MARKET REGULATIONS AND INVESTMENT IN EUROPEAN REGIONS

Javier Escribá[*] *and Mª José Murgui*[*]

D-2015-04

September, 2015
(preliminary draft)

[*] University of Valencia, Spain.

e-mail corresponding authors: Maria.j.murgui@uv.es ; Francisco.j.escriba@uv.es

The authors gratefully acknowledge the financial support of the ERDF.

This document is available at: http://www.sepg.pap.minhap.gob.es/sitios/sepg/es-ES/Presupuestos/Documentacion/Paginas/Documentacion.aspx

Abstract
This paper investigates the impact of product and labour market imperfections on non-farm business sector investment in European regions for the period 1995-2007, using dynamic panel and GMM methods. We derive and estimate a Euler investment equation that accounts for the influence of national regulation of markets, which may affect regional capital-intensive technologies, mark-up, adjustment cost and, therefore, business investment. Moreover, other conventional factors are introduced into the investment equation, such as the rate of corporate profits proxy liquidity conditions. Our empirical findings show that investment is negatively correlated with the level of national product market regulation. Product market regulations (barriers to entrepreneurship and to trade and investment) decrease the productivity of capital and increase adjustment costs and mark-up, which have negative effects on European regions' investment. Corruption leads to increased operational costs, creates uncertainty and thereby deters investment. Greater labour market regulation also means higher firing costs and, therefore, higher labour costs. Accordingly, in European regions between 1995 and 2007, there was a substitution effect of labour with capital, with the consequence of likely higher capital accumulation growth rates.

Keywords: *Panel data, Investment, Regulation, European Regions*

Clasificación JEL: C23, E22, L51, R58

1.-Introduction

This paper is an empirical investigation into the effects of regulation on business investment in European regions, over the period dating from 1995 to 2007. The aim of this paper is to analyse the effect of the intensity of regulations in the goods and labour markets within a basic theoretical framework of investment determinants.

Most of the literature on market regulation has focused primarily on its effects on unemployment or on productivity[1]. Although most studies analyse the relationship between investment and credit constraints, to the best of our knowledge there is very little economic literature addressing the effect of imperfections in the labour market[2] and products[3] on investment. Exceptions are Rendon (2004) and Wasmer and Weil (2004), which theoretically analyse the impact of labour market imperfections and credit constraints on investment. Within this field, it is worth mentioning the work of Alesina et al. (2005), who find evidence in several sectors of many OECD countries that strict government regulation on entry deters investment. Their model predicts that deregulation working either through reduced mark-up or lower adjustment costs will lead to an increase in investment and the capital stock. Klapper, Laeven, and Rajan (2006), using data for 3.5 million European firms, find that over-regulation is a barrier to entrepreneurship. Almeida and Carneiro (2005) find an inverse relationship between stricter enforcement of labour standards and investment in Brazil using firm-level data on informal employment in 2002. Calcagnini, Giombini and Saltari (2009) and Calcagnini, Ferrando and Giombini (2014) show a negative correlation between product, labour and financial market imperfections and investment in a panel of European firms over the period 1994-2000. Cingano et al. (2014) find that an increase in firing costs leads to an increase in the capital-labour ratio in firms with fewer than 15 employees in Italy over the period 1986-1994. Cambini and Rondi (2012) show for a large sample of EU publicly-traded regulated firms from 1994 to 2004, that when an Independent Regulatory Agency (IRA) is in place, or when the regulator is more independent, investment in the public utility sector increases. Cambini and Spiegel (2011) show that when an IRA is in place, investment in regulated firms increases.

Studies of the role of market regulation at the regional level are still scarce, except those related to disparities in regional unemployment rates. Generally speaking, studies on the effects of market imperfections on investment are based on countries and panels of firms: we know of no such studies at the regional level. The literature estimating regional investment functions is also very scarce[4], despite the fact that regional economic dynamics are closely linked to investment performance. This paper integrates research on factors related to the regulation of domestic markets along with regional factors that can affect regional investment behaviour.

