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Labour market regulation and fiscal parameters: A structural model for European regions*

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Abstract

Deregulation of the labour market and public budget balance are usually considered a fundamental requirement for economic performance. This study analyses the long term relationship between these indicators and gross value added (GVA) for a panel of European regions from 1995 to 2008. Following Olley and Pakes (1996) and Levinsohn and Petrin (2003), a structural equation is estimated using a two stages semi-parametric procedure. Results suggest no univocal evidence of a detrimental effect of labour protection on long term GVA, while public deficit spending is positively associated with higher output. A negative relationship with debt arises only for economies with very high debt/GDP ratios.

Keywords: Labour protection; convergence criteria; production function; European Union

JEL Classification: C20; E23; O47; R11

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1 Introduction

Starting from the Eighties of the last century, economic receipts have been suggesting that a market oriented environment sets up the right conditions for successful economic activities. Liberalization, privatization and less State intervention have been invoked as a prerequisite for the appropriate functioning of markets. In particular, the State should just guarantee free competition and avoid any potentially distorting intervention. This implies more abstentions than active policies. Consequently, balanced budget has been proposed as the main policy target, to be achieved by reduced public spending rather than by increasing taxation. Deregulation is intended to remove frictions affecting markets' functioning in favour of free competition. Similarly, the rationale for privatization is the belief that private industry performs better than State enterprise because of the more direct incentives to managers (Williamson, 1990).

Originally catalysed by the experience of Latin America in the Eighties, this set of reforms has been adopted as main conditioning receipt by the Bretton Woods institutions for their Structural Adjustment programs, mainly in Africa and Latin America. It is known as the Washington Consensus after Williamson (1990). However, its main principles have been recently adopted in the European Union (EU), in particular during the last crisis. Indeed, despite no direct reference has been made to the Washington Consensus itself, the ingredients are the same, with more emphasis on fiscal consolidation and less on privatization.

Two main domains assume relevance in the current EU scenario. First, liberalization and deregulation have been advocated as the main means to make markets as close as possible to perfect competition. Indeed, regulation is traditionally seen as a source of both unemployment and unsatisfactory economic performance.[1] In particular, labour markets should be made more flexible, while employment protection should be reduced since it discourages firms to hire and invest because of firing restrictions.

Second, budget imbalances are usually invoked to explain the difficulties of some countries of the EU to get out of the crisis. Despite the crisis was not born as a debt crisis, it is argued that public debt must be addressed in order to help Europe to recover.[2] Moreover, the two Maastricht parameters concerning public finance state that the debt/GDP ratio should be lower than 60%, while the deficit/GDP ratio should not exceed 3%. On this basis, a conservative pro-cyclical response package has been adopted throughout Europe, mainly by cutting public expenditure.

As already happened for the original Consensus, the soundness of such polices has been heavily questioned. For instance, there is no agreement on the actual effects of contractionary fiscal policies. Critics have pointed out how contractionary policies during a recession could worsen it, instead than favouring a recovery. Therefore, countercyclical interventions should be preferred.[3] Moreover, the Maastricht fiscal parameters have been criticized for being neither theoretically grounded nor supported by empirical evidence.[4]

[1] For the relationship between labour market institutions and employment see for instance Blanchard and Wolfers (2000) and Bassanini and Duval (2006).

[2] Reinhart and Rogoff (2010) is probably the most influential paper which gives support to the hypothesis that high debt hampers economic growth.

[3] See Blinder (1997) and Barba (2001) for an assessment of the depressive and the expansionary hypothesis of fiscal rentrenchments.

[4] See Pasinetti (1998) for a critique of the 3% deficit/GDP criterion, Herndon et al. (2014) for a reassessment of the debt/GDP results of Reinhart and Rogoff (2010).

More generally, context conditions, such as the overall status of the economy, future prospects of growth, access to credit, etc. should be accounted for when considering budget deficit targets (Stiglitz 1999). For what concerns deregulation and liberalization policies, Stiglitz (1999) already pointed out that they do not necessarily imply increased competition.[5] This can be true for the current deregulation of the labour market, if either the overall economic conditions do not allow for actual competitive markets or globalization opportunities (and threats) do exist. Moreover, deregulation could have perverse effects in terms of unemployment, especially for the youth (O'Higgins, 2012).

The present paper sets in this framework by analysing the relationship between labour market deregulation, fiscal parameters and Gross Value Added (GVA). We use several institutional indicators for the labour market, debt and deficit shares on GDP. We also consider the Maastricht thresholds to investigate their empirical relevance. The main scope of this study is to assess the existence of a long-run relationship between the variables considered, GVA being the main dependent variable.[6] Hence, we estimate an augmented *structural equation*, drawing the methodology from the firm-level literature on production functions. In particular, we adapt the estimation procedure originally proposed by Olley and Pakes (1996) and reviewed by Levinsohn and Petrin (2003). This allows to approximate nonparametrically any unobserved factor influencing likely endogenous regressors. This in turn yields consistent estimates of the coefficients.

Overall, we do not find univocal evidence of a detrimental effect of labour markets regulation on GVA. Furthermore, larger debt/GDP and deficit/GDP ratios are associated with higher output. Debt is found to be detrimental for economic performance only when its share on GDP becomes large.

The paper proceeds as follows. Section 2 introduces the methodological background on estimation of production functions. Section 3 describes the estimation procedure. The data are presented in Section 4. Results are discussed in Section 5. In Section 6 we present some specification tests to verify the appropriateness of our assumptions. Section 7 concludes.

2 Methodological background

We adopt the approach used in the *structural* literature, following Ackerberg et al. (2006), which focuses on the computation of total factor productivity (TFP) at the firm level by estimating a general production function, usually assumed as a Cobb-Douglas technology. The approach explained below works also with any different assumption about the form of the production function (Olley and Pakes 1996, Levinsohn and Petrin 2003). The use of the Cobb-Douglas is just a convenient approximation which, in the case of the present study, helps also understanding the link between the adopted approach and the widely used growth regressions.[7] Olley and Pakes (1996) and Levinsohn and Petrin (2003) develop a method to estimate a production function providing more consistent

[5] With respect to the financial markets, the support for deregulation comes from the assumptions that free-market capitalism works better without the constraints imposed by State control. For a critical assessment on this regard, with a specific focus on the causes of the last crisis, see Soros (2008) and Varoufakis (2011). It is worth noting how such two different perspectives converge to the role of financial deregulation in favouring the crisis.

[6] The results can be naturally extended in terms of labour productivity (see Bresson et al. 2011).

[7] See below for a discussion and Del Gatto et al. (2011) for a survey on production functions estimation.

results with respect to OLS and fixed effects estimators. The approach accounts for the simultaneity problem arising from the acknowledgement that any productivity shock known to the firm, but unknown to the analyst, could affect the choice of inputs. This in turn causes OLS estimates to be inconsistent. Similarly, fixed effect techniques make sense as long as the unobserved effect is assumed to be constant overtime. This is a strong assumption not likely to hold if we consider shocks (Ackerberg et al., 2006). Moreover, within estimator eliminates between-firm variation which is likely to contain relevant information for the estimates (Levinsohn and Petrin, 2003). Differently, the methodology we use builds on the use of a 'proxy' variable to solve the simultaneity problem. Therefore, such a solution should also be much more informative than traditional alternatives (Griliches and Mairesse, 1998).

