convergence to pre-crisis trends, leaving some long-term consequences for productivity.

CRediT authorship contribution statement

Luigi Salvati: Writing – review & editing, Writing – original draft, Supervision, Methodology, Data curation, Conceptualization. **Pasquale Tridico:** Writing – review & editing, Supervision, Conceptualization.

[5] "The confidence to act: monetary policy and the role of wages during the disinflation process". Speech by Piero Cipollone, Member of the Executive Board of the ECB, at an event organised by the House of the Euro and the Centre for European Reform. Brussels, 27 March 2024. URL: https://www.ecb.europa.eu/press/key/date/2024/html/ecb.sp240327~30a05c6862.en.html

[6] "Drivers of employment growth in the euro area after the pandemic – a model-based perspective". Prepared by Agostino Consolo and Claudia Foroni. Published as part of the ECB Economic Bulletin, Issue 4/2024. URL: https://www.ecb.europa.eu/press/economic-bulletin/focus/2024/html/ecb.ebbox202404_04~6d75d098ab.en.html

[7] The ECB wage tracker: your guide to euro area wage developments. 18 December 2024. The ECB Blog. By Colm Bates, Vasco Botelho, Sarah Holton, Marc Roca I Llevadot and Mirko Stanislao. URL: https://www.ecb.europa.eu/press/blog/date/2024/html/ecb.blog20241218~1b3de009b4.en.html

Data availability

Data will be made available on request.

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