---

[1] Blanchard and Giavazzi (2003), for example, develop an insightful model of both labour market and product market regulation and their interconnection; and Nicoletti and Scarpetta (2003) find that product market regulation lowers multifactor productivity growth in OECD countries. Indirectly, factors that raise productivity also raise investment. Total factor productivity tends to be lower if there is a low level of competition in the product market and a high level of product market regulation including high barriers to entry. Griffith and Harrison (2004) and Griffith, Harrison and Simpson (2006), suggest that competition boosts R&D, innovation and hence investment.

[2] In some literature, unions are typically associated with lower investment (see, for example, Metcalf (2002) and Hirsch (2004)). Unions, by capturing quasi-rents or otherwise, will tend to raise wages and hence reduce investment. Unions are often more effective in the presence of strong employment protection and legislation but are much weakened if the firm faces a high level of product market competition.

[3] Corruption is one of the subcomponents of business regulation in the EFW (Economic Freedom of the World, Fraser Institute) index. See Shleifer and Vishny (1993) and Mauro (1995, 1996).

[4] See Escribá and Murgui (2009) for a survey of regional functions of investment estimation.

The databases used are the BD.EURS (NACE Rev1)[5], OECD indicators of market regulation and the Fraser Institute. The 121 regions (NUTS2) considered are from nine countries: Germany, Austria, Belgium, Spain, France, Netherlands, Italy, Portugal and Sweden[6]. During the period under study, the process of economic integration in the EU led to reforms in the regulatory framework towards greater liberalization in product and labour markets subject to greater competition. Although, in general, regulation has become less restrictive, this has occurred to different degrees, to different extents and with differential impacts across the EU regions. We focus on these different regulatory reforms in each country in order to study their effects on productive private sector investment in European regions. Nor has investment behaviour been homogeneous in this period in the different countries and regions. With the exception of Italy, there was a general fall in productive investment from 2000 onwards, which was especially pronounced in the Netherlands, Germany, Austria and even France. Regionally, the average rate of investment (I/K) is particularly low in French regions and some Spanish regions whereas the highest values are found in Swedish regions, some Spanish regions and especially Italian regions.

In order to study the role played by market imperfections in regard to regional business investment, we derive and estimate a structural investment function: a Euler equation as in Bond and Meghir (1994), augmented with product and labour market regulation variables. This function is estimated using the Generalized Method of Moments (Arellano and Bond, 1991) in order to deal with explanatory variable endogeneity and sample heterogeneity accordingly. Our empirical findings show that investment is negatively correlated with the level of national product market regulation. Product market regulations (barriers to entrepreneurship and to trade and investment) decrease the productivity of capital and increase adjustment costs and mark-up, which have negative effects on European regional investment. Corruption (extra payments/bribes/favouritism) raises operational costs, creates uncertainty and thereby deters investment. Higher employment protection legislation values also mean higher firing costs and, therefore, higher labour costs. Accordingly, in European regions between 1995 and 2007, there was a substitution effect of labour with capital, with the consequence of likely higher capital accumulation growth rates.

The paper is organized as follows. In section 2, investment behaviour in Europe and in the 121 regions is reviewed. In section 3, the theoretical framework combining regional determinants and national regulation determinants is defined. In section 4, data and sources are described and the estimation results are discussed. In the final section the main conclusions are presented.

[5] See Escribá and Murgui (2014a and 2014b). The basic source of this database is EUROSTAT, so ensuring its compatibility with AMECO and EU-KLEMS, which is why it commences in 1995. The lack of homogeneous data for the remainder of the European regions, especially for data relating to the GFCF, determined the final choice of regions that were included in this database. This European regional database, in year 2000 euros, is compiled by the Budget General Directorate of the Spanish Ministry of Economic and Financial Affairs and is available on the following web page: http://www.sepg.pap.minhap.gob.es/sitios/sepg/es-ES/Presupuestos/Documentacion/Paginas/BasededatosBDEURS.aspx

[6] Appendix 1, details the regions from the nine countries.