The present paper differs in two ways from the previous literature on the topic. Firstly, the unit of observation is not the firm, but the regional economies of the European Union as defined by the Eurostat classification (NUTS2 level). This has some relevant implications in terms of the economic interpretation of the results. Indeed, the unobserved term cannot be merely referred to as a pure productivity shock, since at such a level of aggregation other factors affect economic activity and its output. After the pioneering study by Solow (1956), the literature has focused on the identification of the components of the TFP residual. For instance, Mankiw et al. (1992) augment the original model by adding human capital. In general, the approach proceeds by endogenizing those factors that originally were taken as exogenous. For what concerns practical applications, the empirical growth literature uses to adopt a generic representation of the implied equation of the Solow's model, by adding a vector of explanatory variables, depending on the specific focus of the study. The resulting equations are usually known as Barro regressions in growth econometrics (Barro 1991, Caselli et al. 1996, Durlauf and Quah 1999, Durlauf et al. 2005). In the present paper, the main interest concerns the long-run relationship between labour market deregulation, public finance constraints, and economic performance. Therefore, we *augment* the standard structural model by adding these explanatory variables and some additional controls to account for the structural composition of the economy.

Secondly, we are not directly interested in obtaining a measure of TFP, but in explaining which factors account for the heterogeneity in GVA and, therefore, labour productivity. However, it may still be that some other unobserved factors may affect economic choices, i.e. how much capital to use and how much employment to hire. Take for instance political factors, external economic shocks, non measurable innovations causing pure productivity increases. Hence, we think that the structural approach suits the goal of obtaining consistent estimates of the parameters. The TFP term can still be properly computed to understand how much variability in the dependent variable is left unexplained.

Our augmented specification is equivalent to the *canonical augmented* growth regression but with the dependent variable is in levels, instead of in growth rate, and steady-state implications are not considered. In other terms, the focus is on the *long-run* behaviour of the economy. In the following section, we can see that our approach appears to be theoretically grounded as well as suitable for a proper estimation of the parameters of a GVA equation. An equivalent application, with a different estimating procedure, is performed in Bresson et al. (2011). The use of the Olley and Pakes' (1996) approach helps to obtain consistent estimates of the coefficients of interest, especially when there is reason to suspect simultaneity issues. As long as this is true, the point of such an estimation

methodology applies fairly generally (Wooldridge, 2009).

3 Specification and estimation procedure

We begin by assuming a standard Cobb-Douglas production technology for the economy with two traditional inputs, capital stock and labour. We *augment* it by adding further explanatory variables leading to the following specification:

$$Y_{it} = [A_{it} Z_{it}^{\vartheta}] K_{it}^{\beta_k} L_{it}^{\beta_l}$$

where K_{it} and L_{it} are capital stock and employment in the economy, respectively. Note that no specific restriction is imposed on the parameters. Additional factors affecting output are considered by specifying the composition of the technological level (or total factor productivity) into two parts, A_{it} and Z_{it}. It should be noted that A_{it} is the traditional technological level whereas Z_{it} includes two sets of variables in which we are mainly interested, i.e. *fiscal parameters* and *labour market institutional indicators*. We assume that A_{it} can be varying over time and heterogeneous between observations, i.e.

$$A_{it} = A_0 e^{\omega_{it}}.$$

Taking the logs of the above production function we get

$$y_{it} = \beta_0 + z_{it}' \vartheta + \beta_l l_{it} + \beta_k k_{it} + \omega_{it} + \epsilon_{it} \tag{1}$$

where lowercase letters represent variables in log, $\beta_0 = \ln A_0$, ϵ_{it} is the standard i.i.d. disturbance, and ω_{it} includes the unobserved factors (or shock) likely to affect the choice of inputs, i.e. capital and employment. This is known as the *simultaneity* issue. For a non-firm approach as in our case, we may think at any kind of macroeconomic perturbation, as well as pure technological drifts, political events or international factors which shape the economic environment. The intuition is still that such a perturbation is not observed (or measurable) by the analyst, still it may be known to the economic actors, therefore shaping their decisions.

In order to address the simultaneity issue, we follow the estimation procedure as proposed by Levinsohn and Petrin (2003). The approach requires a suitable proxy variable being *monotonically* related to ω_{it} (Olley and Pakes 1996, Levinsohn and Petrin 2003, Ackerberg et al. 2006). We use investment s_{it}, as originally proposed by Olley and Pakes (1996). This turns out to be an adequate proxy as long as we believe that investment reacts monotonically to ω_{it}. In other terms, we are just assuming that investment increases whenever the overall conditions become more favourable to economic activity.[8] The next step consists in specifying a function for s_{it}. Following Levinsohn and Petrin (2003), a reasonable time schedule implies that k_{it} is chosen in $t-1$, then l_{it} and investment

[8] Levinsohn and Petrin (2003) rise some doubts on the strict monotonicity assumption regarding investment. They argue that empirically investment is very lump, due to adjustment costs which reduce its responsiveness to the transmitted shocks. Therefore investment may not adequately capture the variation in inputs' usage due to productivity shocks. Although this sounds reasonable at the firm level, at the aggregate level, investment measures the overall increase in capital stock in response to depreciation *and* improved economic conditions. Moreover, considering macroeconomic data excludes cases in which investment is zero for some observations, as it may happen when using microdata.

decisions are taken in t. Therefore capital in t depends on investment decisions in $t-1$, while investment in t affects the capital stock in $t+1$ and depends on the information set available in t. Employment is treated as a flexible variable. The time schedule allows to express investment as function of capital and overall economic factors (including any kind of shock). Therefore, we have

$$s_{it} = f(\omega_{it}, k_{it}). \tag{2}$$

where s_{it} is investment. We also assume that ω_{it} follows a first-order Markov process

$$\omega_{it} = E[\omega_{it}|\Omega_{it-1}] + \xi_{it} = E[\omega_{it}|\omega_{it-1}] + \xi_{it} \tag{3}$$

where ξ_{it} is a random disturbance. If monotonicity holds, it is possible to invert equation (2) as

$$\omega_{it} = f^{-1}(s_{it}, k_{it}). \tag{4}$$

Therefore, the equation to be estimated is the following

$$y_{it} = \beta_0 + z'_{it}\vartheta + \beta_l l_{it} + \beta_k k_{it} + f^{-1}(s_{it}, k_{it}) + \epsilon_{it}. \tag{5}$$

We use the two-stage estimation procedure given by Levinsohn and Petrin (2003) to obtain consistent estimates of the coefficients of the model. A step-by-step guide to the estimation is presented in Levinsohn and Petrin (2004) and Yasar et al. (2008). A similar procedure is also described by Olley and Pakes (1996) and Ackerberg et al. (2006). Differences are due to the assumptions about the time schedule and the proxy (see Van Beveren, 2012, for a review). Alternatively, one may adopt the one step estimation as in Wooldridge (2009). Equation (5) can be rewritten as

$$y_{it} = z'_{it}\vartheta + \beta_l l_{it} + \phi(s_{it}, k_{it}) + \epsilon_{it}. \tag{6}$$

where

$$\phi(s_{it}, k_{it}) = \beta_0 + \beta_k k_{it} + f^{-1}(s_{it}, k_{it}). \tag{7}$$

In the first stage, equation (6) is estimated by using an estimator which is linear in l_{it} and nonlinear in ϕ. One can use OLS and a polynomial expansion in s_{it} and k_{it} to approximate $\phi(s_{it}, k_{it})$ as in Olley and Pakes (1996). Alternatively, a semi-parametric regression as in Robinson (1988) can serve the scope as well. This is the option we follow. More precisely, we use the Epanechnikov kernel and the Silverman's (1986) rule-of-thumb for the bandwidth parameter. Results do not change when a normal kernel or different bandwidths are set (see also Racine, 2008). As a result, the first stage yields a consistent estimator of β_l and ϑ whereas β_k cannot be estimated at this step as capital stock enters ϕ more than once.

