ECONOMIC POLICY

MINISTÈRE DE L'ÉCONOMIE, DES FINANCES ET DE LA RELANCE
Liberté
Égalité
Fraternité

Direction générale du Trésor

75th Economic Policy Panel Meeting

7- 8 April 2022

The Macroeconomic Effects of Structural Reforms: An Empirical and Model-based Approach

Emanuela Ciapanna, Sauro Mocetti & Alessandro Notarpietro

CEPR CESifo SciencesPo.

The macroeconomic effects of structural reforms: An empirical and model-based approach*

Emanuela Ciapanna†, Sauro Mocetti‡, and Alessandro Notarpietro§

Bank of Italy

February 18, 2022

Abstract

This paper quantifies the macroeconomic effects of three major structural reforms (i.e., service sector liberalizations, incentives to innovation and civil justice reforms) undertaken in Italy in the last decade. We employ a novel approach that estimates the impact of each reform on total factor productivity (TFP) and markups in an empirical micro setting and uses these estimates in a dynamic general equilibrium model to simulate the macroeconomic effects of the reforms. Microeconometric estimates indicate that the reforms imply a sizeable increase in TFP and a reduction in service markup. Structural model–based analysis shows that, accounting for estimation uncertainty, the increase in the level of GDP at the end of the decade is between 2.5% and 6%, with non-negligible effects on the labor market.

Keywords: Structural reforms; DSGE models; liberalization; innovation; civil justice.

JEL Codes: E10, E20, J60, K40, L50, O30.

*We thank Roberto Galbiati (managing editor of Economic Policy), three anonymous referee and an anonymous panelist for their precious insights on previous drafts. We are also indebted to Lorenzo Burlon, Fabio Busetti, Guzman Gonzales Torres, Massimiliano Pisani, Luigi Federico Signorini, Roberto Torrini, Francesco Zollino and seminar participants at the Bank of Italy workshop on potential output. The views expressed here are our own and do not necessarily reflect those of the Bank of Italy.

†Emanuela Ciapanna, Bank of Italy, Via Nazionale 91, 00184 - Rome, Italy. E-mail: emanuela.ciapanna@bancaditalia.it.

‡Sauro Mocetti, Bank of Italy, Via Nazionale 91, 00184 - Rome, Italy. E-mail: sauro.mocetti@bancaditalia.it

§Alessandro Notarpietro, Bank of Italy, Via Nazionale 91, 00184 - Rome, Italy. E-mail: alessandro.notarpietro@bancaditalia.it

1 Introduction

For the past twenty years, and particularly since the sovereign debt crisis, the importance of structural reforms, aimed at promoting sustainable and balanced growth, has been at the center of the economic debate, in advanced economies and in Europe in particular, as well as in the agenda of G20-G7. Structural reforms are measures designed for modifying the very structure of an economy; they typically act on the supply side, i.e. by removing obstacles to an efficient (and equitable) production of goods and services, and by increasing productivity, so as to improve a country's capacity to increase its growth potential along a balanced path. This objective can be pursued by improving the environment in which companies operate: for example, removing cumbersome and anti-competitive regulation, easing the functioning of the labor market, increasing enforcement of contracts and protection of property rights, or even designing incentives to boost investment in research and development (R&D) and innovation.

This paper quantifies the macroeconomic effects of three major structural reforms carried out in Italy over the last decade: (i) liberalization of services, (ii) incentives to business innovation (included in the so-called "Industry 4.0" Plan) and (iii) measures in the civil justice system aimed at increasing courts efficiency.[1] We adopt a novel approach that combines microeconomic empirical evidence with macroeconomic analysis, following a 3-step procedure:

1. description of the reform and selection of a synthetic indicator in order to produce a quantitative measure of the reform to be assessed;

2. estimation of the effects of the reform (i.e., the change in the synthetic indicator) on some variables of interest, such as, e.g., total factor productivity (TFP), or firms' markup;

3. simulation of a structural dynamic general equilibrium model to evaluate how the change in the indicators estimated in steps 1 and 2 influences the macroeconomic variables of interest.

Specifically, we first estimate the impact of each reform on two variables: markups and TFP. The first is typically considered in the literature as an (in-

[1] A number of other important reforms were implemented in Italy over the same period. We do not consider them because of the lack of quantitative indicators (e.g., labor market reforms) and/or because they were not effective in the temporal span considered in this paper.

verse) indicator of the degree of competition in a given sector, and it is therefore natural to consider the effects of a liberalization on it. TFP captures efficiency gains entailed by the reforms.

We then simulate the estimated changes in markups and TFP using a multi-country, two-sector New Keynesian dynamic general equilibrium model featuring nominal price rigidities. The world economy is composed of three blocs. Two blocs, Home (calibrated to Italy) and the rest of the euro area, are members of a monetary union, thus having a common nominal exchange rate and a common monetary policy rate. The third bloc, representing the rest of the world, has its own monetary policy rate and nominal exchange rate. Crucially for our analysis, the model includes two key building blocks. First, intermediate tradable and nontradable sectors, identified with manufacturing and services, respectively. Second, search and matching frictions in the labor market that allow for a characterization of the dynamics of hours worked per employee (intensive margin) and the number of employees (extensive margin).

We simulate the three reforms separately, by gradually and permanently reducing the service sector markup and increasing sectoral (or aggregate) TFP, according to our micro-econometric estimates. Reforms that permanently reduce market power and/or increase TFP have two main effects on the macroeconomy. First, they enhance productive capacity thus increasing permanent income, which favors an increase in aggregate demand. Second, reforms also favor an increase in aggregate supply. Finally, on the open-economy dimension, the effect of the reforms on the supply of services impacts the real exchange rate and trade competitiveness. Hence, while the long-run expansionary effects on output are uncontroversial, the short-term effects on economic activity, employment and inflation are less obvious.

Our results are as follows. Microeconometric estimates indicate that the reforms imply a sizeable increase in TFP and a reduction in service markup. Structural model-based analysis shows that, accounting for estimation uncertainty, the three reforms, introduced in different years and with different timing, starting in 2011 and up to 2017, have already begun to produce their effects on the main macroeconomic variables. In particular, by 2019 GDP was between 2.5% and 6% higher than it would otherwise have been in the absence of these reforms. We also detect non-negligible effects on the labor market: employment would increase in the long term by about 0.5%, while the unemployment rate would be reduced by almost 0.4 percentage points (pp).

The main novelty of our paper is the joint analysis of the effects of a specific structural reform on some quantity of interest, via micro-econometric techniques that get as close as possible to the estimation of a causal impact, and the simulation of a macroeconomic model, which allows us to analyze the transition towards the new steady state, and to assess the general equilibrium effects.

The existing literature typically provides two distinct approaches to the assessment of the economic effects of structural reforms.

The first approach is based on reduced-form evidence. Among the others, Lanau and Topalova (2016) examine the impact of liberalizations in Italy by exploiting the variation in the timing and degree of deregulation across sectors. Beyond direct effects, other papers have examined the impact on downstream industries that use the output of regulated network industries as inputs in their production function (Barone and Cingano (2011) and Bourlès et al. (2013)). Westmore (2014) examines, using panel regressions across countries, the relationship between innovation-specific policies, innovation indicators and multifactor productivity. Finally Chemin (2020), using a triple difference approach, finds that comprehensive judicial reforms improve perceptions of judiciary efficiency and firm productivity. However, these results do not account for general equilibrium effects, and the empirical setting does not allow to explore the transition of the economy towards its new (post-reform) steady state.

The second approach is based on structural dynamic general equilibrium models. Forni et al. (2010), Lusinyan and Muir (2013), Varga et al. (2014) and Gerali et al. (2016) analyse a wide array of structural reforms in Italy. However, in these studies the size of the simulated reform is generally based on working assumptions (e.g. "what would happen if the gap vis-à-vis best practices was closed?"), without any underlying empirical estimate. Bayoumi et al. (2004) examine the effects of greater competition in the euro area, but they do not focus on country-specific reforms or distinguish between the manufacturing and services sectors. Everaert and Schule (2008) use a similar approach to analyze the effects of synchronized structural reforms in the euro area. Gomes et al. (2013), using a multi-country dynamic general equilibrium model of the euro area, assess the macroeconomic effects of increasing competition in the labour and services markets in Germany and the rest of the euro area and, in an alternative scenario, Portugal and the rest of the euro area. Eggertsson et al. (2014) study the effects on the European economy of structural reforms that increase competition in the product and labor

markets, and show that such reforms may be contractionary at the effective lower bound, since they induce a fall in inflation and an increase in the real interest rate. Cacciatore et al. (2016a) explore the effects of labor and product market reforms in a New Keynesian, small open economy model with labor market frictions and endogenous producer entry. Different from the above-mentioned studies, we focus on some specific reforms implemented in Italy and, crucially, estimate the magnitude of the effects of each reform on TFP and markups, and use such estimates as inputs in our model-based simulations.

The paper is organized as follows. Section 2 describes the three considered reforms; Section 3 illustrates the micro-econometric approach for the estimation of the effects of the reforms; Section 4 presents the model and the macro-level analysis; Section 5 shows the results and discusses them in a comparative fashion, with respect to those obtained by other studies employing different methodologies. The final section offers some concluding remarks.

2 Structural reforms in Italy: the institutional background

In this section, we provide a description of the three major structural reforms considered in the paper, within the Italian institutional framework.

2.1 Liberalization reforms

Reforming regulation in a way to enhance competition can have large macroeconomic effects (Griffith and Harisson (2004)). More competition is expected to reduce the level of economic rents, bring prices closer to marginal costs (i.e., reduce mark-up), improve resource allocation, and create incentives to undertake more productive activities and pursue efficiency (i.e., increase TFP).

According to the OECD Product Market Regulation (PMR) indicators, Italy was one of the biggest *de jure* reformers between the second half of the 2000s and the beginning of the 2010s.

In this paper, we examine the liberalization of services introduced with the Decree Law "Salva Italia" (L. 22 December 2011, n. 214) and with the Decree Law "Cresci Italia" (L.24 January 2012, n. 1). The various measures included (i) the liberalization of opening days and hours in retail trade; (ii) the abrogation of

restrictions on fees and advertising, the expansion of the possibility to do business as a company and the establishment of a limit of 18 months for internship and mandatory training in the professional services; (iii) for specific activities, characterized by formal limits to access (notaries, pharmacies), the Law increased the planned number of practitioners and eliminate some restrictions to carrying out the activities; (iv) the liberalization of the transport sector; and (v) the ownership separation of SNAM (the gas infrastructure company) from its service distribution branch.

2.2 Incentives to innovation

R&D expenditure, product and process innovation and the adoption of new technologies are central to ensuring efficiency gains at the firm level and hence the growth of the economy as a whole (Bugamelli et al. (2018)). Italy is characterized by under-investment in innovation and the so called "diffusion machine" seems to be relatively malfunctioning (Andrews et al. (2015)). On the one hand, there are few highly innovative, productive, and internationalized firms belonging to the "productivity frontier". On the other hand, the great majority of firms lags behind, apparently unable to benefit from knowledge spillovers and adopt innovation developed by leading firms.[2]

Since the second half of the 2010s, several interventions have redesigned the industrial and innovation policy in Italy, aimed at boosting firms' productivity through fiscal incentives for investment in innovation. In line with international best practices, they were to intervene on the entire innovation chain: supporting start-ups and innovative small and medium-sized enterprises (SMEs), moving on to R&D tax credit for existing innovative companies, up to the Patent Box to prevent leaks abroad of the large multinationals in the most innovative sectors.

These measures have been integrated with the "Industry 4.0" Plan, launched in 2016 and subsequently renewed, which, among the various initiatives, includes a series of fiscal incentives aimed at fostering investments (super-amortization, so-called "new Sabatini"[3]), and at boosting adoption of so called "Industry 4.0" technologies (hyper-amortization) and R&D expenditure (tax credit on R&D).

[2]See Westmore (2014) and the works cited therein for a review of the literature.

[3]The law carries the name of a politician, Armando Sabatini, who first promoted a law aimed at fostering technological innovation in small and medium-sized firms in 1965.

More specifically, hyper- and super-amortization are measures aimed at supporting and incentivizing companies (by means of an overvaluation of 250% and 140% of investments respectively) to invest in new, tangible or intangible capital goods as long as they are functional to the technological and digital transformation of production processes. Moreover, a 50% tax credit aims at encouraging RD spending up to a ceiling of 20 million euros per year. Other measures aim to facilitate access to credit such as the "Nuova Sabatini" law, supporting businesses that require bank loans (between 20,000 and 2,000,000 euros) for investments in new industrial capital goods and digital technologies.

According to a survey among entrepreneurs conducted by the national institute of statistics, the super-amortization played a quite or relevant role in the decision to invest for 62% of the companies, hyper-amortization for 48% of the companies and the tax credit for RD expenditure for 41% of the companies.[4]

2.3 Civil justice reforms

The functioning of the civil justice, by enforcing contracts and securing property rights, crucially affects the legal protection of investment and trade, two key elements of economic activity. As a result, judicial reforms are often seen as key factors driving economic development. Chemin (2020) provides a direct assessment of the impact of judicial reforms across countries on productivity, showing that reforms improve firm perceptions of the judiciary and that this translates into an increase in firm productivity in sectors relying on relationship-specific investments (i.e., sectors relying more on the judiciary).[5]

The Italian civil justice system has long suffered from considerable dysfunctions (Giacomelli et al. (2017)). Two notable examples are the enormous backlog of cases and the excessive length of trials. At the beginning of the current decade, about 3.5 million civil proceedings were pending before the Italian trial courts (*tribunali*), the highest amount ever; according to World Bank (2020), the resolution of a

[4]See https://www.istat.it/storage/settori-produttivi/2018/Capitolo-4.pdf. The document also includes the expected results (in a three-year horizon) in terms of additional private investments and spending on research, development and innovation.

[5]See Chemin (2020) and the works cited therein for a review of the literature. With reference to Italy, inefficiencies of the judicial system worsen financing conditions for households (Fabbri and Padula (2004)) and firms (Jappelli et al. (2005), Magri (2010) and Rodano (2021)) and have negative effects on the participation of firms in global value chains (Accetturo et al. (2017), on their size (Giacomelli and Menon (2017)) and on firm turnover (Bamieh et al. (2021)).

commercial dispute required 850 days, more than twice the time needed in the other advanced economies.