2. Investment behaviour in Europe and European regions.

Although investments may be very volatile at firm level, cyclical trends can be observed at the macro (country and regional) level. Figure 1 shows the investment rate for our nine European countries, USA and EU-15, with investment in fixed assets as a percentage of value added created in the production process. From 1995 to 1999 the investment rate shows a positive pattern. After a fall starting in 2001, the investment rate of our nine countries and the EU grew from 2004 onwards. Similar patterns were observed in the United States and EU-15, whose investment cycles broadly overlap. Germany, the Netherlands, Austria, Belgium, Portugal and Sweden also experienced a downward trend of the investment rate after 2001, but the drop was less prominent in France and was not observed in Italy and Spain. Indeed, Spain experienced a significant increase in its investment rate from 29 % in 2000 to 34.2 % in 2007.

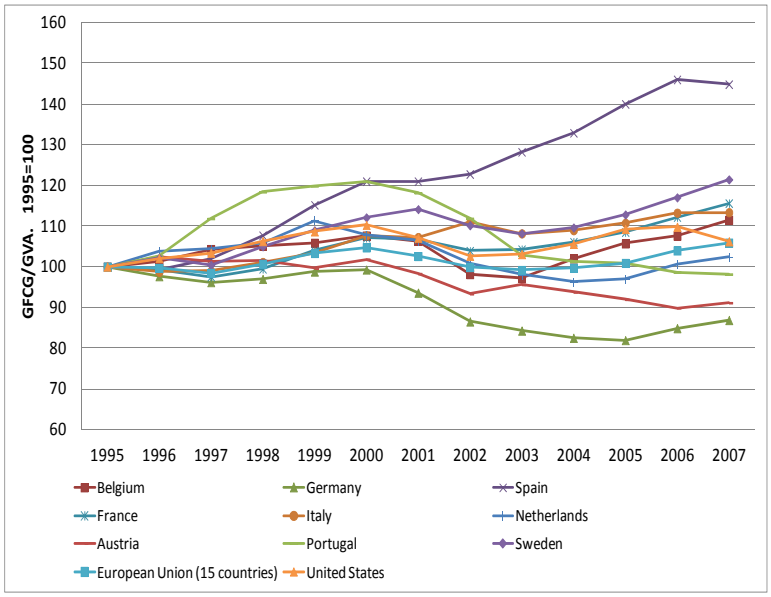


Figure 1. Relative changes in the ratio of gross fixed capital formation (GFCF) to gross value added (GVA), 1995=100. Source: AMECO

Investment rates showed sizable disparities across Europe in 2007. The highest investment rates were recorded in Spain (34.2%) and Portugal (25.7% in 2007 and 31.6% in 2000), and the lowest in Germany and France (22%). This can be partly explained by the relative importance of construction investment, rather than investment in productive capital. Gross investment in construction is more than 60% in Spain (69% in 2006) and Portugal, and less than 50% in Sweden (under 40%), Germany and Belgium, as can be seen in figure 2. Moreover, besides differences in investment intensity, there are also significant differences in the composition of investment. According to the European System of Accounts (ESA 95), "fixed assets" consists of six broad asset types: dwellings; other buildings and structures; transport equipment; other machinery and equipment; cultivated assets; and intangible assets. Making up more than a third of overall fixed investment, machinery and equipment is the asset type with the largest share of fixed investment (41% in Sweden, 38% in Belgium but only 28% in Spain). Gross investment in construction (dwellings and other buildings and structures) is more or less equally distributed between dwellings and other buildings and structures. Intangible

assets such as software, mineral exploration and specialized knowledge make up almost the entire group of "Other Investment" (generally above 10% but 25% in Sweden and only 8% in Spain).