Note that the additional variables z_{it} are not included in (2). The rationale for this assumption is twofold. Firstly, as k_{it} is a *state* variable that gathers all informations available in previous periods, i.e. investment decisions and other factors from time $t-1$ to time t, the inclusion of z_{it} in (2) would have a little additional value because z_{it} do not vary a lot between two successive years. Secondly, despite the previous argument, if we want to include z_{it} in equation (2) such as $s_{it} = f(\omega_{it}, z_{it}, k_{it})$, then the nonparametric estimation of $\phi(s_{it}, z_{it}, k_{it})$ will encounter the *curse of dimensionality* because of a high number of arguments in ϕ. A plausible way to include z_{it} is then to assume $s_{it} = f(\omega_{it} - z'_{it}\eta, k_{it})$

which gives $\omega_{it} = f^{-1}(s_{it}, k_{it}) + z'_{it}\eta$. However, in this case, the coefficient associated to z_{it} in equation (5) becomes $\vartheta + \eta$, the rest of the equation remaining unchanged, showing that η is not separately identified from ϑ. Thus, the model as described in (5) still applies here.

In the second stage, we firstly approximate non-parametrically $\phi(s_{it}, k_{it})$ from equation (6):

$$\hat{\phi}(s_{it}, k_{it}) = E[y_{it} - \hat{\beta}_l l_{it} - z'_{it}\hat{\vartheta}|s_{it}, k_{it}]. \tag{8}$$

Then, we can exploit equation (7) to compute an approximation for $\omega_{it} = f^{-1}(s_{it}, k_{it})$. For doing this we need a value for β_k to plug in the equation. We follow Levinsohn and Petrin (2003) and we estimate equation (1) by standard OLS for obtaining a *candidate* β_k^0. Hence, ω_{it} is approximated by

$$\tilde{\omega}_{it} = \hat{\phi}(s_{it}, k_{it}) - \beta_k^0 k_{it}. \tag{9}$$

Therefore, the Markov chain assumption yields a nonparametric estimate of $\hat{\omega}_{it}$,

$$\hat{\omega}_{it} = E[\tilde{\omega}_{it}|\tilde{\omega}_{i,t-1}]. \tag{10}$$

Finally, we have all the elements needed to compute the residuals of equation (5). Using coefficients $\hat{\vartheta}$ and $\hat{\beta}_l$ from the first stage, and the fact that the non-parametric estimate $\hat{\omega}_{it}$, under the Markov-Chain assumption, implies the innovation $\xi_{it} = \tilde{\omega}_{it} - E[\tilde{\omega}_{it}|\tilde{\omega}_{it-1}]$, equation (5) can be rewritten as (remark that β_0 is not separately identified from $\hat{\omega}_{it}$)

$$y_{it} = z'_{it}\hat{\vartheta} + \hat{\beta}_l l_{it} + \beta_k k_{it} + \hat{\omega}_{it} + \xi_{it} + \epsilon_{it}. \tag{11}$$

Hence, the new residuals correspond to $\xi_{it} + \epsilon_{it}$. Since, by construction, the residuals are cleaned of the unobserved shock and therefore are uncorrelated with k_{it}, β_k can be estimated by the minimization of the squared sum of residuals

$$\min_{\beta_k} \sum \left(\widetilde{\xi_{it} + \epsilon_{it}}\right)^2 \tag{12}$$

where

$$\widetilde{\xi_{it} + \epsilon_{it}} = y_{it} - z'_{it}\hat{\vartheta} - \hat{\beta}_l l_{it} - \beta_k k_{it} - \hat{\omega}_{it}.$$

This concludes the estimation procedure.[9]

The above framework is valid under our timing assumption, i.e. that capital is determined before investment and employment are set. If we instead assume that employment is determined together with capital in $t-1$, then it enters equation (2), since investment is chosen according to information available at time t, which now includes both employment level and capital stock. Therefore, the coefficient for β_l could not be obtained at the first stage and must be estimated at the second stage (Ackelberg et al., 2006). However, in what follows, we keep our time setting assumption, excluding employment from

[9]The moment condition in equation (12) includes no instruments. Of course, it can be reinforced with overidentification conditions yielding a GMM estimator, as in Levinsohn and Petrin (2003). In this case, the moment conditions become

$$E[\widetilde{\xi_{it} + \epsilon_{it}}|W_{it}] = 0$$

where W_{it} is the vector of instruments, for instance $W_{it} = \{k_{it}, k_{it-1}, l_{it-1}, ...\}$. However, in our case it provides similar results (Petrin et al., 2004). See also Wooldridge (2000, 2010).

the investment function. Indeed, it is just as saying that the level of employment of the economy in t is determined in t, instead than in $t-1$. We think that from an economic point of view, assuming that employment in t is set in t instead than in $t-1$ sounds legit. Ackerberg et al. (2006) also remark that a *collinearity* issue may arise if employment is only function of the same variables as the proxy (investment) is. Indeed, they state that 'One simply cannot simultaneously estimate a fully non-parametric (time-varying) function of (ω_{it}, k_{it}) along with a coefficient on a variable that is only a (time-varying) function of those same variables (ω_{it}, k_{it})' (p.10). However, it is reasonable to believe that the level of employment does not depends on ω_{it}, *once* labour market regulation is accounted for. Similarly, we can also safely state that our additional variables are not functions of (ω_{it}, k_{it}). Therefore, no collinearity problem should arise and we can estimate the corresponding coefficients at the first stage. Additional implicit support for this way of reasoning comes from the growth literature. Indeed, the general Barro regression is usually stated as $\gamma_i = \beta \ln y_{i0} + \psi X_i + \pi Z_i + \epsilon_i$, which implies that the additional *non canonical* variables are included in Z, meanwhile investment (savings) is also present in X and simultaneity (or collinearity) issues are not considered.

4 Data

The study uses data for the NUTS-2 sub-national territorial units, as classified by Eurostat. Overall, we have informations about regional economies for 20 European countries from 1995 to 2008. The countries are Austria (AT), Belgium (BE), Czech Republic (CZ), Germany (DE), Denmark (DK), Spain (ES), Finland (FI), France (FR), Greece (GR), Hungary (HU), Ireland (IE), Italy (IT), Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Sweden (SE), Slovenia (SI), Slovakia (SK) and the United Kingdom (UK). Variation in sample size occurs for some of the estimates, due to data availability. In particular, we draw gross value added (GVA), employment, capital stock, investment from the Cambridge Econometrics database. We then compute the sector shares as the ratios on aggregate GVA. The focus is on manufacturing, financial services and other market services, since they are the sectors which contribute the most to productivity growth in Europe.[10]

Additional variables included in the augmented model are taken from different sources and they are indicators at the national level.[11] The *implicit tax on labour* is defined as the ratio of (direct and indirect) taxes and social security contributions on employed labour income to total compensation of employees. The *implicit tax on capital* is the ratio between revenue from all capital taxes, and all (in principle) potentially taxable capital and business income in the economy. Both of them are drawn from Eurostat.