To address these issues, especially starting from the summer of 2011, the civil justice system underwent considerable reforms. The actions undertaken, of diverse nature and importance, were designed, on the one hand, to reduce the number of legal disputes and, on the other, to improve the productivity of the courts. Concerning the demand side, conditions (i.e. rules and costs required to initiate a case) were modified and alternative dispute resolution instruments were introduced. Concerning the supply side, there was a geographical reorganization of the trial courts throughout the country; investments were made and rules introduced to encourage the use of information technologies; incentives for court managers to reduce their backlogs were introduced; finally, projects were launched to promote the spread of best practices.

3 Micro-econometric estimation of the effects of the reforms

In this section we provide micro-econometric estimates of the effects of each reform on the variable of interest, such as markup or TFP.

3.1 Effects of liberalization reforms

To quantitatively assess the extent of the liberalization reforms, we resort to the OECD sectoral regulation indicators (NMR).[6] These indicators provide a measure of how restrictive the regulation is in two groups of sectors: energy, communications (posts and telecommunications) and (road and air) transports (ECTR) and retail and professional services (RBSR) in 34 advanced countries. They cover information in four main areas: state control, barriers to entry, involvement in business operations and, in some cases, market structure (Figures 1).[7] The information summarised by the indicators is objective, as opposed to survey-based, and consists of rules, regulations and market conditions. All of these regulatory data

[6]https://www.oecd.org/governance/regulatory-policy/indicators-sectoral-regulation.htm.

[7]Notice that in the graph the sectors posts and telecommunication and road and air transport are aggregated for the sake of simplicity in presentation, whereas they are considered separately in the estimation procedure.

are vetted by Member country officials and/or OECD experts. The indicators are calculated using a bottom-up approach in which the regulatory data are quantified using an appropriate scoring algorithm and then aggregated into summary indicators by sector of activity in each of the four areas or across them. They range from 6 (fully regulated sector) to 0 (perfectly liberalized sector) and are computed every 5 years, so that they are available for 1998, 2003, 2008 and 2013.[8] Figure 2 shows the variation over time of the NMR index in the seven sectors for 11 main OECD countries. The graphs represent the changes in terms of deviations from the 1998 value, which is normalized to zero and treated as a reference point. Notice that, while most of the indicators show a decreasing trend, the extent and the time patterns of the reduction were quite heterogeneous across sectors and countries. Such heterogeneity is crucial to our scope, as we will resort to across country and sector variation in the regression model.

The weighted average value for Italy of the indicators in the service sector drops from 3.9 to 3.2 in the period 1998-2013 (Figure 3). The drop is particularly intense in the last five years, reflecting the liberalization reforms introduced by the Decree Law "Salva Italia" (L. 22 December 2011, n. 214) and by the Decree Law "Cresci Italia" (L. 24 January 2012, n. 1). Concerning the sector analysis, the drop was larger in the retail trade and in the professional services (with a reduction of 0.9 points in the 0-6 scale), as also shown in Figure 2.

In theory, the less restrictive regulation and the greater openness to competition in services, as reflected by the indices, has essentially two effects: on the one hand, it directly compresses the monopoly rents; on the other hand, it induces a general recovery of efficiency. The latter results from a selection and reallocation process of market shares towards productive companies, and from the higher average degree of efficiency in production within firms that prove able to stay in the market. Overall, these adjustments induce a lowering of average costs and an increase in TFP.

We estimate the effects of liberalization on markup and TFP, by exploiting the temporal variation, across sectors and countries, of the OECD regulatory indicators. To this aim, we combine NMR information with data on value added, intermediate inputs, capital stock and employment at the country-industry-year level contained in the OECD Structural Analysis (STAN) dataset.[9] These data have

[8]For a more detailed description see Conway and Nicoletti (2006).

[9]http://www.oecd.org/sti/ind/stanstructuralanalysisdatabase.htm

been assembled complementing member countries' Annual National Accounts with information from other sources, such as national business surveys and censuses, and classified according to the International Standard Industrial Classification. Table 1 provides a short description of the main data sources used in the paper.

Regarding the effects on markup, as our data are aggregated at the sector level, we use the Lerner markup, a monotone transformation of the Lerner index (or price-cost margin), which takes the following form:

$$\mu = \frac{P}{c} = \frac{1}{1-L} \tag{1}$$

where P and c indicate price and marginal cost respectively, and L is a synthetic measure of the degree of market power itself, defined as the ratio of the difference between final sales prices and the marginal costs over price, in line with Griffith and Harisson (2004) and Høj et al. (2006). L takes values between zero (in case of perfect competition) and 1 (in a monopolistic market). The associated markup takes values in the interval $[1, +\infty)$. Given the difficulties in retrieving data on marginal costs, these are approximated by average variable costs, accounting for materials and labor costs.[10] Thus, we can compute the Lerner index as the ratio between gross operating surplus (corrected for the cost of self employed workers) and gross output,[11] sourced from the STAN dataset, and the associated markup according to the transformation stated in equation 1. Within the considered period, the Lerner markup associated to regulated services in Italy is decreasing, partly reflecting liberalization policies undertaken over the years, (Figure 4). Empirically, the relationship between the Lerner markups and the degree of regulation (as reflected in the OECD indicators) is estimated as follows:

$$\mu_{ijt} = \beta_1 Reg_{ijt} + \eta_i + \eta_j + \eta_t + \epsilon_{ijt} \tag{2}$$

[10]Other implicit assumptions for the Lerner markup to be a valid measure of market power are constant returns to scale, substitutability among variable inputs and negligible fixed costs. In order to check whether these restrictions imposed on the production technology could invalidate our results, we have correlated for Italy – the country of interest and that for which micro data are available – the Lerner markup described in the main text with the estimated firm-level markups based on the De Loecker et al. (2020) method, which we average for the seven considered sectors. We find that the two indicators are positively correlated and that the main patterns are qualitatively confirmed. See Ciapanna et al. (2021) for more details.

[11]This approximation, though imposing non negligible restrictions, is widely employed within the literature. See Boone (2000) for a complete survey.

where μ_{ijt} is the Lerner markup in country i, sector j at time t; Reg_{ijt} is the regulatory indicator observed at the same unit of analysis; the η variables capture fixed effects of country, sector and year, respectively. We also propose a second specification with interacted country-year and sector-year fixed effects, to account for common shocks at the country and sector level, respectively and a third one with country-year and country-sector interacted fixed effects[12].

The results of our baseline model indicate that a reduction of one point in the regulatory indicator is associated with a statistically significant decrease in markups (Table 2). In our preferred specification, i.e. by saturating the model with sector-year and country-year fixed effects, the estimated effect is a 2.7 pp decrease (second column).[13]

To assess the impact of the reform on markups of the service sector in Italy, we use the estimated value of β_1 and the observed variation in Reg Italy. Namely:

$$\Delta\mu_{ITAjt} = \beta_1 \sum_j (\omega_{ITAjt} \Delta Reg_{ITAjt}) \tag{3}$$

where ΔReg_{ITAjt} measures the variation (reduction) of the OECD regulation indicator relating to sector j between 2008 and 2013; ω_{ITAjt} is the weight of sector j within the whole service sector. Using simple algebra, we find that the total effect of the liberalization package on the Italian markups in the service sector as a whole is estimated at around -1.1 pp.[14]

[12]In unreported evidence (available upon request), we investigate the presence of non-linear responses to regulation. In particular, we wonder whether the effect can be stronger when liberalization occurs in highly regulated contexts compared to more competitive ones. Along this line, we construct a regulation restrictiveness index taking value 1 if the country-sector NMR in the first sample year (1998) is above the first third of the distribution and zero otherwise, and include the resulting measure interacted with the NMR index in our regression. We find that the associated coefficient is non significant and negligible in magnitude, while leaving the rest of our results unchanged; thus we cannot reject the absence of non-linearities in our model.

[13]The estimates do not seem to be influenced by the measure of market power adopted: using the mark-up constructed according to the methodology proposed by Roeger (1995) the results do not change substantially. We choose the specification with country-year and sector-year fixed effects because of a general principle of parsimony: although the results are very similar in all the proposed models, we give our preference to the one returning the lowest values for the coefficients of interest.

[14]This result is in line with the estimates of Griffith and Harisson (2004) regarding the impact of liberalization reforms on markups. It is also worth noting that, as detailed in several recent contributions for Europe (Gutiérrez and Philippon (2019), McAdam et al. (2019)) and Italy (Ciapanna et al. (2021)), markups in the EU and in Italy are lower in level than their US counterpart, showing, on average, a flat/decreasing evolution over time.

Regarding TFP dynamics, within the considered years, we can observe a decreasing pattern for the regulated service sectors on average (Figure 5). This is a common feature in the Italian economy as a whole, reflecting several context factors. Nevertheless, reforms as those treated in this work have helped to contain the drop in productivity, as we will illustrate in the econometric analysis.[15] To measure the impact of reforms on TFP in the service sector, we follow a similar approach. We compute TFP as the Solow residual, i.e., the difference between the logarithm of value added in real terms and the logarithms of the factors of production (labor and capital), weighted by the respective share in value added. In the regressions, TFP is normalized with respect to the so-called "production frontier": the value observed in each country-sector-year is divided by the corresponding value measured in the country with the highest average productivity in the period considered (in our sample, Denmark, which was therefore excluded from the estimation). We estimate the elasticity of TFP with respect to regulation using (the logarithm of) TFP as a dependent variable, similarly to equation (2):

$$TFP_{ijt} = \beta_2 Reg_{ijt} + \phi_i + \phi_j + \phi_t + \epsilon_{ijt} \tag{4}$$

where TFP_{ijt} is the log of TFP in country i, sector j at time t, the ϕ variables capture fixed effects of country, sector and year, respectively. As in the markup case, we also consider the version with interacted fixed effects.

The aggregate impact for Italy is then calculated using an expression similar to equation (3):

$$\Delta TFP_{ITAjt} = \beta_2 \sum_j (\omega_{ITAjt} \Delta Reg_{ITAjt}) \tag{5}$$

The results indicate that a reduction of one point in the regulatory indicator is associated with an increase in TFP of around 9% (Table 2, fifth column). In this case, the coefficient remains fairly unchanged when we consider the baseline model and the two models with interacted fixed effects, ranging between 9% and 11%.[16] As a result, at the aggregate level the reforms imply a permanent increase in the service sector TFP of 3.51%.[17]

[15] For a more extensive discussion of productivity dynamics in the service sector, see Bugamelli et al. (2018)

[16] As above, we choose the country-year and sector-year fixed effects model, which provides the lowest coefficient following a prudential criterion.

[17] It is worth noting that these parameters are obtained through cross-country data and are not

3.2 Effects of the incentives to innovation

To provide a quantitative assessment of the effects of incentives we use data sourced from the Survey on Industrial and Service Firms (INVIND), yearly conducted by the Bank of Italy, which includes firms with more than 20 employees, as well as balance sheet data from Cerved Group.

We build, from balance sheets data, a measure of TFP and we merge this information with data from INVIND where we observe whether the firm used the incentives for innovation or not. TFP is computed using the Levinsohn and Petrin (2003) estimator with the Ackerberg et al. (2015) correction. We measure firm's output with the value added and we include in the production function the capital stock, the number of employees and the intermediate inputs (which are also referred as materials). We estimate the production function within narrowly defined sectors to account for possible heterogeneity in the use of capital and labor.

INVIND data, in turn, contains detailed data on the use of the incentives. The first year to use the incentive was 2016. About 70% of the 4,200 firms in the sample declared to have used at least one of the available incentive schemes (so-called "new Sabatini", tax credit on R&D, super-amortization and hyper-amortization). Moreover, the same firm can use incentives in more years and, indeed, we find that this occurs in the vast majority of the cases.[18] Finally, among the companies that have benefited from the incentives, about one out of four considers them fundamental for their investment decisions (considering both the extensive and the intensive margins).

The propensity to use these incentives was highly heterogeneous across firms: this share was below 60% for smaller firms (below 50 employees) and nearly 80% for larger ones. Beyond size, the firms using incentives (treated firms) were also more productive, more likely to be in the manufacturing sector and less likely to be located in the South of Italy with respect to other firms (control firms).

The aim of the empirical analysis is to estimate the impact on TFP of the

Italy-specific. This choice has been dictated by the fact that we have only a very limited number of observations per country and, therefore, country-specific regression would lead to less reliable estimates. However, in unreported evidence, we find that the main findings are qualitatively confirmed when we replicate the regression using only observations for Italy.

[18] About 90 per cent of the firms using incentives in year t is also using incentives the year after. Moreover, we do not observe any drop in the investments. Therefore it is seems that the incentives promoted an accumulation of capital over time, rather than anticipation or substitution effects.

incentives to invest in innovation, due to improvements in production processes and, in general, efficiency gains in the use of inputs. By employing a difference-in-difference (DID) approach, we exploit the temporal variation of TFP before and after the introduction of the incentive itself and the cross-sectional variation between the group of firms declaring the use of incentives (treated firms) and the other firms (control firms). Our temporal window includes years from 2010 to 2018. The empirical specification is the following:

$$TFP_{it} = \gamma I_{it} + \alpha_i + \alpha_t + \epsilon_{ijt} \tag{6}$$

where TFP_{it} is the TFP of firm i in year t; I_{it} is an indicator equal to 1 if the firms used the incentive to innovate and 0 otherwise; the α terms capture structural differences in the TFP across firms and common shocks, respectively. The parameter of interest is γ, which provides the effect of the incentive on TFP. Standard errors are clustered at the firm level.

The credibility of this strategy crucially relies on the assumption that, in the absence of the incentives, the TFP for the treated and the control firms would have followed parallel paths over time. This assumption may be implausible if the two groups are structurally different (and therefore likely exposed to different macro shocks). To account for this concern, we adopt a combination of matching with DID, as proposed in Heckman et al. (1997), thus pairing each treated firm with "similar" control firms. Specifically, we adopt the kernel matching, thus giving larger weight to controls with closer "propensity score" (i.e., treatment probability conditional on the observables). The control variables include sector of activity (NACE sections), geographical area (NUTS2), firm's size (in terms of employees), TFP and its average growth rate (with the latter three variables observed in the first half of the decade, i.e., before the treatment).[19]

Moving to the regression results, according to our preferred specification (i.e., the one with the PSM sample) the effect of the incentives on TFP is 0.06 (table 3, column II). [20] This figure, multiplied by the fraction of firms that considers the incentives fundamental for their investment decisions implies an effect on TFP of 1.4%. The impact is heterogeneous between firms of different size, being larger for

[19]Sector controls, in particular, are important to disentangle the firm-specific effects of incentives from sector-wide effects due to other industry-specific reforms, such as liberalizations.