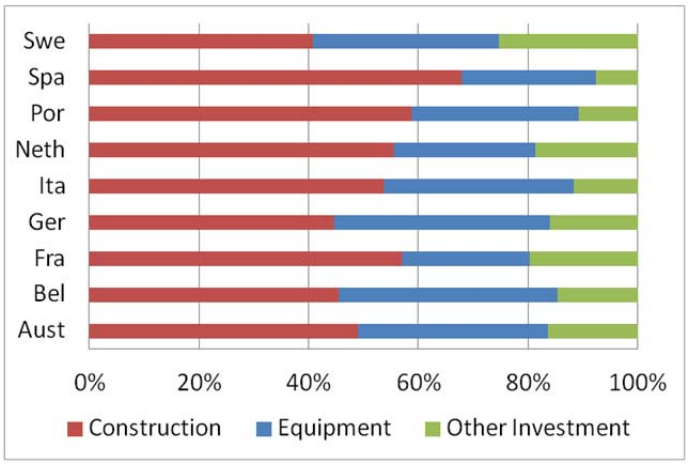


Figure 2. Composition of investment in 2007. Source: AMECO

In this paper we will focus on defining one sector as close as possible to the productive business sector. The business sector plays a key role in productive investment and therefore in economic growth. However, individual households, government and not-for-profit organizations are not included in the business sector[7]. The existing sectorial breakdown of Eurostat NACE Rev 1 does not allow a complete representation of the business sector after eliminating real estate and financial, agriculture and non-market services; the resulting sector is called the non-farm business sector. Figure 3 shows the rate of productive investment during the 1995-2007 period.

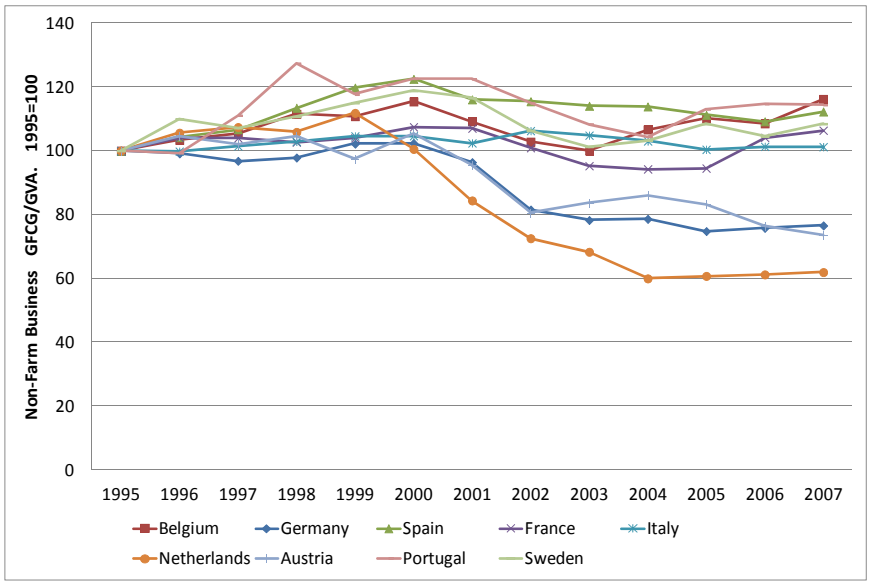


Figure 3. Relative changes in the ratio of gross fixed capital formation to gross value added, in the non-farm business sector. 1995=100. Source: BD.EURS

[7] Investment behavior in these excluded branches depends on different makers than strictly business and responds to other different economic and institutional variables.