The *public budgetary position* is taken from the World Bank and it is computed as the ratio of deficit/surplus over GDP. We will refer to it as *budget balance*. Note that positive values for the variable imply a surplus in public budget for the year. A negative sign for the coefficient implies a *positive* correlation between deficit spending (i.e. increased deficit) and GVA.

[10] See for instance van Ark et al. (2008), O'Mahony et al. (2010) for a sectoral analysis on productivity in Europe. See Rodrik (2013) for an investigation of the role of manufacturing in cross-country convergence. See Martino (2014) for the role of sectoral composition in determining labour productivity dynamics in the European Union.

[11] A summary of variables definition is reported in Appendix A.

The remaining indicators are drawn from the OECD database. The *Employment Protection Legislation* (EPL) indicators refer to the regulation concerning hiring and firing workers and it is expressed in scale 0-6. It is decomposed in EPL for *individual* and *temporary* contracts. It is argued that excessive regulation (i.e., higher values of the indicator) may disincentive firms to employ workers, since firing costs increase. On the contrary, arguments in favour of employment protection concern macroeconomic stability against adverse shocks, as well as job security as a factor favouring human capital investment and productivity (see Cazes and Nesporova, 2003 and OECD, 2013). The *unit labour cost* (ULC) measures the average cost of labour per unit of output and it is given by the labour compensation share on total GDP. It should not be interpreted as a comprehensive measure of competitiveness, but as a reflection of cost competitiveness. Indeed it deals exclusively with the cost of labour and should be considered in relation to changes in the cost of capital, especially in advanced economies. *Trade union density* corresponds to the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners. The *(youth) temporary employment* indicates the share of (15-24 aged) temporary workers for all dependent employees. The *debt/GDP ratio* and the *interbank rate* conclude the list.

Finally, we also consider the relationship between fiscal consolidations and GVA in the long run. We use the dataset developed by Devries et al. (2011), which focuses on discretionary changes in *taxes* and *government spending* motivated by budget deficit reduction. The main scope of the database is to provide data which are independent of the status of the economy. It is argued that fiscal rentrenchments may have positive effects on the economy (Blinder 1997, Barba 2001). The fiscal policies in the EU following the last crisis, as well as the Maastricht criteria, respond to such an hypothesis. We use these data to verify if regions belonging to countries which adopted fiscal consolidation measures perform better in the long run.

Table 1: Descriptive statistics

	Mean	Std.Dev.	Min	Max
GVA*	9.89	1.06	6.34^a	12.94^b
Employment*	6.38	0.87	2.67^a	8.63^b
Capital stock*	11.19	1.03	7.15^c	14.30^b
Labour productivity*	1.56	0.15	1.11^d	2.40^a
ULC*	-0.55	0.21	-1.90 (RO)	-0.26 (SI)
Tax on labour	34.26	10.97	21.6 (PT)	49.30 (SE)
Tax on capital	27.47	7.90	13.40 (SI)	49.90 (DK)
EPL individual	2.46	0.72	1.03 (UK)	4.58 (PT)
EPL temporary	1.80	1.22	0.25 (IE,UK)	4.75 (GR,IT)
Temporary empl. share	12.34	6.91	3.49 (SK)	35.01 (ES)
Temporary empl. youth share	33.84	17.20	6.34 (SK)	76.49 (ES)
Union density	35.44	20.48	7.54 (FR)	83.14 (SE)
Debt/GDP	54.17	25.84	9.22 (CZ)	113.76 (BE)
Budget balance	-1.88	2.99	-9.85 (GR)	6.79 (FI)

Note: * indicates that variables are in logs. ^{a} is the region of Aland (FI), ^{b} is Ile de France (FR), ^{c} is Ciudad de Melilla (ES), ^{d} is Sud-Muntena (RO)

Table 1 reports descriptive statistics for the main variables. Mean and standard de-

viation are in the second and third columns, while minimum and maximum values are in columns 3 and 4. The region with the highest levels of GVA, employment and capital is Ile de France, which includes Paris. The minimum value for capital stock is registered in the Spanish region of Melilla, while Aland (FI) has the lowest value of both employment and GVA. However, the latter is found to be the best performer in terms of labour productivity, defined as the share GVA/employment. Since the labour force is measured in terms of employees, this implies that Aland produces the highest level of GVA per worker. This can be due either to labour being more efficient or to specialization in more productive industries. To account for the latter, in the next Section we control for GVA shares in manufacturing, financial and business-related market services, since they are respectively the most growing and productive sectors in Europe. Specialization also contributes to explain why the lowest productive region is located in Eastern Europe. The Implicit taxes on labour and capital have the highest variation, as the standard deviation suggests. Nordic countries have the maximum values for both, while the lowest are in Portugal and Slovenia for labour and capital respectively. EPL statistics are representative of the different labour market systems in Europe: Mediterranean countries (Portugal, Greece and Italy) have the highest levels of protection, while the United Kingdom has the lowest. The Continental regions are in between. Statistics on temporary employment reveal that the share of workers with temporary contracts is dramatically higher for people in age 16-24. In particular, the recent deregulation of labour markets had a significant impact on Spain, in which 3 young workers out of 4 have a temporary job, while the European mean is 1/3. The ratio of wage and salary earners that are trade union members varies considerably, ranging from 7.54 % (France) to 83.14% (Sweden). Public finance statistics are characterized by high standard deviation. Therefore, even though average Debt/GDP is 54%, some countries have a ratio larger than 1, such as Belgium and Greece after the last crisis, others have very low ratio, such as Czech Republic. Finally, governments are on average deficit spenders. Finland and Greece have respectively the highest surplus and deficit.

5 Estimation results

5.1 The base case

We proceed by estimating our model as described above.[12] The focus is on two sets of variables. The first set describes the degree of regulation of the labour market. It includes the two indexes of employment protection and the measure of trade union density. The second set represents the budget status of the central government. It is composed by the ratio of debt and deficit on GDP. Additional variables are used as controls. Manufacturing and services sector shares account for the structural composition of the economy, which heavily affects the level of output. The increasing deregulation of the labour market during the last decades has changed the composition of employment, with a rise in the adoption of temporary contracts. This is especially true in the countries in which the level of employment protection was higher, as in Spain and in Southern Europe (O'Higgins,

[12]For comparison purpose, various estimations of the basic production function with just capital stock and employment as inputs without any other explanatory variable are presented in Appendix B. Some results for robustness check are discussed in Appendix C.

2012). Therefore, we include the share of temporary employment for the whole labour force, as well for the youth. The implicit tax on capital and labour, and the unit labour cost (ULC) are used as indicators of competitiveness. However, both the ULC and the tax on labour include social contributions for the employees, then we use them alternatively in two different sets of estimates. The interbank interest rate is also included.