[20]A similar impact has been found in Griffith et al. (2006). See also Hall (2011) for a review of the literature on the relationship between innovation and productivity.

small firms (table 3, columns III and IV); however, the implied effect is homogeneous between the two groups of firms because the incentives were more widely used by larger firms.

The results discussed so far provides no sense of the dynamic effect of the incentives on firms' productivity. Moreover, one might wonder whether there are anticipation effects that might cast doubts on the validity of the parallel trend assumption. To explore these issues, we augment the model with leads and lags of the explanatory variable in the spirit of Autor (2003). Specifically, we include dummies that capture the difference in the TFP of firm between treated and control firms for different years, before and after the introduction of the incentives (with the year 2015, the last year before the treatment, taken as reference category). As shown in (Figure 6), the coefficients on the lags are not significantly different from zero, suggesting the absence of any anticipation effect and of divergent patterns between the two groups before the treatment. Hence, the parallel trend assumption is empirically satisfied.[21]

3.3 Effects of the civil justice reforms

The variables used to measure the functioning of the civil justice system is the length of proceedings. Since data on the actual duration of civil proceedings are not available, we use case-flow data to construct an index that proxies the average length of proceedings (in days) which is calculated as follows:

$$Length_{c,t} = 365 * \frac{P_{c,t-1} + P_{c,t}}{I_{c,t} + R_{c,t}} \tag{7}$$

where P, I and R are, respectively pending, incoming and resolved cases in court c at time t. This index provides an estimate of the average lifetime of proceedings in a court.

Simple descriptive evidence suggests that, in the current decade, the civil justice system has improved. The total number of pending proceedings before the trial courts fell by 27% between 2010 and 2018 (Figure 7A). In the same temporal window, the estimated length of civil cases (ordinary and commercial disputes) decreased from 15 to 13 months (Figure 7B).

[21] Although largely reassuring, we cannot exclude that unobservable shocks might have affected both the adoption of incentives and the dynamics of TFP.

The length of proceedings and its variation over time, however, were quite heterogeneous across courts. At the beginning of the period, the interquartile range over the median was above 58%. Moreover, there was a clear territorial divide, with the courts in the South of Italy recording significantly higher length of proceedings. The variation over time was also heterogeneous – 37% of the courts recorded a decrease above 20% over the entire temporal window while 21% recorded an increase – although in this case we do not detect peculiar geographical patterns, suggesting that policy interventions were orthogonal with respect to the location of the courts over the territory (Figure 8).[22]

Concerning the effect of the reforms, simple descriptive evidence shows that firms located in the courts experiencing a larger decrease in civil proceedings have been characterized, on average, by a better performance in terms of TFP (Figure 9). The aim of the empirical strategy is to confirm the visual evidence in a regression setting and, more importantly, to get the elasticity of TFP with respect to the length of civil proceedings. First, we compute the TFP using data from Cerved group. As in the previous section, TFP is computed using the Levinsohn and Petrin (2003) estimator, using the value added as measure of firm's output and the capital stock and the number of employees as main production inputs.

Second, we use an aggregate indicator as weighted average (by size) across firms. The geographical unit of analysis is a partition of the territory in areas corresponding to cluster of municipalities referring to the trial courts. The period of observation is the current decade (with 2017 being the last available year in which TFP is estimated). Formally:

$$TFP_{ct} = \delta length_{ct} + \rho_c + \rho_t + \epsilon_{ct} \tag{8}$$

where TFP_{ct} is the log of TFP in the area referring to court c, at time t; $length_{ct}$ is the estimated length of civil cases in the same area and year; and ρ_c and ρ_t capture structural differences in the TFP across areas and common shocks, respectively. The parameter of interest is δ, which represents the elasticity of the TFP with

[22] Although the policy interventions were nationwide, there might have been a bunch of court-specific factors leading to heterogeneous effects at the local level. For example, the entrusting to administrative bodies of some procedural steps in the disputes involving social security reduced the backlog, with positive effects on court productivity and lengths of proceedings. Such effect was presumably stronger in the courts characterized by a larger number of social security proceedings. Other reforms, such as the the geographic organization of the judicial system, produced heterogeneous effects across courts by construction.

respect to the length of civil cases. Standard errors are clustered at the court level.

Before showing the results, we must stress the fact that they might be plagued by reverse causation and omitted variable bias. Concerning reverse causality, one might argue that the economic conditions at the local level might affect the court activity. This might occur, for example, if level of economic activity affects the litigation rate (i.e., the demand of justice) which, in turn, affects the courts' workload. However, in our data we do not find any significant relationship between the dynamics of the TFP at the local level and the litigation rate, after controlling for court and year fixed effects.[23] More generally, to address potential endogeneity concerns, we examine whether the courts exposed to larger decrease in the length of civil proceedings in the temporal window considered are systematically different from the others in terms of observable characteristics. As shown in Table 4, there are no significant differences – both from a quantitative and a statistical point of view – between the main economic characteristics of the courts (as observed at the beginning of the period) and the exposure to the justice reforms (measured with the variation of the length of civil proceedings). Although these results cannot be interpreted as a test on the exogeneity assumptions, they suggest (quite reassuringly) that the exposure to the reforms is orthogonal with respect to the main observable characteristics that might be correlated with TFP dynamics ate the local level.

Table 5 shows the main results. In the odd columns, we use the TFP and the length of the proceedings in the same year while in the even columns we consider a 2-year moving average, to capture some lagged effects of the length of proceedings on the TFP. In the first two columns, we use the average TFP of the firms located in each court-year while in the latter two columns the average TFP is obtained after controlling for sector-year fixed effects, to account for sector-specific shocks. According to our results, the elasticity is around 0.03 and is fairly stable across specifications. According to these results, the 15% decrease in the length of proceedings (i.e. that observed in our sample period) has lead to an increase in TFP by around 0.45%.

[23] Results are available upon request.

3.4 Summary of the estimates

Table 6 summarizes the estimation results. For each reform episode, it reports the corresponding estimated long-run effect on TFP and markups, along with the year in which the reform was introduced and the timing, i.e., the speed of implementation. The service liberalization reforms induce positive effects both on service sector productivity and on the degree of competition. Estimates indicate a permanent increase in the service sector TFP of 3.51% and a permanent reduction in the services sector markup of 1.1 pp. Incentives to innovation lead to a permanent efficiency gain of 1.37%. Finally, civil justice system reforms would lead to a permanent increase in TFP of 0.45%.

The final column of Table 6 reports the speed of implementation of each reform. The assumption about the length of each reform episode will play a role in the simulations illustrated in the next section. For the service liberalization, we assume that the implementation takes 7 years to fully materialize, broadly in line with what assumed in Annicchiarico et al. (2013), Lusinyan and Muir (2013) and MEF (2016). Concerning incentives to innovation, we assume a 4-year length, consistent with the official announcements about its implementation. Finally, about the civil justice reforms, we assume a 3-year horizon as an average over several reform interventions. As clarified in the following section, our assumptions about the implementation speed of the reforms only affect the short-to-medium term dynamics, but have no impact on the long-run effects, including those on potential output.

4 The macroeconomic effects of the reforms

In this section we illustrate our model-based analysis of the macroeconomic effects of the reforms. The micro-econometric estimates of the impacts on markup and (sector-specific or aggregate) TFP are used as exogenous shocks to quantify, through the simulation of a structural model, the corresponding macroeconomic effects. In the following, we first provide a short description of the model and its main transmission mechanisms, and subsequently describe the simulated scenarios.

4.1 Overview of the model

We simulate a multi-country two-sector dynamic general equilibrium model. The world economy is composed of three blocs. Two blocs, Home (calibrated to

Italy) and rest of the EA (REA), are members of the EA, modeled as a monetary union. The two countries have a common nominal exchange rate and a common monetary policy rate. The third bloc, representing the rest of the world (RW), has its own monetary policy rate and nominal exchange rate. The model is New Keynesian and features nominal price rigidities, capital accumulation, and international trade in goods and bonds.[24]

Importantly for our analysis, the model includes two key building blocks that allow us to evaluate the effects of the reforms on the productive structure of the Italian economy.

First, the model includes final consumer and investment goods and intermediate goods. The latter are produced in two sectors, manufacturing and services, using capital and labor, with exogenous TFP. There are many varieties of intermediate goods all of which are imperfect substitutes. Each variety is produced by a single firm operating under monopolistic competition and setting nominal prices as a markup over marginal costs. The markup can therefore be interpreted as an indicator of the degree of market power in each intermediate sector. As shown in the following, reforms aiming at increasing the degree of competition in one sector are modelled as affecting the corresponding markup.

Second, there are search and matching frictions in the labor market, which allow for a characterization of the dynamics of hours worked per employee (intensive margin) and the number of employees (extensive margin). The presence of real rigidities in the labor market creates a wedge between the real wage and marginal labor productivity. A complete characterization of labor market dynamics is essential for evaluating the effects of the reforms on the productive capacity of the economy.

Moreover, the New Keynesian structure of the model, based on nominal price rigidities, allows for a proper distinction between demand and supply effects of the different shocks (i.e., reforms) and, in line with the literature, for the measurement of potential output using a model-consistent definition of "natural" output.[25] The latter is the level of output that is obtained by simulating the model under the assumptions that prices are fully flexible and (net) markups are greater than zero. Remaining model features are summarized in the Model Appendix. The model

[24]The model largely draws on Burlon et al. (2021). See the Online Model Appendix for a detailed description.

[25]See, among the others, Justiniano et al. (2013)

is calibrated at quarterly frequency. We calibrate the three blocs to Italy (Home country), REA, and RW. We set some parameters to match the great ratios and the trade matrix. The remaining parameters are in line with previous studies and estimates available in the literature.[26]

4.2 The transmission mechanism of the reforms

The reforms considered imply an exogenous change in TFP (either sector-specific or aggregate), services markup, or both. The supply of each Home intermediate nontradable good n is denoted by $N_t^S(n)$

$$N_t^S(n) = TFP_{N,t}\left((1-\alpha_N)^{\frac{1}{\zeta_N}} L_{N,t}(n)^{\frac{\zeta_N-1}{\zeta_N}} + (\alpha_N)^{\frac{1}{\zeta_N}} K_{N,t}(n)^{\frac{\zeta_N-1}{\zeta_N}}\right)^{\frac{\zeta_N}{\zeta_N-1}} \tag{9}$$

Firm n uses labor $L_{N,t}(n)$ and capital $K_{N,t}(n)$ with constant elasticity of input substitution $\zeta_N > 0$ and capital weight $0 < \alpha_N < 1$, for a given exogenous total factor productivity $TFP_{N,t}$. Firms producing intermediate goods take the prices of labor inputs and capital as given. Denoting W_t the nominal wage index and $R_{K,t}$ the nominal rental price of capital, the nominal marginal cost $MC_{N,t}(n)$ can be expressed as:

$$MC_{N,t}(n) = \frac{1}{TFP_{N,t}}\left((1-\alpha_N) W_t^{1-\zeta_N} + \alpha_N R_{K,t}^{1-\zeta_N}\right)^{\frac{1}{1-\zeta_N}} \tag{10}$$

The elasticity of substitution between services of different firms, θ_N, determines the market power of each firm. In the long-run flexible-price (symmetric) steady state, firms set prices according to the first-order condition

$$\frac{P_N}{P} = \frac{\theta_N}{\theta_N - 1}\frac{MC_N}{P} \tag{11}$$

where $\frac{P_N}{P}$ is the relative price of the generic service and $\frac{MC_N}{P}$ is the real marginal cost. The gross mark-up is $\frac{\theta_N}{\theta_N-1}$ and depends negatively on the elasticity of substitution between different services, $\theta_N > 1$. The higher the degree of substitutability, the lower the implied mark-up and the higher the production level for a given price. Thus, the long-run mark-up reflects imperfect competition. In the

[26] Details on the calibration are reported in the working paper version. See Ciapanna et al. (2020).

short-run, sector-specific nominal rigidities (adjustment costs on nominal prices) determine deviations of the markup from its long-run level.

In the simulations, we gradually and permanently increase: (i) the elasticity of substitution among Home intermediate nontradable goods (our proxy for services), θ_N, to augment the degree of competition in that sector, and/or (ii) sectoral (or aggregate) TFP, according to our micro-econometric estimates. Reforms that permanently reduce market power and/or increase TFP have two main effects on the macroeconomy. First, the enhanced productive capacity (reflecting higher TFP and less market power) stimulates capital accumulation and makes both capital and labor more productive, thus increasing permanent income. The corresponding positive wealth effect favors a permanent increase in aggregate demand. Second, reforms also favor an increase in aggregate supply. Hence, and importantly for the purpose of our analysis, potential output increases. However, while the long-run positive effect on output is uncontroversial, some mildly negative effect may be observed in the short run, due to intertemporal substitution. As households anticipate that services will be cheaper in the future, when their supply will be larger, they therefore have an incentive to postpone consumption, given its large services content. The corresponding short-term effect on inflation may thus be negative, if the increase in supply is sufficiently large to offset the increase in aggregate demand. However, a sufficiently large increase in expected future aggregate demand may induce an increase in the stream of future marginal costs, by favoring a rise in firms' demand of capital and labor, which may exceed the increase in the corresponding supplies, thus implying a positive effect on short-run inflation.[27] On the open-economy dimension, the excess supply of services induces a real exchange rate depreciation, which in the medium term favors an increase in exports.

4.3 Simulated scenarios

Each of the three reforms is treated as a separate exogenous shock. Specifically, the model is fed with information on (i) the estimated impact of the reform on the synthetic indicator considered (markup, TFP) and (ii) the timing of imple-

[27] Eggertsson et al. (2014) show that product and labor market reforms implemented at the effective lower bound may be contractionary as they induce a fall in inflation and, therefore, a rise in the real interest rate. Gerali et al. (2014) show that, when the short-term rate is at its effective lower bound, the response of investment is key in determining the sign and size of the response of inflation to liberalization reforms in the service sector.

mentation of the reform itself. All reforms are assumed to be perfectly credible at the time of the announcement and implemented without delays with respect to the announced path. Families and firms thus perfectly know the evolution of the variables directly affected by the reform and make their own consumption and investment decisions taking into account this information (perfect foresight hypothesis).