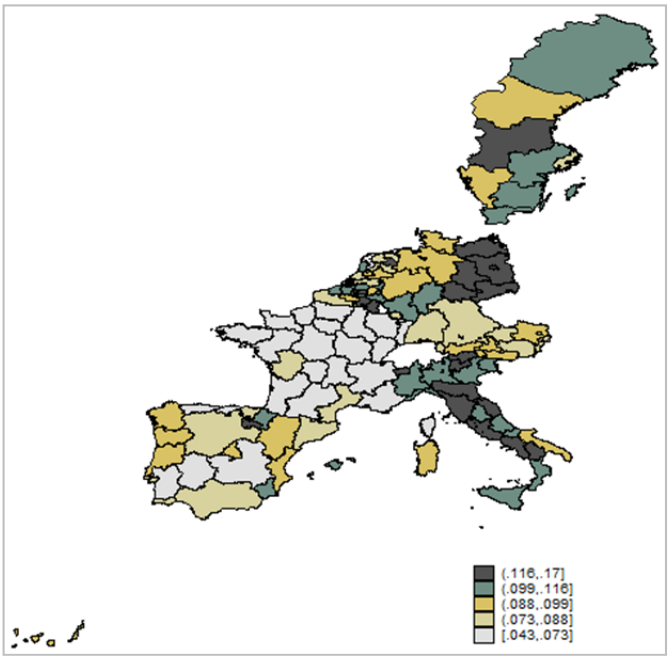


Figure 4. European regions I/K in 1995. Non-farm business sector
Source: BD.EURS data and own elaboration

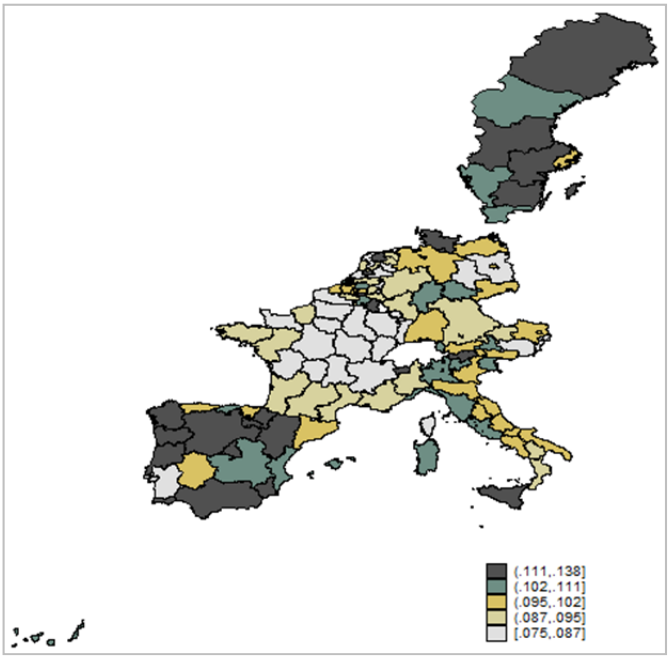


Figure 5. European regions I/K in 2007. Non-farm business sector
Source: BD.EURS data and own elaboration

The fall in productive investment, except in Italy, generally occurs from 2000 and the drop is particularly marked in the Netherlands, Germany and Austria (and even France). As regards regional behaviour, figures 4 and 5 show the I/K ratio in the year at the beginning

(1995) and the end (2007) of the period under study. They are separated into five quantiles, represented in a range from light to dark colours. Thus, regions that appear lighter in colour belong to the lowest I/K ratio and those that are darker belong to the higher levels. The lowest I/K values in 1995 are found in French regions as well as some Spanish and Portuguese regions whereas the highest values are for Swedish, German and Dutch regions, and especially Italian regions. Spanish regions show higher investment rate values at the end of the period under study. Moreover, the values are particularly low in some German and Dutch regions, and very low in all French regions.