Table 2 reports the results. All the variables are in logs, excluding the two indexes of employment protection, the budget balance and the implicit taxes on capital and labour, whose coefficients can be interpreted as semi-elasticities. In model (1) ULC is included among the regressors. The coefficient on employment is 0.241, while the estimated elasticity of GVA with respect to capital is larger (0.385). The coefficient on EPL is negative and significant, while EPL of temporary workers has no significant effect. On the opposite, the density of trade unions is positively associated with higher levels of GVA. The temporary employment shares and ULC have no explanatory power. Interesting results are obtained for what concerns the budgetary variables. Firstly, the debt/GDP ratio is positively associated with higher levels of GVA, with an estimated elasticity around 0.06. Secondly, public deficit has a positive effect, even though the magnitude is minimal and it is significant only at 5%.[13] Finally, there is no significant relationship between the interest rate and GVA, while the tax on capital, although positive, is barely economically relevant. ULC reflects mainly the wage share on country GDP. In model (2) we substitute it for the implicit tax on labour. The related coefficient is negative and significant, suggesting that implicit taxation on labour compensation hinders GVA. However, similarly to the tax on capital, the magnitude of the coefficient is small. Interestingly, the shares of (total and young) temporary employment turn to be significant with relevant explanatory power, though with opposite signs. Temporary contracts among the youth positively affect total output, while their share on total labour force has a negative effect. We can interpret temporary contracts as an incentive for introducing young people in the job market, increasing participation and therefore total production. However, in the long run they are likely to be associated with precarious and low productivity activities, which negatively affects the productive capacity of the economy.[14] Consistently with this interpretation, the coefficient on EPL for temporary workers is now positive and significant, even though its magnitude is low. Finally, the elasticity of GVA to the Union Density almost doubled.

Overall, the results suggest that the deregulation of labour markets is not univocally associated with higher levels of GVA. Even though employment protection has a negative effect on total output, regulation of temporary contracts has either no or positive effect on economic performance. For what concerns budget policies, the estimates show no evidence of a detrimental effect of public debt on economic performance. If any, a positive association is in place, especially for debt/GDP.

[13] Recall that positive values of budget balance indicate budget surplus. Therefore, a negative value of the coefficient indicates a positive relationship between deficit spending and GVA.

[14] Some caution must be used for what concerns the temporary share of youth workers. Indeed, countries differ in the kind of temporary contracts and in the rules for their application and renewal. The difference between the dual apprentice system in Germany and the temporary contracts in Italy and Spain is an example (see O'Higgins, 2012, for an analysis on the topic).

Table 2: Estimation results: the base case

	Model 1	Model 2
Employment	0.241^{***}	0.242^{***}
	(0.010)	(0.009)
Capital stock	0.385^{***}	0.427^{***}
	(0.003)	(0.003)
Manufacturing share	0.079^{***}	0.088^{***}
	(0.011)	(0.010)
Financial share	0.305^{***}	0.312^{***}
	(0.016)	(0.015)
Trans. share	-0.134^{***}	-0.124^{***}
	(0.017)	(0.016)
ULC	-0.006	–
	(0.033)	
Tax on labour	–	-0.010^{***}
		(0.001)
Tax on capital	0.005^{***}	0.005^{***}
	(0.000)	(0.000)
EPL individual	-0.074^{***}	-0.066^{***}
	(0.005)	(0.005)
EPL temporary	-0.002	0.018^{***}
	(0.003)	(0.003)
Temp. empl. share	-0.030	-0.174^{***}
	(0.015)	(0.016)
Temp. empl. youth share	0.002	0.142^{***}
	(0.013)	(0.015)
Trade union density	0.046^{***}	0.081^{***}
	(0.006)	(0.006)
Debt/GDP	0.065^{***}	0.064^{***}
	(0.007)	(0.007)
Budget balance	-0.003^{*}	0.000
	(0.001)	(0.001)
Interest rate	-0.002	-0.007
	(0.007)	(0.006)
Number of obs.	2919	2919

Notes. Standard errors are in parentheses. Significance levels: $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

5.2 Maastricht parameters

Maastricht parameters have been established as a prerequisite to join the Euro area. They are referred to as *convergence criteria* and presented as the conditions a country must respect to safely join the Euro area. In particular, soundness and sustainability of public finances are required, through limits on government borrowing and national debt. Soundness is defined through a threshold of 3% on public deficit relative to GDP. Sustainability requires the ratio Debt/GDP to be lower than 60%.

The sustainability threshold finds its confirmation in Reinhart and Rogoff (2010) empirical study. However, the latter has been shown to be flawed by selective exclusion of available data, coding errors and inappropriate weighting of summary statistics (Herndon et al. 2014). The soundness criterion has not be criticized *per se*, but because of being imposed independently of context considerations. The sustainable deficit should be based on circumstances, including the cyclical state of the economy, prospects for future growth, the level of national savings and investment (Stiglitz, 1999, p.16).

In Table 3 we test the soundness of the convergence criteria, by substituting the budgetary variables of Table 2 with the Maastricht parameters. In particular, $Def/GDP > 3\%$ is a binary variable which takes value 1 if deficit spending is larger than 3% of GDP, i.e. if the *Budget Balance* variable is lower than -3. Similarly, $Debt/GDP > 60\%$ is a binary variable which is equal to 1 if *Debt/GDP* is larger than 60%. The two thresholds are introduced in the first two columns of Table 3, while a different specification for the debt/GDP criterion is used in the third and the fourth regressions where a nonlinear effect of the debt/GDP ratio is investigated. We find that higher levels of debt are still associated with higher GVA levels. However, the effect is indeed nonlinear, since the coefficient on the squared term is negative and significant. Moreover, the elasticity of GVA to debt/GDP is about four-five times higher than in Table 2. Hence, even though threshold gives significant results, a nonlinear expression in debt seems more appropriate, having higher explanatory power. Finally, we find no support for the soundness criterion. Indeed, deficit spending beyond 3% is positively related to GVA. Furthermore, the magnitude of the coefficient is much higher than in Table 2, around ten times for model 1.

We interpret the results as an evidence that public spending in the EU tends to increase aggregate demand and crowd in private investment, rather than crowding it out. Still, an excessively high burden of debt is likely to force the State to reallocate excessive amount of resources to repay interests on debt, hampering economic activity. The negative sign on the interest rate variable seems to confirm such an argument.

5.3 Fiscal consolidations

The analysis above shows that deficit spending and debt are not associated with lower levels of GVA. On the opposite, a reversed argument could be told. A further interesting piece of the story would be to understand if regions belonging to countries which undertake budget balancing policies are likely to have higher GVA levels in the long run. Note that this is a different exercise than analysing the short term effects of fiscal consolidations, i.e. the relationship between the growth rate of GDP and fiscal consolidations.[15]

[15]The positive effect of fiscal consolidations on economic growth is usually referred to as the non-Kenyesian effect, or expansionary austerity. For some empirical reviews on the topic, see, for instance, Giudice et al. (2007), Guajardo et al. (2014), and Medvedev and Seth (2014).