While the long-run effects of the reforms obtained by simulating the model are unaffected by assumptions concerning the implementation speed, the short-to-medium term adjustment of the main macroeconomic variables reflects, among other things, the length of the reform process. For the services liberalization, we simulate a gradual, permanent increase in the services TFP of 4.54% over a seven-year horizon and, contemporaneously, a gradual permanent reduction of 1.02 pp in the services sector markup over the same time window. For incentives to innovation, we impose a permanent increase in TFP of 1.4% in both sectors (services and manufacturing), taking place in a gradual way over a four-year horizon. Finally, for civil justice reforms, we simulate a permanent increase in TFP (in both sectors) of 0.5% over three years.

Finally, it is worth noting that each reform episode is treated separately, as an orthogonal shock to the other two. In this way, we can isolate the contribution of each reform and highlight the corresponding transmission channels. A few comments are in order. From an empirical perspective, in our micro-econometric estimation we use a number of control variables in each regression to ensure that the estimated effects of each reform are not influenced by, and in turn do not have spillovers on, the others reforms that we consider. Thus, the estimated effects that we use as shocks to feed the model-based simulations are as close as possible to be orthogonal in the data. This notwithstanding, we acknowledge that interactions and synergies may arise among different reforms implemented over the same period. For example, while liberalization in the service sector might already have started generating its expansionary effects on production, the introduction of incentives to innovation and investment may further amplify such expansionary effects. However, in the interest of clarity and in order to make the interpretation of our results more transparent, we do not consider such interactions here. We leave this issue for future research.[28]

[28]See e.g. Gerali et al. (2016) for an analysis of the effects of simultaneously implementing fiscal consolidation and competition-friendly reforms.

5 Results

This section illustrates the results of our model-based simulations, where the micro-econometric estimates are taken as input. We also report the results of a sensitivity analysis. Finally, we compare our findings to those provided by the main international institutions, obtained using different methodologies and focusing at times on different subsets of reforms over possibly different time horizons.

5.1 Model-based simulation results

Figure 10 reports the effects of the reforms on the main macroeconomic variables. All reforms support GDP and have mild deflationary effects in the short run, reflecting the supply-side expansion induced by the increase in TFP and the reduction in market power in the service sector.

The decrease in the service sector markup implied by the liberalization takes seven years to fully materialize. As households and firms anticipate a future larger supply of services, two effects occur. First, households postpone consumption, given its large services content, to the future, when it will be cheaper. As a result, the liberalization *per se* would provide a mildly negative contribution to consumption dynamics in the first four years since its inception. Second, firms slowly start to increase investment, to build up a larger stock of capital for future production. Hence, the service sector liberalization starts contributing to the increase in GDP in the third year, while it mildly lowers inflation, reflecting the excess supply induced by the reduction in the markup. The overall contribution of the sole markup reduction is, however, relatively small, as is the estimated size of the increase in the degree of competition in the services sector. The service sector liberalization also brings about an estimated increase in services TFP of 3.51%, over the same seven-year horizon. Since services TFP is anticipated to increase to a large amount in the future, firms initially postpone investment to the next periods, when capital (and labor) will be more productive. From the third year onward, the liberalization-induced increase in TFP starts to sustain investment, contributing to capital accumulation. The increase in TFP also implies a fall in prices, as a consequence of an expected large increase in the productive capacity of the economy. Imports initially show a mild decrease, reflecting the dynamics of investment, which has a large import content. Subsequently, both the

decrease in markup and the increase in TFP sustain import dynamics. Exports start increasing quite rapidly.

Incentives to innovation and civil justice reforms are both estimated to increase overall TFP. The dynamics of GDP and its components are qualitatively similar to the case of an increase in the service sector TFP. The only exception is in the response of investment, which always increases, reflecting the shorter implementation phase of the two reforms (three and four years, respectively), compared to the liberalization case. Since the increase in TFP is smaller in size and takes a few years to fully materialize, the substitution effect is smaller and investment starts to increase immediately. In all cases, reforms imply in the medium-to-long run an increase in GDP (of almost 6%) and all its components.

Figure 11 reports the effects on the main labor market variables. Two main results stand out. First, increases in TFP always imply an initial decrease in hours worked and a corresponding increase in the unemployment rate. The fall in hours worked is a typical result of the presence of sticky prices.[29] Since prices cannot completely adjust, aggregate demand does not increase enough to meet the expansion in supply, and firms require less labor input to produce the same level of output. Moreover, given the presence of real rigidities in the labor market, unemployment increases in the first years after the introduction of reforms that imply a higher TFP. Real wages initially remain barely constant, reflecting the responses of both labor and prices. Once prices adjust and the effects of the reforms begin to materialize, firms start to increase labor demand. As a result, there is a positive effect on the intensive margin. Hours worked increase in the long run, mainly reflecting the expansionary effect of increased competition in the services sector. Moreover, all reforms imply an upward adjustment on the extensive margin too: total employment increases by around 0.5% and the unemployment rate correspondingly falls, by almost 0.4 pp.

Finally, Figure 12 illustrates the overall effects on potential output. We measure potential output using the model-consistent definition of "natural" output, i.e. the level of output that is obtained by simulating the model under the assumptions that prices are fully flexible and (net) markups are greater than zero. The figure reports both the actual level of GDP (solid black line) and the level of potential output, in response to the three reforms considered. Clearly, the two measures

[29]See Gali (1999) for a seminal contribution on the negative effects of technology shocks on hours worked in New Keynesian models with nominal price rigidities.

tend to coincide in the long run. In order to take into account uncertainty around the point estimates obtained in the previous Section, we build two scenarios. The lower bound scenario is obtained by considering the 33th percentile of all the estimates, while the upper bound corresponds to the 66th percentile. We then simulate the two scenarios in the same way as described above. Specifically, we maintain the same assumptions about the timing and implementation horizon of each reform. Hence, the only differences compared to the central scenario (i.e. the simulations described above) are in the size of the estimated increases in service-specific TFP, services markup and overall TFP, respectively. The corresponding effects on GDP and potential output are reported in Figure 12 (dashed lines). The overall estimated impact on potential output lies in between 3.5% and 8%.

5.2 Sensitivity analysis

In the following, we discuss the role of specific assumptions and parameters calibration in determining the main results. We first explore the labor market setup and the specific role of assumptions concerning wage setting. Next, we study in detail the role of the trade channel by altering the values of (i) the elasticity of substitution between domestic and imported goods and (ii) the elasticity of substitution between tradable and nontradable goods (i.e., services).

5.2.1 The role of wage rigidities

The responses of labor market variables to the shocks characterizing the different reform episodes reflect the main features of the search–and–matching labor market structure assumption. As it is well known in the literature since the seminal contribution by Shimer (2005), such setup cannot generate sufficiently large business–cycle fluctuations in (un)employment and vacancies in response to shocks of a plausible magnitude. As suggested by Hall (2005), adding wage rigidity helps an otherwise a search–and–matching model generate sufficiently volatile responses in labor market variables in response to exogenous shocks at business–cycle frequency.

In this section, we introduce wage rigidities in our framework and study how the behavior of labor market and macroeconomic variables changes in response to the shocks that characterize the reforms. We introduce wage rigidity à la Hall

(2005) in a parsimonious way.[30] Specifically, we assume that households and the labour firm bargain over the real wage, but wages only adjust by a fraction, so that the real wage is a weighted average of the steady-state wage and the fully flexible wage that would result from Nash bargaining in our baseline setup. Formally:

$$w_t = \theta_w w_{Nash,t} + (1 - \theta_w)\, \bar{w}, \tag{12}$$

where w_t is the real wage, $0 < \theta_w < 1$ is the weight of the Nash-bargained wage, $w_{Nash,t}$, while $\bar{w}$ is the steady-state wage. The case of flexible wages corresponds to $\theta_w = 1$.

Figure 13 reports the overall effects of the reforms on labor market variables, in three cases: (i) the baseline model without wage rigidity; (ii) the model with real wage rigidity as in equation (12), with the real wage being kept constant at its steady-state value (full wage rigidity, corresponding to $\theta_w = 0$) ; (iii) an intermediate wage rigidity case, corresponding to $\theta_w = 0.5$. When the real wage is kept constant at its steady–state level (blue lines with circles), the corresponding adjustment of quantities, i.e. per–capita hours worked, unemployment and total employment, is amplified. In particular, the effect on hours worked becomes negative, while the increase in employment is magnified. The response of unemployment is one order of magnitude larger compared to the case of flexible wages. By the same token, an intermediate degree of real wage adjustment (red-dashed lines), alos implies an amplification in the response of hours worked, unemployment and total employment, although the effects are quantitatively less pronounced. Figure 14 reports the corresponding effects on the main macroeconomic variables. The more rigid are wages, the stronger is the negative effect on inflation, via marginal costs. The corresponding expansionary effects on output and its components are magnified. The overall long–run GDP increase moves from almost 6% in the baseline case to around 7% in the intermediate case ($\theta_w = 0.5$) and about 8% in the extreme case of no real wage adjustment ($\theta_w = 0$).

5.2.2 The role of trade elasticity and tradable–services elasticity

All the considered reforms, both those that directly hit the services sector and those affecting aggregate TFP, alter the supply-side of the economy and determine endogenous adjustments in quantities and prices. Two parameters are particularly

[30] A similar approach is followed in Burlon et al. (2021) and Jacquinot et al. (2020).

important for the transmission of markup and TFP shocks: (i) the elasticity of substitution between domestic and imported tradable goods; and (ii) the elasticity of substitution between tradable and nontradable goods (i.e., services). The first parameter affects the response of exports and imports: as the excess supply of services induced by the reform favors a real exchange rate depreciation, exports and imports tend to increase and decrease in the short term, respectively. The size of the response depends on how easy it is to substitute domestic with foreign goods. Moreover, the macroeconomic effects of an expansion in the services supply also depend on the substitutability between tradable and nontradable goods.

We first double the elasticity of substitution between domestic and imported tradable goods (from 1.5 in the benchmark calibration, to 3). Figure 15 reports the corresponding results. The overall effect of the reforms does not largely change compared to the one observed in the benchmark case (blue lines with circles and black solid lines, respectively). The main difference is in the responses of imports, which initially fall by less and subsequently increase by more than in the benchmark case. Since it is easier to substitute domestic with foreign goods, the increase in consumption connected with the positive wealth effect of the reforms can now be more easily accommodated via higher imports. The response of investment also reflects the higher substitution between domestic and imported goods. The effects on labor market variables do not largely change with respect to the benchmark case, as reported in Figure 16.

Next, we double the elasticity of substitution between tradable goods and services (from 0.5 in the benchmark calibration, to 1.1). Figure 15 reports the results (red-dashed lines) on the main macro variables. The overall expansionary effects of the reforms are reduced compared to the benchmark case. The sectoral reform in the services sector expands the supply of the latter, but a higher substitutability (or, equivalently, a lower complementarity) between tradable goods and services implies a more muted expansion in the demand for tradables, which in turn implies a lower increase in capital and labor. The overall expansion in aggregate demand is therefore reduced. Inflation correspondingly falls by less than in the benchmark scenario. The corresponding expansionary effects on hours worked, employment and unemployment are also more muted (see Figure 16).

5.3 A comparison with existing estimates

Our model-based results, obtained using the novel three-step approach that we propose, are in line with estimates provided by other studies. A systematic comparison is made difficult by differences in methodologies, in the type of reform considered and the time periods, which vary significantly across studies. OECD (2015) provides reduced-form estimates of the macroeconomic effects of the public administration (PA) and judicial system reforms. The estimated long-run effect on GDP is 0.9 pp, which is broadly comparable to our estimated impact of the sole judicial system reform on potential output (0.7 pp). The corresponding impact on productivity (TFP) estimated by the OECD is 0.8, about twice as large as our estimate (0.5), which possibly reflects the gains in productivity due to the PA reform. Similar estimates are reported by the Italian Ministry of Economy and Finance (see MEF (2016)). Concerning services liberalization, Lusinyan and Muir (2013) consider liberalizations taking place in Italy in 2008-2012 and assume that the reforms close roughly a half of the existing gap with respect to the rest of the euro area over a five-year period. The corresponding assumed reduction in the services markup amounts to 13 pp (1.1 pp in our case). The overall long-run effect on GDP is 6.9%. In order to facilitate the comparison, we calculated the corresponding standardized effect of a 1pp reduction in the service sector markup on potential (long-run) output. In Lusinyan and Muir (2013) it amounts to 0.5, while in our case it is 0.4. Hence, the estimated impact, for a given shock to the markup, is broadly in line with their estimates. MEF (2016) also reports estimates for the goods and services liberalization reforms occurring in 2012-2015. The estimated standardized impact of a 1pp markup reduction is quite larger than ours (1.2 vs 0.4), possibly reflecting a different transmission across the two sectors. The overall estimated impact of reforms in the 2012-2015 is 8.2%, close to the upper bound of our estimates. All in all, our estimates are in line with those provided by other existing analyses, once differences in time, scope and methods of analyses are accounted for.

6 Conclusions

In this paper we have provided micro- and macroeconomic evidence on the effects of three structural reforms episodes occurred in Italy in the past decade.

We have used a novel approach that estimates the impact of each reform on TFP and markups in an empirical micro setting and uses these estimates in a dynamic general equilibrium model to simulate the macroeconomic effects of the reforms. According to our micro-econometric estimates, liberalization in the service sector, incentives to innovation, and civil justice reforms would imply a sizeable increase in TFP (both service-specific and aggregate) and a reduction in services markup. Our structural model–based analysis, based on such estimates, suggests that the corresponding macroeconomic effects would be sizable. The increase in the level of GDP observed as of 2019 because of the sole effect of the considered reforms (and therefore ignoring all the other shocks that hit the Italian economy in the same period) would be in between 2.5% and 6%. A further increase of about 2 percentage points would be reached in the current decade, due to the unfolding of the effects of all the reforms considered here. Employment would increase in the long term by around 0.5%, while the unemployment rate would be reduced by about 0.4 pp. Taking into account the uncertainty surrounding our micro-econometric estimates, the overall increase in potential output in the long run would lie in between 3.5% and 8%.

It is worth stressing that our analysis focuses on Italian GDP and potential output of (a subset of) structural reforms implemented in the past decade, and it deliberately excludes all other factors (i.e., exogenous shocks) that contemporaneously hit the Italian economy in the same period. Our results also suggest that in the absence of the reforms the patterns of TFP and GDP growth would have been even weaker.