3. A structural model and econometric methods

Most studies have assessed the relationship between regulation and investment using an empirical equation that integrates a neoclassical (accelerator-type) investment model (with quadratic adjustment cost) augmented with variables of financial, products and labour market imperfections (Calcagnini, Giombini and Saltari, 2009; and Calcagnini, Ferrando and Giombini, 2013, 2014).There is no strict derivation of a structural investment equation. The most solid attempts can be found in Alesina et al (2005) and Cambini and Rondi (2012). Alesina et al (2005) represents the most comprehensive attempt to integrate those determinants of investment that are related to imperfections in different markets and so we will make several references to this work. Cambini and Rondi (2012) use a Euler equation in its Bond and Meghir (1994) version, although artificially extended to include the regulatory variables.

In this section we present a structural model in which these dynamic elements appear explicitly in the optimization problem and the estimated coefficients are linked explicitly to the underlying technology and expectation parameters. We will use an approach that combines the Euler equation and adjustment cost technology[8].

The version of the Euler equation model we estimate is based on Bond and Meghir (1994), extended to include through imperfect competition, specific determinants of the productivity of capital (Escribá and Murgui, 2009) as well as the effects of regulatory changes targeted by Alesina et al. (2005).

A representative firm in a region *i* of a country *c* maximizes the present discounted value of current and future net dividends ($R_{ic,t}$). Let $L_{ic,t}$ denote the amount of hired labour, $I_{ic,t}$ gross investment, $K_{ic,t}$ capital stock, $\omega_{ic,t}$ the price of labour, $p^{I}_{ic,t}$ the price of investment goods, $p_{ic,t}$ the price of output, δ_{ic} the depreciation rate and E(.) the expectations operator conditional on information available in period *t*. Defining $r_{c,t}$ to be the rate of return and $\beta^{t}_{c,t+j} = \prod_{i=0}^{j-1}(1+r_{c,t+i})^{-1}$ the discount factor, the firm solves

$$\begin{aligned} &Max\ \mathrm{E}_t\left[\sum_{j=0}^{\infty}\beta^{t}_{c,t+j}\,R\left(K_{ic,t+j},L_{ic,t+j},I_{ic,t+j}\right)\right] \\ &s.t.\quad K_{ic,t}=\left(1-\delta_{ic}\right)K_{ic,t-1}+I_{ic,t} \end{aligned} \tag{1}$$

[8] According to Chirinko (1993), the literature can be divided into two categories depending on whether dynamics are treated implicitly or explicitly.

where $R_{ic,t} = p_{ic,t}\,Q_{ic,t} - \omega_{ic,t}\,L_{ic,t} - p^{I}_{ic,t}\,I_{ic,t}$ and $Q_{ic,t} = F\left(K_{ic,t}, L_{ic,t}\right) - Z\left(K_{ic,t}, I_{ic,t}\right)$ is the net output of adjustment costs, $Z\left(K_{ic,t}, I_{ic,t}\right)$.

The Euler equation characterizing the optimal path of investment is given by

$$-\left(1-\delta_{ic}\right)\beta^{t}_{ct+1}\mathrm{E}_t\left(\frac{\partial R_{ic,t+1}}{\partial I_{ic,t+1}}\right) = -\left(\frac{\partial R_{ic,t}}{\partial I_{ic,t}}\right) - \left(\frac{\partial R_{ic,t}}{\partial K_{ic,t}}\right) \qquad (2)$$

To allow for imperfect competition we let p_{it} depend on output, while the price elasticity of demand is assumed constant (η>1). We assume that $F\left(K_{ic,t}, L_{ic,t}\right)$ is constant returns to scale and the adjustment cost function, $Z\left(K_{ic,t}, I_{ic,t}\right) = b/2\left(I_{ic,t}/K_{ic,t} - a\right)^2 K_{ic,t}$, is linearly homogeneous in investment and capital.