Table 3: Estimation results: Maastricht parameters

	Model 3	Model 4	Model 1a	Model 2a
Employment	0.217^{***}	0.220^{***}	0.269^{***}	0.259^{***}
	(0.009)	(0.009)	(0.010)	(0.009)
Capital stock	0.389^{***}	0.445^{***}	0.383^{***}	0.423^{***}
	(0.003)	(0.009)	(0.003)	(0.003)
Manufacturing share	0.076^{***}	0.086^{***}	0.081^{***}	0.088^{***}
	(0.011)	(0.010)	(0.011)	(0.010)
Financial share	0.332^{***}	0.336^{***}	0.328^{***}	0.326^{***}
	(0.016)	(0.015)	(0.016)	(0.015)
Trans. share	-0.097^{***}	-0.093^{***}	-0.134^{***}	-0.124^{***}
	(0.017)	(0.016)	(0.017)	(0.016)
ULC	-0.048	–	-0.023	–
	(0.033)		(0.032)	
Tax on labour	–	-0.010^{***}	–	-0.009^{***}
		(0.001)		(0.001)
Tax on capital	0.006^{***}	0.006^{***}	0.003^{***}	0.004^{***}
	(0.000)	(0.000)	(0.000)	(0.000)
EPL individual	-0.072^{***}	-0.065^{***}	-0.082^{***}	-0.072^{***}
	(0.005)	(0.005)	(0.005)	(0.005)
EPL temporary	0.017^{***}	0.034^{***}	0.011^{***}	0.024^{***}
	(0.003)	(0.003)	(0.003)	(0.003)
Temp. empl. share	-0.055^{***}	-0.176^{***}	-0.045^{**}	-0.167^{***}
	(0.015)	(0.016)	(0.015)	(0.016)
Temp. empl. youth share	0.014	0.138^{***}	-0.019	0.113^{***}
	(0.013)	(0.014)	(0.013)	(0.015)
Trade union density	0.086^{***}	0.118^{***}	0.046^{***}	0.078^{***}
	(0.006)	(0.006)	(0.006)	(0.006)
Debt/GDP $> 60\%$	-0.063^{***}	-0.047^{***}	–	–
	(0.008)	(0.008)		
Debt/GDP	–	–	0.342^{***}	0.231^{***}
			(0.030)	(0.030)
$(\text{Debt/GDP})^2$	–	–	-0.041^{***}	-0.024^{***}
			(0.004)	(0.004)
Def/GDP $> 3\%$	0.033^{***}	0.023^{***}	–	–
	(0.006)	(0.006)		
Budget balance	–	–	0.000	0.002
			(0.001)	(0.001)
Interest rate	-0.016^{*}	-0.016^{*}	-0.032^{***}	-0.023^{***}
	(0.007)	(0.006)	(0.008)	(0.007)
Number of obs.	2919	2919	2919	2919

Notes. Standard errors are in parentheses. Significance levels: $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

Table 4: Estimation results: Fiscal consolidations

	Model 5	Model 6	Model 7	Model 8
Employment	0.340***	0.358***	0.359***	0.368***
	(0.029)	(0.031)	(0.029)	(0.031)
Capital stock	0.514***	0.582***	0.510***	0.579***
	(0.007)	(0.006)	(0.006)	0.006)
Manufacturing share	0.130***	0.126***	0.129***	0.127***
	(0.016)	(0.015)	(0.016)	(0.015)
Financial share	0.342***	0.346***	0.338***	0.340***
	(0.024)	(0.025)	(0.024)	(0.024)
Trans. share	0.029	0.014	0.047	0.040
	(0.039)	(0.037)	(0.039)	(0.038)
ULC	−0.252**	–	−0.135	–
	(0.090)		(0.098)	
Tax on labour	–	−0.002	–	−0.002
		(0.001)		(0.001)
Tax on capital	0.007***	0.007***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
EPL individual	−0.149***	−0.160***	−0.165***	−0.173***
	(0.011)	(0.010)	(0.012)	(0.011)
EPL temporary	0.006	0.013**	0.006	0.011*
	(0.004)	(0.004)	(0.004)	(0.004)
Temp. empl. share	0.073*	0.058	0.099**	0.068
	(0.037)	(0.036)	(0.037)	(0.036)
Temp. empl. youth share	0.054	0.062	0.057	0.084*
	(0.036)	(0.033)	(0.036)	(0.034)
Trade union density	0.048***	0.045***	0.043***	0.042***
	(0.013)	(0.011)	(0.013)	(0.011)
Debt/GDP	0.043*	0.076***	0.033	0.053***
	(0.018)	(0.014)	(0.018)	(0.015)
Budget balance	−0.012***	−0.013***	−0.011***	−0.011***
	(0.002)	(0.002)	(0.002)	(0.002)
Total contractionary	0.225***	0.207***	–	–
	(0.034)	(0.034)		
Total contr.×Debt/GDP	−0.047***	−0.042***	–	–
	(0.007)	(0.007)		
Tax increase	–	–	0.275***	0.291***
			(0.047)	(0.047)
Tax increase×Debt/GDP	–	–	−0.063***	−0.067***
			(0.011)	(0.011)
Exp. cuts	–	–	0.052	0.003
			(0.067)	(0.063)
Exp. cuts×Debt/GDP	–	–	0.005	0.018
			(0.017)	(0.016)
Interest rate	−0.022	−0.011	−0.010	−0.006
	(0.014)	(0.015)	(0.014)	(0.014)
Number of obs.	947	947	947	947

Notes. Standard errors are in parentheses. Significance levels: $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

We use the dataset developed by Devries et al. (2011), which focuses on discretionary changes in taxes and government spending primarily motivated by a desire to reduce the budget deficit, independently of economic conditions. Contemporaneous policy documents are examined to identify the rationale of the fiscal policy. As a result, the latter are unlikely to be systematically correlated with other developments affecting output, and are thus valid for estimation purpose (Devries et al. 2011). The variable is given by the size of the deficit reduction over GDP. Note that a side effect of the selection criterion is that the variable takes mostly values equal to zero. Moreover, the sample size is sharply reduced. Therefore, the following results must be interpreted with caution.

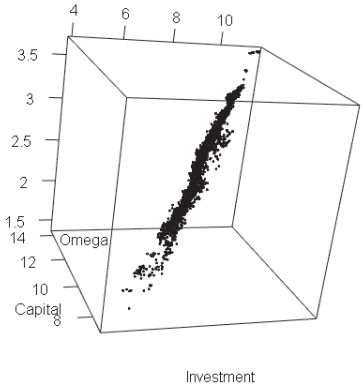
Table 4 reports the results for the two main specifications. The first and second columns (Models 5 and 6) use the total value of the fiscal consolidation over GDP, i.e. tax increases and expenditure cuts. The coefficient is positive and significant. However, such an effect is lessened in the regions belonging to more indebted countries. Note also that the elasticity of GVA to ULC becomes negative and significant. Since ULC is the wage share on total output, this may imply that the disincentive to production dominates the positive consumption effect due to higher wages. The third and fourth columns (Models 7 and 8) decompose the fiscal consolidation in tax and expenditure components. It turns out that the positive effects is entirely due to the increase in taxation, while no effect is attributed to expenditure cuts. We may interpret this as an indicator of a better use of available resources.

6 Specification tests

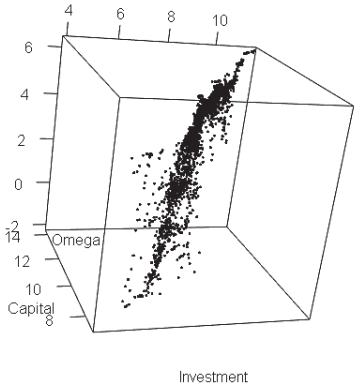
The model we estimate rests on the assumptions about the proxy for the unobserved term. Firstly, estimates are consistent only if the investment proxy can be expressed as a monotonically increasing function of both ω_{it} and capital stock. As long as this is true, then $s_{it} = (\omega_{it}, k_{it})$ can be inverted with respect to ω_{it} and the procedure is valid. However, if this is not the case, then the approach is inappropriate. Secondly, we do not include contemporaneous employment in the investment function and this leads directly to our estimate of the coefficient β_l. Again, if employment belongs to the investment equation, we are not able to obtain a consistent estimate at the first stage. In this section we perform two specification tests to verify empirically the two assumptions.