Our analysis can be extended along several dimensions. Other major reform episodes could be analyzed, provided that sufficient data are available to estimate their quantitative impact on some relevant indicator. The interaction with monetary policy, in particular the presence of an effective lower bound and the implementation of unconventional measures, could be studied. More generally, allowing for a more sophisticated model setup could enrich the transmission mechanisms at play. For instance, allowing for firms' entry (along the lines of Cacciatore and Fiori (2016) and Cacciatore et al. (2016b)) would provide additional insights in terms of firms dynamics and sectoral reallocation. We leave these issues for future research.

References

Accetturo, A., Linarello, A., and Petrella, A. (2017). Legal Enforcement and Global Value Chains: Micro-Evidence from Italian Manufacturing Firms. Questioni di Economia e Finanza (Occasional Papers) 397, Bank of Italy.

Ackerberg, D. A., Caves, K., and Frazer, G. (2015). Identification Properties of Recent Production Function Estimators. *Econometrica*, 83(6):2411–2451.

Andrews, D., Criscuolo, C., and Gal, P. (2015). Frontier Firms, Technology Diffusion and Public Policy: Micro Evidence from OECD Countries. OECD Productivity Working Papers 2, OECD.

Annicchiarico, B., Di Dio, F., and Felici, F. (2013). Structural Reforms and the Potential Effects on the Italian Economy. *Journal of Policy Modeling*, 35(1):88–109.

Autor, D. (2003). Outsourcing at Will: The Contribution of Unjust Dismissal Doctrine to the Growth of Employment Outsourcing. *Journal of Labor Economics*, 21(1):1–42.

Bamieh, O., Coviello, D., Ichino, A., and Persico, N. (2021). Effect of Firing Frictions on Turnover. Technical report, working paper.

Barone, G. and Cingano, F. (2011). Service Regulation and Growth: Evidence from OECD Countries. *Economic Journal*, 121(555):931–957.

Bayoumi, T., Faruqee, H., Laxton, D., Karam, P. D., Rebucci, A., Lee, J., Hunt, B. L., and Tchakarov, I. (2004). GEM; A New International Macroeconomic Model. IMF Occasional Papers 239, IMF.

Boone, J. (2000). Competition. CEPR Discussion Papers 2636, CEPR.

Bourlès, R., Cette, G., Lopez, J., Mairesse, J., and Nicoletti, G. (2013). Do Product Market Regulations in Upstream Sectors Curb Productivity Growth? Panel Data Evidence from OECD Countries. *Review of Economics and Statistics*, 95(5):1750–1768.

Bugamelli, M., Lotti, F., Amici, M., Ciapanna, E., Colonna, F., D'Amuri, F., Giacomelli, S., Linarello, A., Manaresi, F., Palumbo, G., Scoccianti, F., and Sette, E. (2018). Productivity Growth in Italy: A Tale of a Slow-Motion Change. Temi di Discussione (Working Papers) 422, Bank of Italy.

Burlon, L., Notarpietro, A., and Pisani, M. (2021). Fiscal devaluation and labor market frictions in a monetary union. *Economic Modelling*, 97(C):135–156.

Cacciatore, M., Duval, R., Fiori, G., and Ghironi, F. (2016a). Short-Term Pain for Long-Term Gain: Market Deregulation and Monetary Policy in Small Open Economies. *Journal of International Money and Finance*, 68(C):358–385.

Cacciatore, M. and Fiori, G. (2016). The Macroeconomic Effects of Goods and Labor Marlet Deregulation. *Review of Economic Dynamics*, 20:1–24.

Cacciatore, M., Fiori, G., and Ghironi, F. (2016b). Market Deregulation and Optimal Monetary Policy in a Monetary Union. *Journal of International Economics*, 99(C):120–137.

Chemin, M. (2020). Judicial Efficiency and Firm Productivity: Evidence from a World Database of Judicial Reforms. *Review of Economics and Statistics*, 102(1):49–64.

Ciapanna, E., Formai, S., Linarello, A., and Rovigatti, G. (2021). Measuring Market Power: Macro and Micro Evidence from Italy. Temi di Discussione (Working Papers) forthcoming, Bank of Italy.

Ciapanna, E., Mocetti, S., and Notarpietro, A. (2020). The Effects of Structural Reforms: Evidence from Italy. Temi di Discussione (Working Papers) 1303, Bank of Italy.

Conway, P. and Nicoletti, G. (2006). Product Market Regulation in the Non-Manufacturing Sectors of OECD Countries: Measurement and Highlights. OECD Economics Department Working Papers 530, OECD Publishing.

De Loecker, J., Eeckhout, J., and Unger, G. (2020). The Rise of Market Power and the Macroeconomic Implications. *Quarterly Journal of Economics*.

Eggertsson, G., Ferrero, A., and Raffo, A. (2014). Can Structural Reforms Help Europe? *Journal of Monetary Economics*, 61(C):2–22.

Everaert, L. and Schule, W. (2008). Why It Pays to Synchronize Structural Reforms in the Euro Area Across Markets and Countries. *IMF Staff Papers*, 55(2):356–366.

Fabbri, D. and Padula, M. (2004). Does Poor Legal Enforcement Make Households Credit-Constrained? *Journal of Banking & Finance*, 28(10):2369–2397.

Forni, L., Gerali, A., and Pisani, M. (2010). Macroeconomic Effects of Greater Competition in the Service Sector: the Case of Italy. *Macroeconomic Dynamics*, 14(5):677–708.

Gali, J. (1999). Technology, Employment, and the Business Cycle: Do Technology Shocks Explain Aggregate Fluctuations? *American Economic Review*, 89(1):249–271.

Gerali, A., Notarpietro, A., and Pisani, M. (2014). Macroeconomic Effects of Simultaneous Implementation of Reforms After the Crisis. Temi di Discussione (Working Papers) 997, Bank of Italy.

Gerali, A., Notarpietro, A., and Pisani, M. (2016). Macroeconomic Effects of Simultaneous Implementation of Reforms. *International Finance*, 19(1):42–65.

Giacomelli, S. and Menon, C. (2017). Does Weak Contract Enforcement Affect Firm Size? Evidence from the Neighbour's Court. *Journal of Economic Geography*, 17(6):1251–1282.

Giacomelli, S., Mocetti, S., Palumbo, G., and Roma, G. (2017). Civil Justice in Italy: Recent Trends. Questioni di Economia e Finanza (Occasional Papers) 401, Bank of Italy.

Gomes, S., Jacquinot, P., Mohr, M., and Pisani, M. (2013). Structural Reforms and Macroeconomic Performance in the Euro Area Countries: A Model-Based Assessment. *International Finance*, 16(1):23–44.

Griffith, R. and Harisson, R. (2004). The Link Between Product Market Reform and Macro-Economic Performance. European Economy - Economic Papers 209, European Commission.

Griffith, R., Huergo, E., Mairesse, J., and Peters, B. (2006). Innovation and Productivity Across Four European Countries. *Oxford Review of Economic Policy*, 22(4):483–498.

Gutiérrez, G. and Philippon, T. (2019). How EU Markets Became More Competitive than US Markets: A Study of Institutional Drift. NBER Working Papers 24700, NBER.

Hall, B. (2011). Innovation and Productivity. NBER Working Papers 17178, NBER.

Hall, R. E. (2005). Employment Fluctuations with Equilibrium Wage Stickiness. *American Economic Review*, 95(1):50–65.

Heckman, J., Ichimura, H., and Todd, P. (1997). Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme. *Review of Economic Studies*, 64(4):605–654.

Høj, J., Galasso, V., Nicoletti, G., and Dang, T.-T. (2006). The Political Economy of Structural Reform: Empirical Evidence from OECD Countries. OECD Economics Department Working Papers 501, OECD.

Jacquinot, P., Lozej, M., and Pisani, M. (2020). Macroeconomic Effects of Tariffs Shocks: The Role of the Effective Lower Bound and the Labour Market. Working Paper Series 2434, ECB.

Jappelli, T., Pagano, M., and Bianco, M. (2005). Courts and Banks: Effects of Judicial Enforcement on Credit Markets. *Journal of Money, Credit and Banking*, 37(2):223–244.

Justiniano, A., Primiceri, G. E., and Tambalotti, A. (2013). Is There a Trade-Off Between Inflation and Output Stabilization? *American Economic Journal: Macroeconomics*, 5(2):1–31.

Lanau, S. and Topalova, P. (2016). The Impact of Product Market Reforms on Firm Productivity in Italy. IMF Working Papers 119, IMF.

Levinsohn, J. and Petrin, A. (2003). Estimating Production Functions Using Inputs to Control for Unobservables. *Review of Economic Studies*, 70(2):317–341.

Lusinyan, L. and Muir, D. (2013). Assessing the Macroeconomic Impact of Structural Reforms: The Case of Italy. IMF Working Papers 22, IMF.

Magri, S. (2010). Debt Maturity Choice of Nonpublic Italian firms. *Journal of Money, Credit and Banking*, 42(2-3):443–463.

McAdam, P., Petroulakis, F., Vansteenkiste, I., Cavalleri, M. C., Eliet, A., and Soares, A. (2019). Concentration, Market Power and Dynamism in the Euro Area. Working Paper Series 2253, ECB.

MEF (2016). The Assessment of the Macroeconomic Impact of Italy's Reforms with a Focus on Credibility. Quest workshop, Italian Ministry of Economy and Finance.

OECD (2015). Structural Reforms in Italy: Impact on Growth and Employment. Technical report, OECD.

Rodano, G. (2021). Judicial Efficiency and Bank Credit to Firms. Temi di Discussione (Working Papers) 1322, Bank of Italy.

Roeger, W. (1995). Can Imperfect Competition Explain the Difference Between Primal and Dual Productivity Measures? Estimates for U.S. Manufacturing. *Journal of Political Economy*, 103(2):316–330.

Shimer, R. (2005). The Cyclical Behavior of Equilibrium Unemployment and Vacancies. *American Economic Review*, 95(1):25–49.

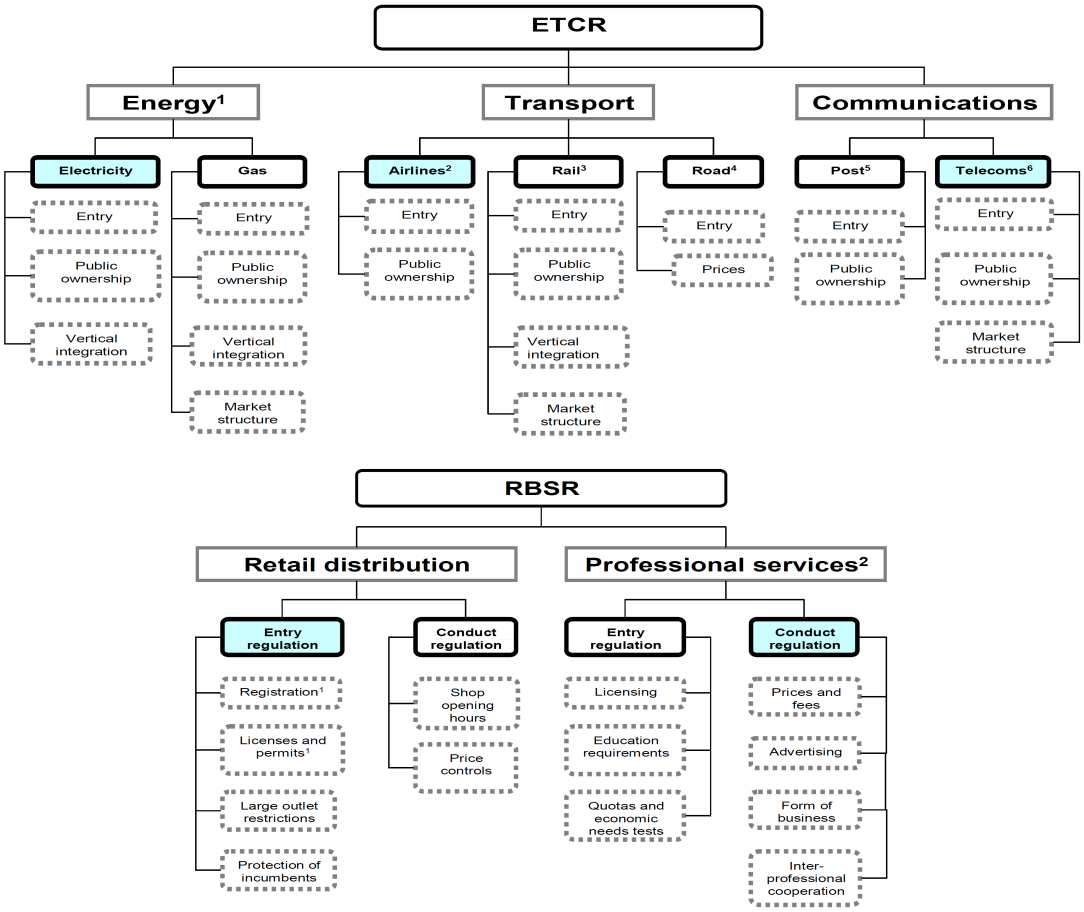
Varga, J., Roeger, W., and Veld, J. i. (2014). Growth Effects of Structural Reforms in Southern Europe: The Case of Greece, Italy, Spain and Portugal. *Empirica*, 41:323–363.

Westmore, B. (2014). Policy Incentives for Private Innovation and Maximising the Returns. Technical report, OECD Publishing.

World Bank (2020). Doing Business. Technical report, World Bank.

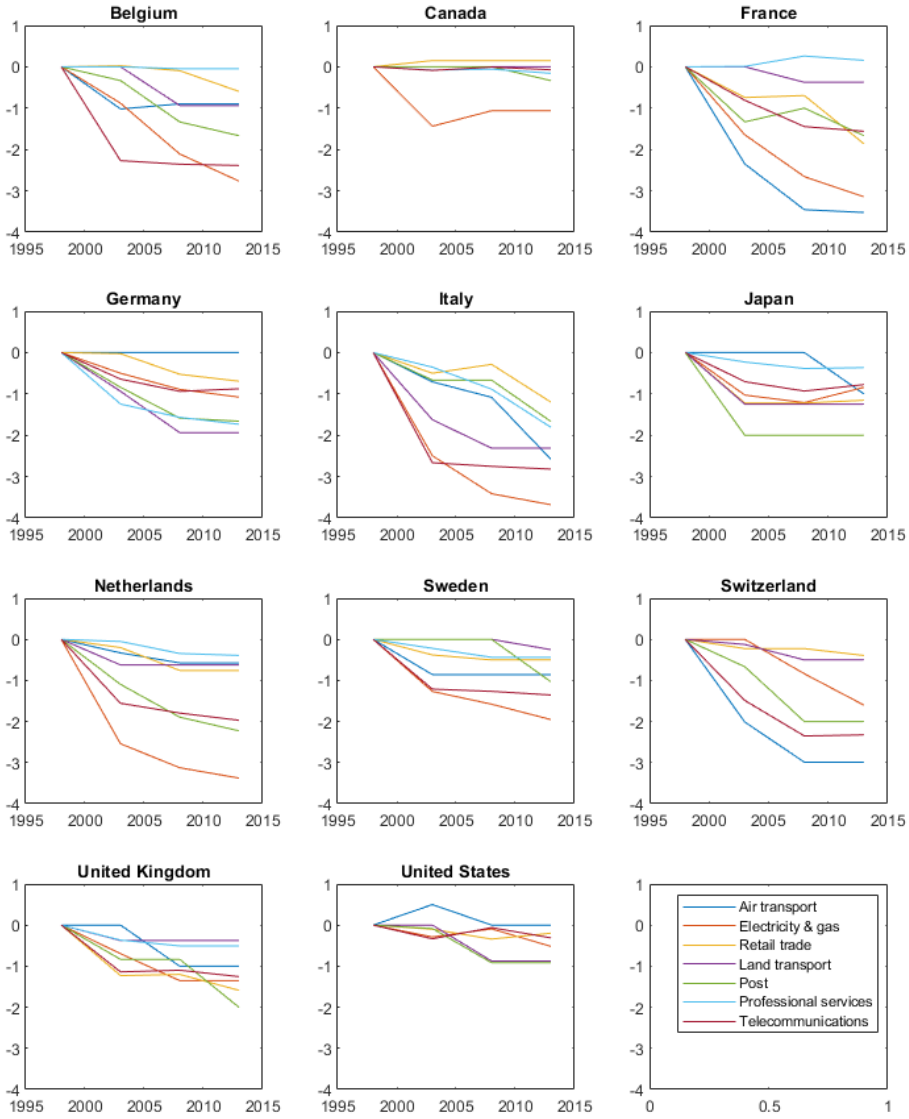
Figures and Tables

Figure 1: Structure of the ECTR and RSBR indicators



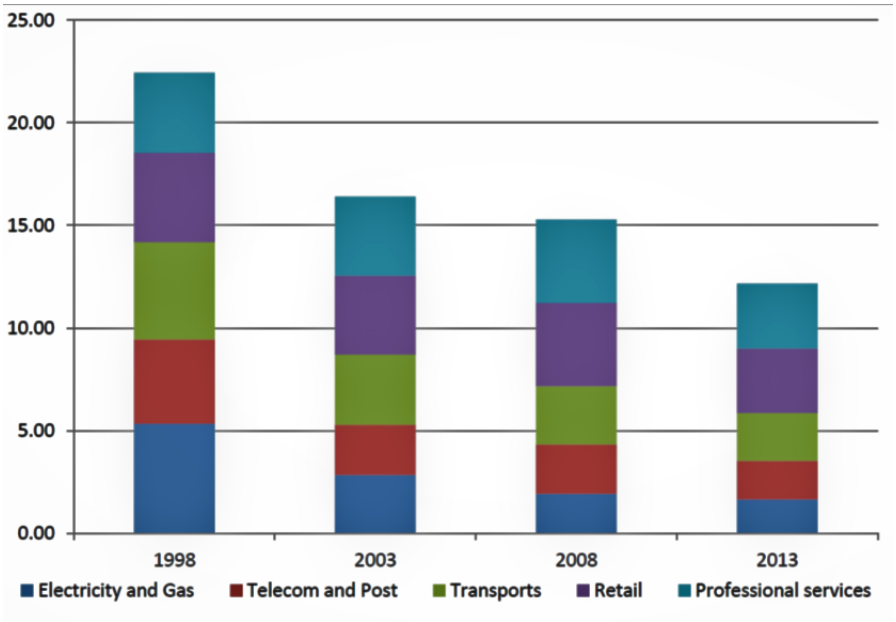
Source: Conway and Nicoletti (2006)

Figure 2: Evolution of the NMR in selected OECD countries, 1998-2013



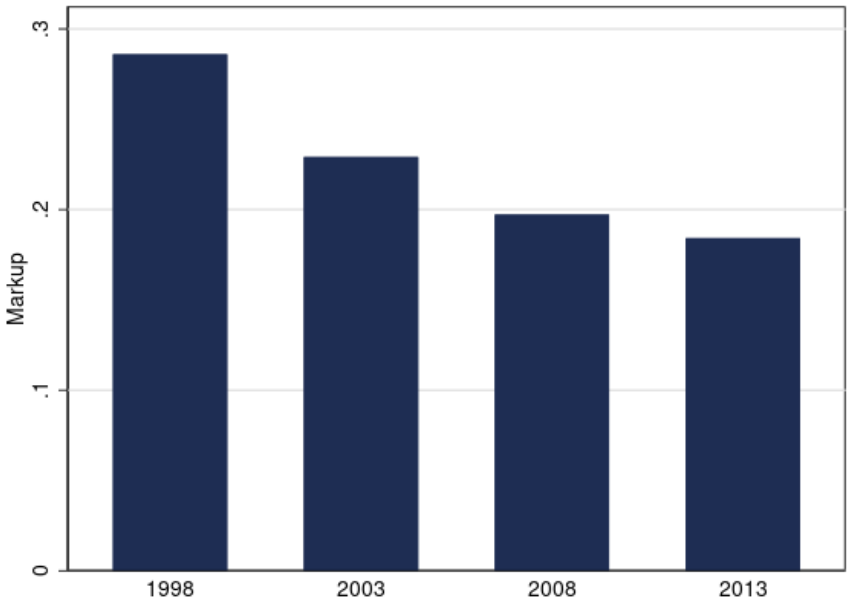
Data source: OECD.

Figure 3: NMR Indicator for Italy, 1998-2013



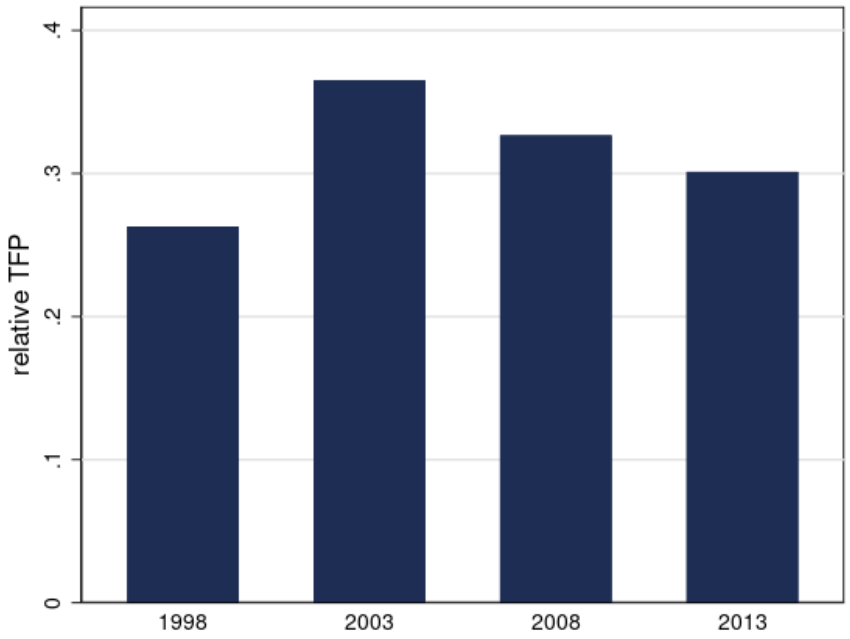
Data source: OECD.

Figure 4: Markups dynamics by years in the Italian regulated services sector



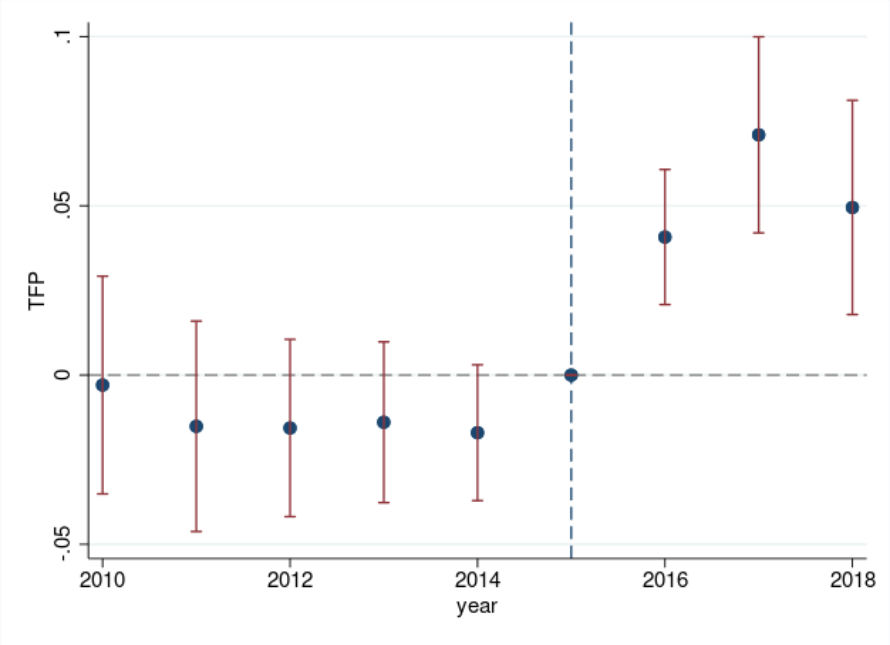
Data source: OECD STAN.

Figure 5: TFP dynamics by years in the Italian regulated services sector



Data source: OECD STAN.

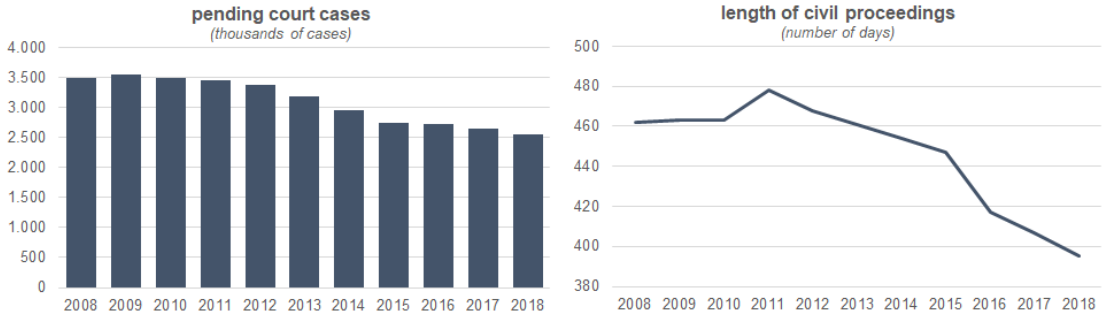
Figure 6: Evolution of the TFP between firms



Each point is the estimate of the treatment effect (use of incentives) on the TFP for different years, before and after the introduction of the incentives (leads and lags); vertical bands are the corresponding 95% confidence intervals; 2015 is the reference category.

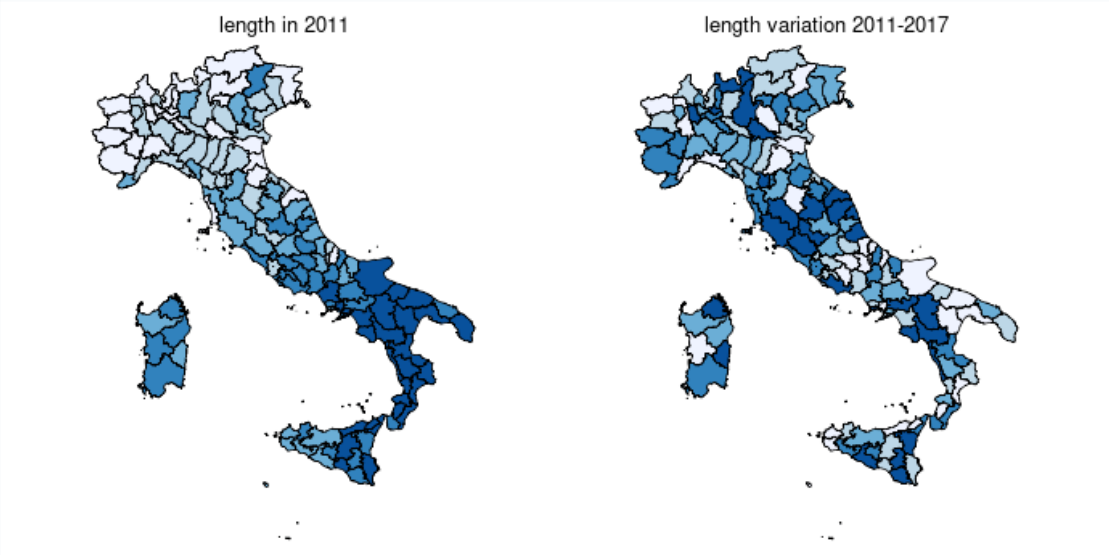
Data source: Invind-Cerved.

Figure 7: Performance of the civil justice system over time



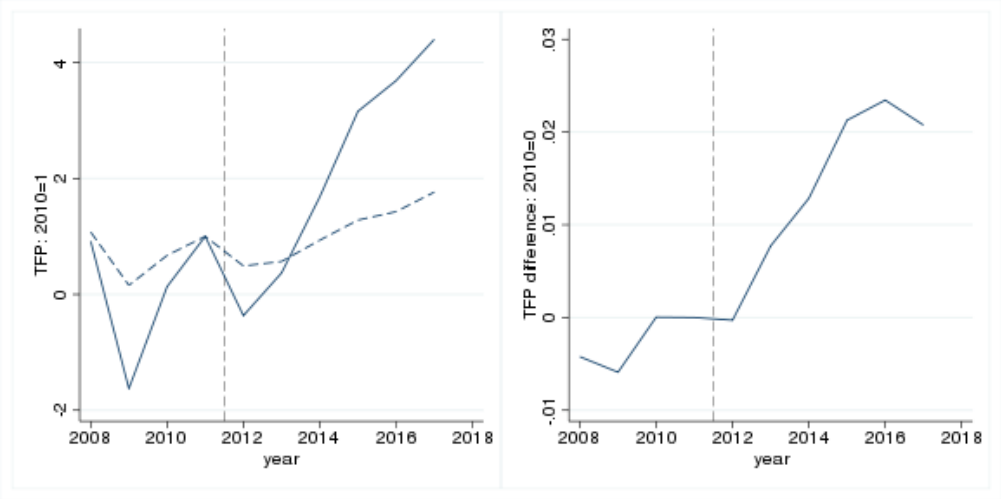
Data source: Ministry of Justice.