The first one is the monotonicity test as proposed by Levinshon and Petrin (2003). We just visually examine $\omega_{it} = f^{-1}(s_{it}, k_{it})$ by plotting the smoothed function and looking for its monotonicity. The three panels of Figure 1 show the plots for the basic production function with only capital and employment (see also Table B1 in Appendix B) and for Model 1 and Model 2 in Table 2. Estimation of ω_{it} is on the vertical axis, while capital and investment are on the horizontal ones. The smoothed function is increasing in investment and capital, and this turns out to be true for each specification of the model. Therefore, we can conclude that monotonicity holds and that our theoretical assumptions appear verified empirically.

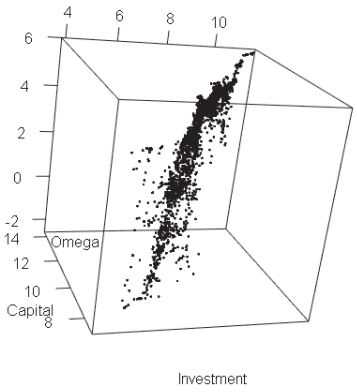
Secondly, our assumption about the investment function leads to the estimation of the coefficient on employment in the base model, as well as of the other coefficients in the augmented specification. In particular, if our assumption holds, l_{t-1} is mean independent of the residuals in t. However, if it is not the case, the estimate of β_l in the first stage is incorrect. We adapt the robustness test in Olley and Pakes (1996, p.1284) to our



(a) Basic production function



(b) Augmented model (1)



(c) Augmented model (2)

Figure 1: Estimations of ω_{it}.

Table 5: Specification test

	Test
l_{it-1}	0.001
	(0.006)
k_{it}	0.603
	(0.002)
Number of obs.	3542

Notes. Standard errors are in parentheses. Significance levels: $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

framework to test whether β_l has been obtained correctly. Given the high correlation between l_{t-1} and l_t (0.99), then in the following productivity equation

$$y_{it} - \hat{\beta}_l l_{it} = \beta_0 + \beta_k k_{it} + f^{-1}(s_{it}, k_{it}) + \epsilon_{it} + \gamma l_{it-1}, \tag{13}$$

the coefficient on l_{it-1} will be significant if the first stage estimate $\hat{\beta}_l$ is obtained with error. Therefore, we estimate equation (13) and report the results in Table 5. The estimate of γ is not significant, while the coefficient on capital is barely different from the base specification. This provides support to our specification.

7 Conclusions

This study analysed the long-term relationship between indicators of labour market regulation, public finance parameters and GVA. We used the estimator procedure as proposed by the *structural literature*, augmenting the model with the additional variables of our interest (labour market protection and fiscal parameters). Therefore, we obtained consistent estimates of the parameters by approximating nonparametrically any unobserved factor influencing likely endogenous regressors. Moreover, less stringent assumptions were needed about endogeneity, differently from the GMM approach.

Some interesting implications for policy can be drawn. Indeed, we do not find univocal evidence of a detrimental effect of labour protection on the long term performance of regional economies. Even though a negative relationship is found for EPL (individual contracts), regulating hiring and firing for temporary workers is associated with higher GVA. Consistently, even though the share of temporary workers among the youth is positively related to economic performance, the share on the whole labour force negatively affects output. These results suggest that on the job security over the life of workers is associated with a higher long-run GVA, while *tout-court* deregulation is not a prerequisite for a better performance. For what concerns the fiscal indicators, the estimates show that larger debt/GDP and deficit/GDP ratios are associated with a higher output. This is especially true for deficit spending over the 3% threshold established by the convergence criteria. Such an evidence can be interpreted as a support for crowding in and expansionary effects of public expenditure, while debt is found to be detrimental for economic performance only when its share on GDP is really large.

As for future research, the relationship between the structure of the labour market and economic performance can be further investigated by considering additional features. Apprenticeship systems and active policies can facilitate the inclusion in the labour market of the unemployed and avoid the depletion of skills, increasing GVA per worker in the long run. Moreover, as the estimation procedure allows to specify several production functions, it would be interesting to investigate the results obtained with different specifications of the model.

A Summary of variables definition

Variable	Definition
GVA	Gross Value Added at 2000 constant prices.
Employment	Number of workers.
Manufacturing share	Share of GVA in manufacturing on total GVA.
Financial serv. share	Share of GVA in financial market services on total GVA.
Business related serv. share	Share of GVA in business-related and other market services on total GVA.
ULC	Unit Labour Costs measure the average cost of labour per unit of output and are calculated as the ratio of total labour costs to real output. ULC should not be interpreted as a comprehensive measure of competitiveness, but as a reflection of cost competitiveness.
Implicit tax on labour	Sum of direct taxes, indirect taxes and compulsory actual social contributions paid by employees and employers on labour employed, divided by compensation of employees increased by wage bill and payroll taxes.
Implicit tax on capital	Ratio between revenue from all capital taxes, and all (in principle) potentially taxable capital and business income in the economy, such as net operating surplus of corporations and non-profit institutions, imputed rents of private households, net mixed income by self-employed, net interest, rents and dividends, insurance property income.
EPL	Indexes of employment protection concerning the legal procedures to fire workers, both individually and collectively. Each index is built using several item which aggregate to the indicator. An index for temporary contracts is also used. All indicators are expressed in scale 0-6.
Temporary employment share	Ratio of temporary employment for dependent employees of all ages.
Temporary employment share for the youth	Ratio of temporary employment for dependent employees in the age 15-24
Trade Union Density	Ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners.
Debt/GDP	Central government debt, divided by Gross Domestic Product.
Budget Balance	Central government deficit (<0) or surplus (>0), divided by Gross Domestic Product.
Fiscal consolidations	Fiscal actions primarily motivated by the desire to reduce the budget deficit and not by a response to prospective economic conditions. Policy makers' intentions and actions are taken from contemporaneous policy documents (Devries et al. 2011).
Interest rate	This is the "call money" interest rate set by the monetary authority. Therefore we have 1 value for the Euro area plus several values for non Euro countries

Note: Definitions are taken from the respective data source of each variable.

B Estimation of the basic production function

We consider the basic production function with just capital stock and employment as inputs without any other explanatory variable (i.e. $Y_{it} = A_{it}K_{it}^{\beta_k}L_{it}^{\beta_l}$). Our model leads to elasticities of employment and capital respectively of 0.11 and 0.58. The ratio of the coefficients is in line with the results of Bresson et al. (2011), in which the coefficient of labour is lower than the one of capital. Similar results are obtained by Levinson and Petrin (2003), while Olley and Pakes (1996) find inverted ratios. In Table B1 we compare our estimates with other four specifications, respectively OLS, fixed effect within estimator (FE) and two alternative GMM models. The first GMM model treats employment as endogenous, the second one treat both capital and employment as endogenous. In both cases the first lag of the endogenous variable is used as instrument.

OLS yields implausible estimates, since it is not suited to deal with panel data. The coefficient on capital is rather constant across the specifications. Our estimate for the elasticity of employment is roughly half of what obtained with FE and GMM. As a further robustness test we estimated the model by approximating $\phi(s_{it}, k_{it})$ as a third-order polynomial in k_{it} and s_{it}, following the algorithm in Petrin et al. (2004). The results are reported in the last column. The resulting coefficients for employment and capital are 0.108 and 0.558, respectively.