Figure 8: Performance of the civil justice system across courts



Data source: Ministry of Justice.

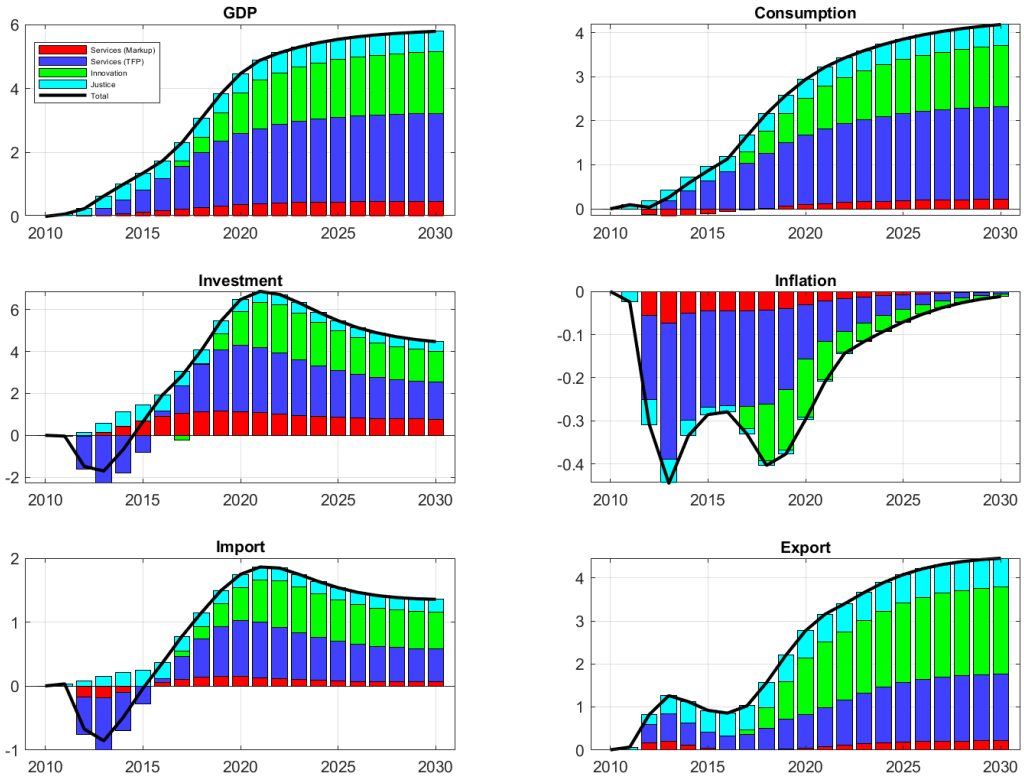
Figure 9: Evolution of the TFP between courts.



The solid (dash) line on the left shows the evolution of the TFP of courts experiencing a larger (lower) decrease of the lengths of civil proceedings, i.e. courts with a reduction above (below) the median; the solid line on the right shows the evolution of the difference in the TFP between the two groups of courts.

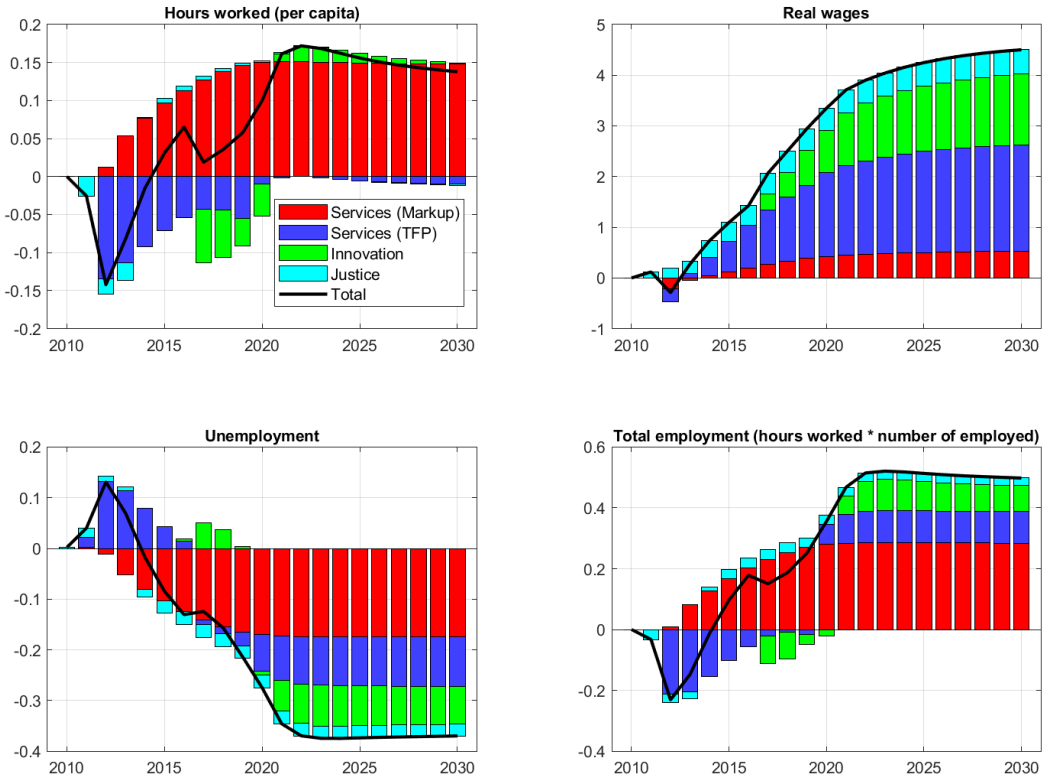
Data source: Cerved and Ministry of Justice.

Figure 10: Macroeconomic effects of the reforms



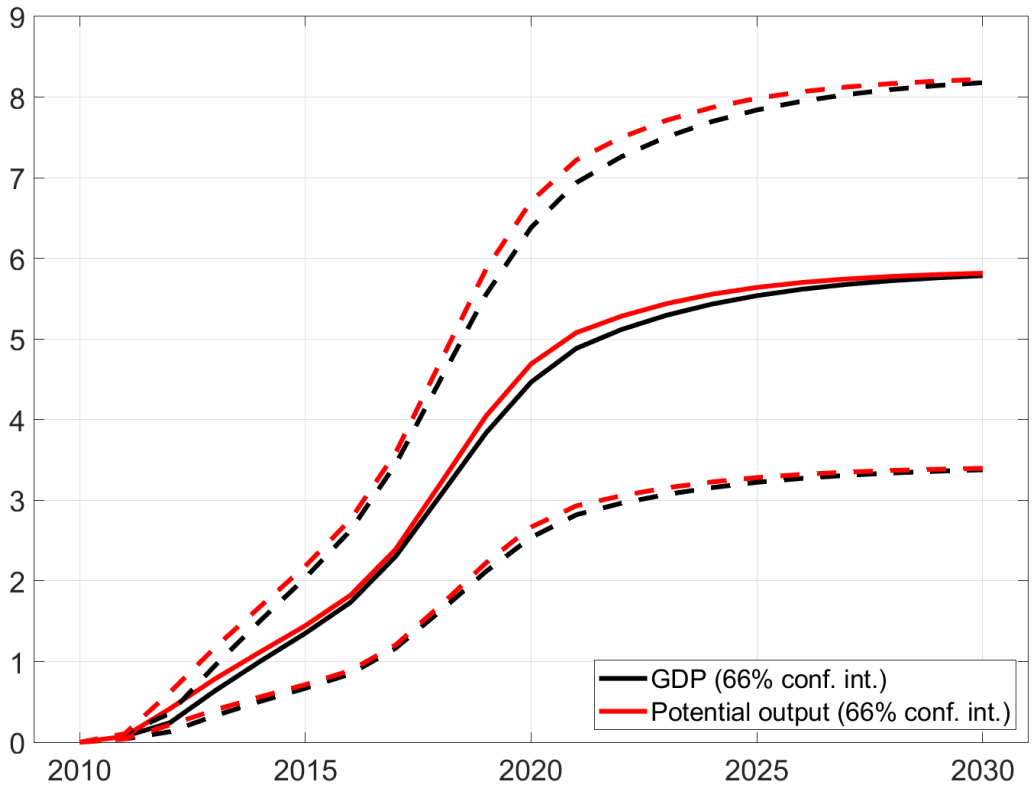
Horizontal axis: years. Vertical axis: % deviations from baseline; for inflation, annualized pp deviations from baseline. GDP and its components are evaluated at constant prices.

Figure 11: Effects of the reforms on labor market



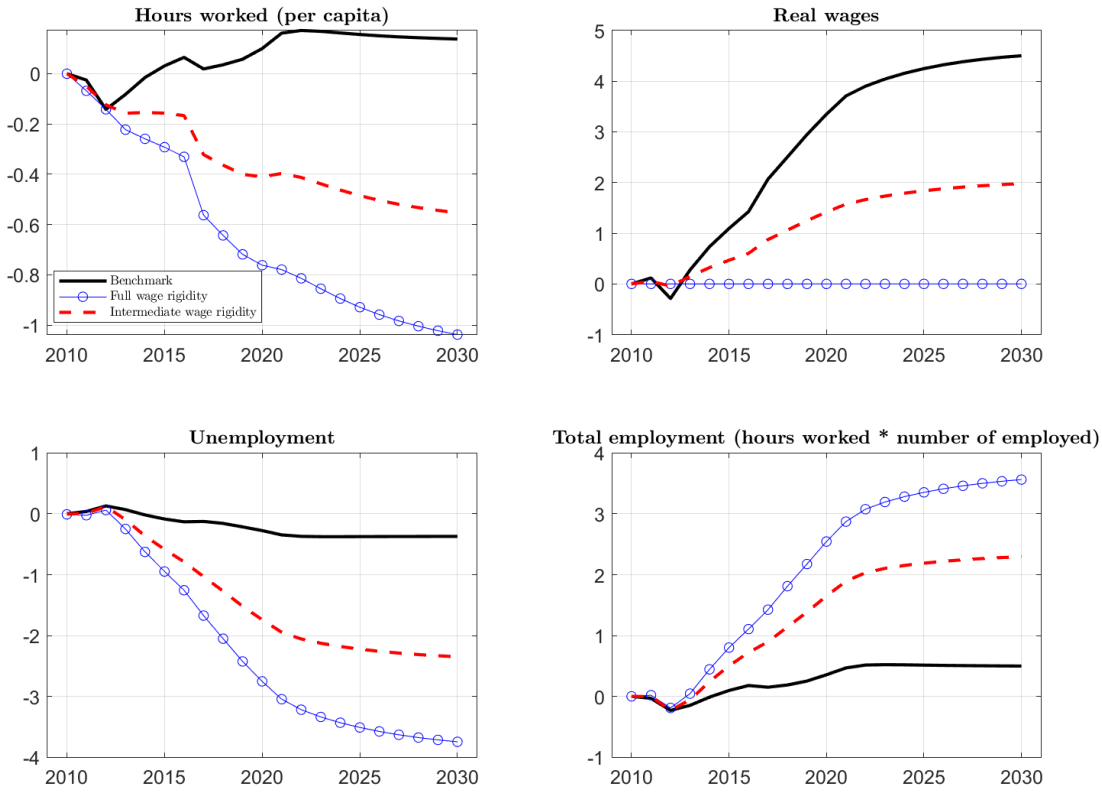
Horizontal axis: years. Vertical axis: % deviations from baseline; for unemployment, pp deviations from baseline.

Figure 12: Effects of the reforms on potential output



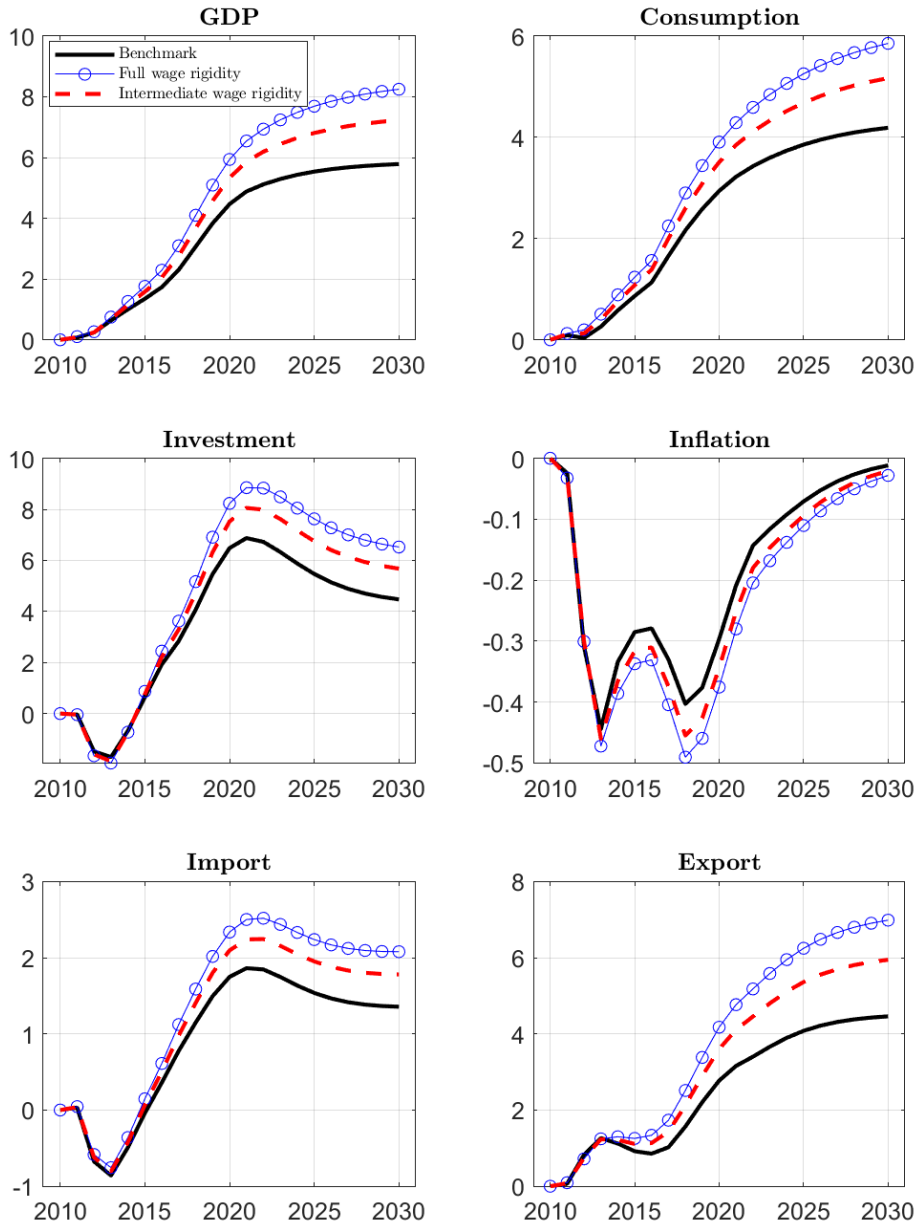
Horizontal axis: years. Vertical axis: % deviations from baseline.

Figure 13: Effects of the reforms on labor market: The role of wage rigidity



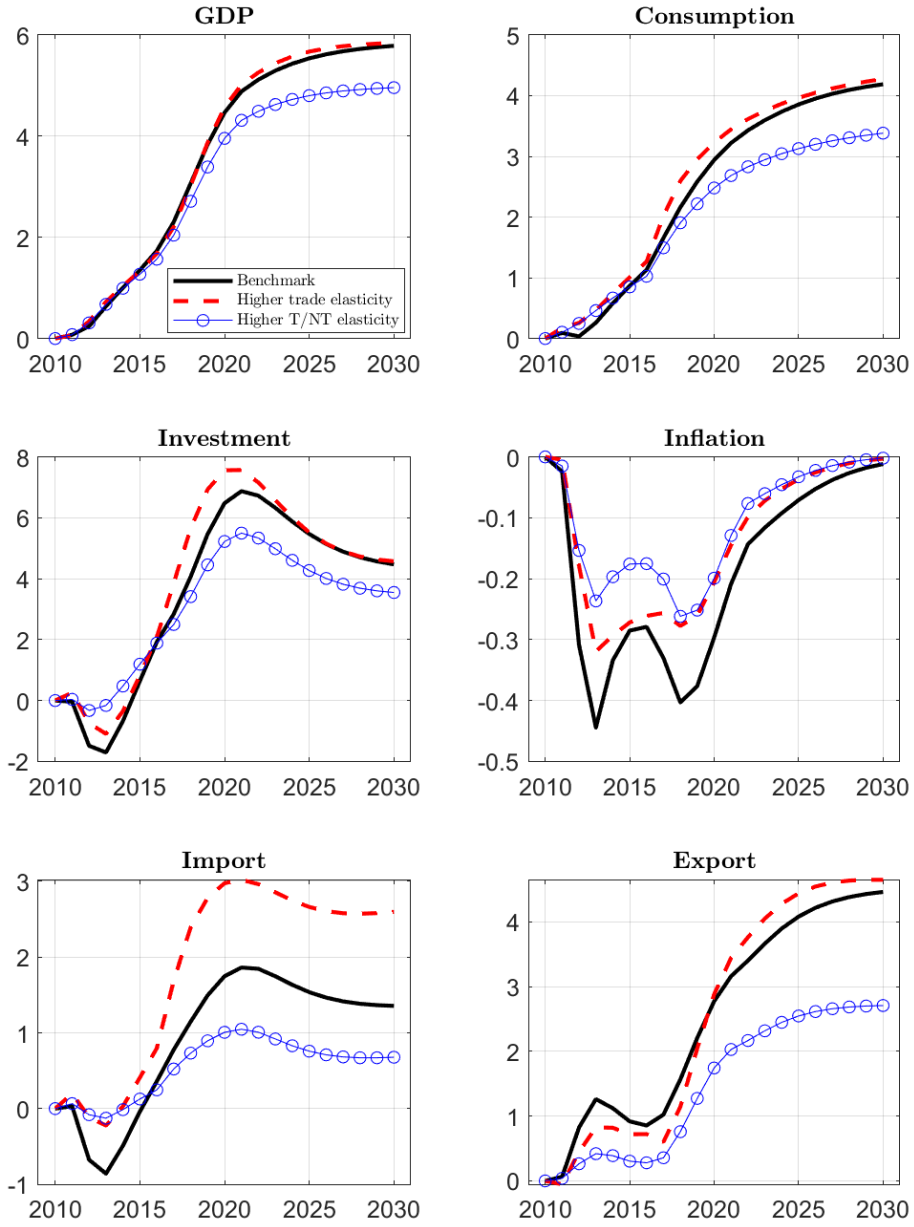
Horizontal axis: years. Vertical axis: % deviations from baseline; for unemployment, pp deviations from baseline.

Figure 14: Macroeconomic effects of the reforms: The role of wage rigidity



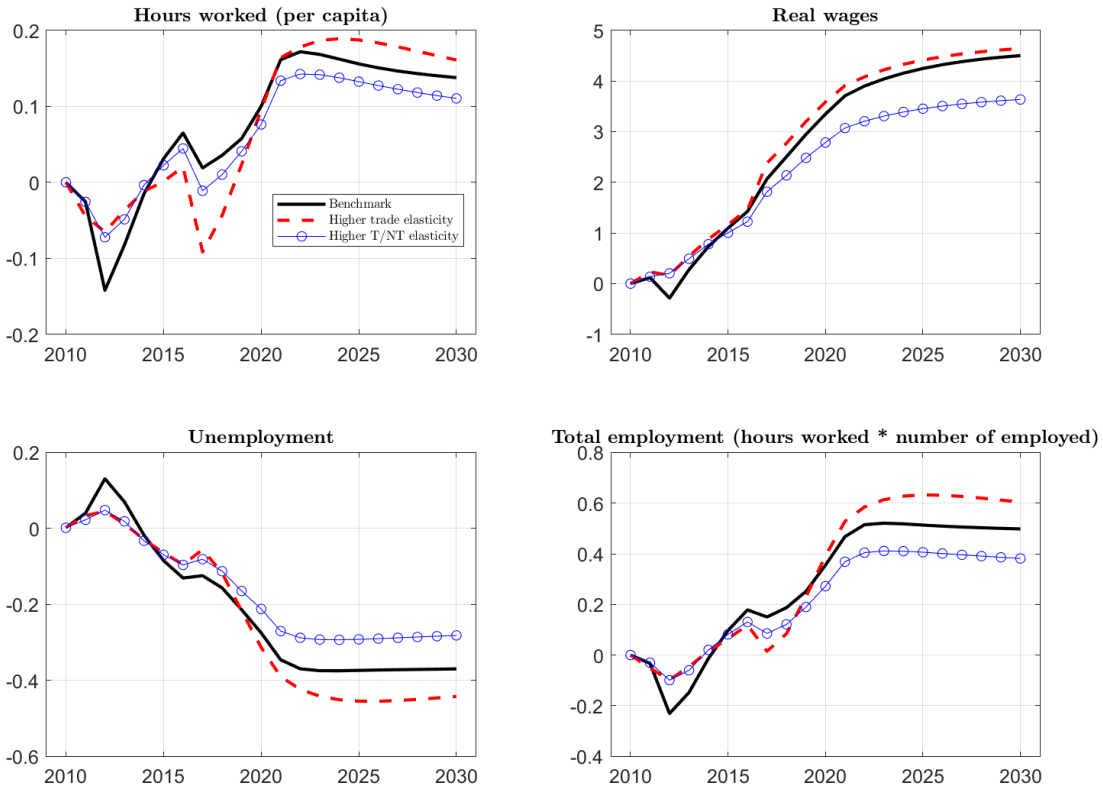
Horizontal axis: years. Vertical axis: % deviations from baseline; for inflation, annualized pp deviations from baseline. GDP and its components are evaluated at constant prices.

Figure 15: Macroeconomic effects of the reforms: The role of trade elasticity and tradable/nontradable goods elasticity



Horizontal axis: years. Vertical axis: % deviations from baseline; for inflation, annualized pp deviations from baseline. GDP and its components are evaluated at constant prices.

Figure 16: Effects of the reforms on labor market: The role of trade elasticity and tradable/nontradable goods elasticity



Horizontal axis: years. Vertical axis: % deviations from baseline; for unemployment, pp deviations from baseline.

Table 1: **Data Sources**

Source	**Description**	**Coverage**
OECD	STructural ANalysis database OECD	34 countries, 1998-2013
OECD	Sector Regulation Indicators	34 countries, 7 sectors, 1998-2013
Invind	Bank of Italy survey	firms 20+, 2010-2018
Cerved	Balance-sheet incorporated firms	Universe, 2010-2018
Ministry of Justice	Stock and flows of civil proceedings	Courts, 2010-2018

Table 2: **The effect of liberalizations on markup and TFP**

Dependent variable:	Markup	Markup	Markup	TFP	TFP	TFP
	I	II	III	IV	V	VI
Reg	0.028**	0.027**	0.036**	-0.102**	-0.090*	-0.110**
	(0.014)	(0.013)	(0.018)	(0.044)	(0.050)	(0.050)
Country FEs	YES	NO	NO	YES	NO	NO
Sector FEs	YES	NO	NO	YES	NO	NO
Year FEs	YES	NO	NO	YES	NO	NO
Country-Year FEs	NO	YES	YES	NO	YES	YES
Sector-Year FEs	NO	YES	NO	NO	YES	NO
Country-Sector FEs	NO	NO	YES	NO	NO	YES
Observations	618	618	618	540	540	540

Regression at the country-sector level. Markup is a monotone transformation of the Lerner index, which is computed as the ratio between gross operating surplus (corrected for the labor cost of self-employed) and gross output. TFP is the log of TFP as distance from efficient frontier. The lower number of observation between the markup and the TFP regressions is due to the lack of information on capital in 10 OECD countries in different year-sector combinations. This implies that we cannot compute the Solow residuals, while we are still able to retrieve the Lerner markup. Robust standards errors in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$, $^{*}p < 0.1$.

Data source: OECD-StaN, OECD Sector Regulation database, 1998-2013.

Table 3: **The effect of incentives on TFP**

Dependent variable:	TFP	TFP	TFP	TFP
	I	II	III	IV
I_{it}	0.046***	0.060***	0.070***	0.053***
	(0.008)	(0.012)	(0.015)	(0.016)
Firm FEs	YES	YES	YES	YES
Year FEs	YES	YES	YES	YES
Model	DID	DID-PSM	DID-PSM	DID-PSM
Sample	All	All	≤ 50	>50
R-squared	0.709	0.691	0.723	0.696
Number of firms	4,182	4,093	1,669	2,843
% Incentive	0.712	0.712	0.614	0.766
% Compliers	0.230	0.230	0.222	0.235
Observations	35,889	35,583	12,487	22,881

Regression at the firm level. The dependent variable is the total factor productivity at the firm-year level. The main explanatory variable is equal to 1 from the year in which the firm declares to have used the incentives onwards (and 0 otherwise). While column 1 use a simple difference-in-difference approach, in columns 2 to 4 we adopt the kernel matching, thus giving larger weight to controls with closer "propensity score". Each specification includes firm- and year fixed effects to account for time-invariant heterogeneity at the firm level and common shocks. Compliers are the firm finding the incentives crucial to innovate. Standards errors clustered at the firm level in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$, $^{*}p < 0.1$.

Data source: Invind 2010-2018.

Table 4: **Balancing properties at the court level**

Variable:	Variation of length over the period:			Regression
	Low	Intermediate	High	coefficient
TFP	0.051	0.026	0.049	-0.007 (0.035)
TFP growth (2005-2010)	0.026	0.025	0.024	0.027 (0.175)
Size of the court	20.46	20.70	20.58	-0.001 (0.001)
South of Italy	0.511	0.383	0.435	-0.000 (0.005)
Average firm size	8.364	8.780	7.903	-0.001 (0.001)
Share of micro-firms	0.818	0.819	0.826	0.097 (0.082)
Share of manufacturing	0.154	0.165	0.157	0.013 (0.045)
Share of construction	0.189	0.179	0.179	-0.047 (0.058)
Observations	47	47	46	140

The table shows the mean value of each variable for courts characterized by low (column 1), intermediate (column 2) and high (column 3) variation of length of civil proceedings over the temporal window considered in the empirical analysis. The variables are instead measured at the beginning of the period. The last column shows the coefficient of the bivariate regression where the dependent variable is the length of civil proceedings and the variables reported in each row are the explanatory variables. Robust standard errors in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$, $^{*}p < 0.1$.

Data source: Cerved and Ministry of Justice.

Table 5: **The effect of length of civil proceedings on TFP**

Dependent variable:	TFP	TFP	TFP	TFP
	I	II	III	IV
Length_{it}	-0.034**	-0.036*	-0.031**	-0.034**
	(0.017)	(0.020)	(0.014)	(0.017)
Court FEs	YES	YES	YES	YES
Year FEs	YES	YES	YES	YES
Sector-Year shocks	NO	NO	YES	YES
R-squared	0.943	0.943	0.943	0.943
Observations	980	980	980	980

Regression at the court level. The dependent variable is the total factor productivity at the court-year level. The key explanatory variable is the log of length of civil proceedings (lagged values in even columns). Each specification includes court- and year fixed effects to account for time-invariant heterogeneity at the court level and common shocks. Correction for sector-year shocks means that the courts' patterns of the TFP are obtained after controlling for sector-year fixed effects. Standard errors clustered at the court level in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$, $^{*}p < 0.1$.

Data source: Cerved and Ministry of Justice.

Table 6: **Summary of the estimated effects**

Reform	Shock	Year	Timing
Services liberalization	services TFP: +3.51%	2012	7 years
	markups: -1.1pp	2012	7 years
Innovation	TFP: +1.37%	2017	4 years
Civil justice system	TFP: +0.45%	2011	3 years