Table B1: The basic production function

	OLS	FE	GMM (1)	GMM (2)	Model 0
Employment	0.090***	0.257***	0.191***	0.176***	0.108***
	(0.008)	(0.019)	(0.029)	(0.032)	(0.006)
Capital	0.940***	0.585***	0.601***	0.616***	0.585***
	(0.006)	(0.008)	(0.012)	(0.013)	(0.002)
Adjusted R^2	0.944	0.689	0.721	0.739	
Number of obs.	3542	3542	3542	3289	3542

Notes. Standard errors are in parentheses. Significance levels: $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

C Robustness check

The model allows to control for any unobserved factor (or shock) that may cause simultaneity or endogeneity issues. The scope of the procedure is to approximate ω_{it} in order to get consistent estimates of the coefficients. Here, we compare our results of the augmented model with the fixed effect within estimator. Results for the OLS estimator are included as a reference. It should be noted that two alternative GMM models, where endogeneity for employment and capital is taken into account, have been also estimated. The results are however not reported here as they are not conclusive.

Table C1 reports the results for the two augmented models. The OLS specification is clearly inappropriate, the coefficient on capital is around two times the magnitude of the other estimators. The FE estimator presents some differences with respect to our specification. In particular, the coefficients for debt/GDP, individual EPL, tax on capital and trade unions density have opposite signs. Moreover, the elasticity of GVA with respect

to employment is more than doubled. As remarked by Levinsohn and Petrin (2003), a within estimator eliminates between-firm variation which can be important for obtaining precise estimates of the other coefficients. This may be affecting the results. We observe that the estimates obtained with GMM do not greatly differ from the FE model. We also estimated the augmented models by using the Levinsohn and Petrin (2004) algorithm, in which the kernel semi-parametric function is replaced by a polynomial expression in s_{it} and k_{it}. Results are substantially the same as our semi-parametric model.

Another possible explanation for the different coefficients in the FE model is the variation in sample size. Indeed, the augmented model reduces the sample from 3542 to 2919 observations. The samples' composition is reported in Table C2. In the augmented specification observations from some *peripheral* countries are dropped. In particular Spanish (ES) and Polish (PL) regions are almost halved, while Greek (GR), Irish (IE), Romanian (RO) and Slovenian (SI) regions are completely wiped out. The smallest sample is somehow more representative of the richest regions of the EU and this may affect the results of the alternative models. To control also for this possibility, we re-estimate the base model using only the smallest subsample. Results are reported in Table C3. Excluding the OLS case, the elasticity of employment increases for every estimator, while the coefficient on capital decreases. The rise of the former is greater for the alternative models and it is particularly evident for the FE estimator. However, excluding the within estimator, the magnitude of the coefficient is still higher for capital. Overall, the estimator we adopt gives much more stable results than the alternatives, even when the sample size is substantially reduced. Differently, the changes in magnitude of FE and the GMM estimator may partially be attributed to sample size.

Table C1: Robustness check for the augmented model

	Model 1	Model 2	OLS 1	OLS 2	FE 1	FE 2
Employment	0.241^{***}	0.242^{***}	0.269^{***}	0.237^{***}	0.575^{***}	0.578^{***}
	(0.010)	(0.009)	(0.013)	(0.011)	(0.021)	(0.021)
Capital stock	0.385^{***}	0.427^{***}	0.711^{***}	0.742^{***}	0.303^{***}	0.344^{***}
	(0.003)	(0.003)	(0.013)	(0.011)	(0.013)	(0.011
Manufacturing share	0.079^{***}	0.088^{***}	0.035^{**}	0.052^{***}	0.095^{***}	0.059^{***}
	(0.011)	(0.010)	(0.013)	(0.011)	(0.013)	(0.013)
Financial share	0.305^{***}	0.312^{***}	0.380^{***}	0.325^{***}	0.126^{***}	0.107^{***}
	(0.016)	(0.015)	(0.022)	(0.019)	(0.014)	(0.013)
Trans. share	-0.134^{***}	-0.124^{***}	-0.090^{***}	-0.062^{***}	-0.015	-0.039^{*}
	(0.017)	(0.016)	(0.021)	(0.019)	(0.017)	(0.017)
ULC	-0.006	–	0.371^{***}	–	0.136^{***}	–
	(0.033)		(0.044)		(0.019)	
Tax on labour	–	-0.010^{***}	–	-0.023^{***}	–	-0.003^{***}
		(0.001)		(0.001)		(0.001)
Tax on capital	0.005^{***}	0.005^{***}	0.012^{***}	0.009^{***}	-0.003^{***}	-0.003^{***}
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
EPL individual	-0.074^{***}	-0.066^{***}	-0.053^{***}	-0.060^{***}	0.075^{***}	0.065^{***}
	(0.005)	(0.005)	(0.007)	(0.006)	(0.010)	(0.010)
EPL temporary	-0.002	0.018^{***}	0.027^{***}	0.064^{***}	0.043^{***}	0.048^{***}
	(0.003)	(0.003)	(0.004)	(0.004)	(0.002)	(0.002)
Temp. empl.	-0.030	-0.174^{***}	0.060^{**}	-0.309^{***}	0.039^{***}	0.008
	(0.015)	(0.016)	(0.020)	(0.020)	(0.011)	(0.011)
Temp. empl. youth share	0.002	0.142^{***}	-0.026	0.329^{***}	0.016	0.053^{***}
	(0.013)	(0.015)	(0.020)	(0.018)	(0.011)	(0.010)
Trade union density	0.046^{***}	0.081^{***}	0.125^{***}	0.173^{***}	-0.227^{***}	-0.270^{***}
	(0.006)	(0.006)	(0.008)	(0.007)	(0.011)	(0.009)
Debt/GDP	0.065^{***}	0.064^{***}	0.016	0.038^{***}	-0.026^{***}	-0.040^{***}
	(0.007)	(0.007)	(0.010)	(0.008)	(0.005)	(0.005)
Budget balance	-0.003^{*}	0.000	-0.003	0.004^{*}	0.003^{***}	0.002^{***}
	(0.001)	(0.001)	(0.002)	(0.002)	(0.000)	(0.000)
Interest rate	-0.002	-0.007	-0.032^{**}	-0.046^{***}	-0.004	-0.008^{**}
	(0.007)	(0.006)	(0.011)	(0.009)	(0.003)	(0.003)
Intercept	–	–	0.166	0.152	–	–
			(0.146)	(0.124)		
Adjusted R^2			0.967	0.975	0.804	0.803
Number of obs.	2919	2919	2919	2919	2919	2919

Notes. Standard errors are in parentheses. Significance levels: $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

Table C2: Samples composition

	AT	BE	CZ	DE	DK	ES	FI	FR	GR	HU
BASIC	126	154	112	546	70	266	70	308	182	98
AUGM.	126	154	112	546	60	171	60	308	0	84
	IE	IT	NL	PL	PT	RO	SE	SI	SK	UK
BASIC	28	294	168	224	70	112	112	28	56	518
AUGM	0	294	168	128	70	0	96	0	24	518

Table C3: The basic model with the smallest subset

	OLS	FE	GMM (1)	GMM (2)	Model 0
Employment	0.031^{**}	0.485^{***}	0.339^{***}	0.362^{***}	0.117^{***}
	(0.011)	(0.026)	(0.045)	(0.044)	(0.009)
Capital	0.995^{***}	0.466^{***}	0.526^{***}	0.516^{***}	0.465^{***}
	(0.010)	(0.010)	(0.016)	(0.016)	(0.002)
Adjusted R^2	0.943	0.713	0.753	0.754	
Number of obs.	2919	2919	2691	2691	2919

Notes. Standard errors are in parentheses. Significance levels: $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

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