To implement this model, we evaluate the expectation $\mathrm{E}_t\left(I_{ic,t+1}/K_{ic,t+1}\right)$ at realized value $\left(I_{ic,t+1}/K_{ic,t+1}\right)$ plus a forecast error. The resulting empirical Euler equation under the null of no financial regimes is

$$\left(\frac{I_{ic,t+1}}{K_{ic,t+1}}\right) = \alpha_1 + \alpha_2\left(\frac{I_{ic,t}}{K_{ic,t}}\right) - \alpha_3\left(\frac{I_{ic,t}}{K_{ic,t}}\right)^2 - \alpha_4\left(\frac{B_{ic,t}}{K_{ic,t}}\right) + \alpha_5\left(\frac{Q_{ic,t}}{K_{ic,t}}\right) + u_{ic,t+1} \qquad (3)$$

where $\alpha_1 = a\left(1-\varphi\right);\ \alpha_2 = \varphi\left(1+a\right);\ \alpha_3 = \varphi;\ \alpha_4 = \varphi\left(\frac{1}{\vartheta b}\right);\ \alpha_5 = \varphi\left(\frac{1}{(\eta-1)b}\right);\ \vartheta = 1 - 1/\eta > 0$,

$\varphi = \left(1+r_{c,t}\right)/\left(1-\delta_c\right)\left(p_{ic,t+1}/p_{ict}\right)$ and $\left(\frac{B_{ic,t}}{K_{ic,t}}\right) = \left(\frac{Q_{ic,t}}{K_{ic,t}}\right) - \frac{\omega_{ic,t}}{p_{ic,t}}\left(\frac{L_{ic,t}}{K_{ic,t}}\right) - \frac{v_{ic,t}}{p_{ic,t}}$ is the gross economic profit rate and $v_{ic,t}$ is the nominal user cost of capital.

The coefficient α_2 is positive and greater than one. The coefficient α_3 is negative and greater than one in absolute value. The coefficient α_4 is negative under the assumption that investment is not overly sensitive to cash flow and positive in the presence of imperfect capital markets. The output term (α_5) controls for imperfect competition and the coefficient is positive. In the empirical literature on the effects of regulation on investment, microeconomic data is usually used rather than aggregate. In this paper we are interested in analysing the effect of the regulatory burden on regional investment but we present the estimation of equation (3) in Table 2.

Therefore we extend the Euler equation to include these variables through their effect on productivity of capital, $\frac{Q_{ict}}{K_{ict}} = F\left(\frac{K_{ict}}{K_{ict}}, \frac{L_{ict}}{K_{ict}}\right) - Z\left(\frac{K_{ict}}{K_{ict}}, \frac{I_{ict}}{K_{ict}}\right) = \Psi\left(\frac{L_{ict}}{K_{ict}}, \frac{I_{ict}}{K_{ict}}, MR_{ct}\right)$.
Regional productivity of capital depends positively on the region's labour/capital ratio and negatively on its investment/capital ratio. MR_{ct} indicates the market regulations: MRP_{ct} (in the product market) and MRL_{ct} (in the labour market). We expect a negative impact of MRP_{ct} on

productivity of capital and investment. Blanchard and Giavazzi (2003), in a non-competitive model of employment determination, emphasize the mechanism by which changes in regulation affect the mark-up of prices over marginal cost. The elasticity of demand varies inversely (mark-up increase) with the degree of product market regulation. Alesina et al.(2005) assume that product market regulation can affect the cost to the firm when expanding their productive capacity; in particular, deregulation decreases it. There is disagreement about the theoretical impact of the labour market regulation on investment behaviour, and some of the empirical evidence is contradictory. It is impossible to determine a priori whether such an MRL effect will raise or lower the level of capital productivity. The effect of the labour market regulation (MRL_{ct}) on investment is ambiguous[9]: on the one hand, greater regulation should have a negative impact on investment, by increasing firms' adjustment costs over time. The installation of new machinery often requires changes in work practices if the new capital is to operate at peak efficiency. The presence of (MRL_{ct}) may inhibit these changes, thereby adding to the effective cost of installation (Denny and Nickell, 1992). On the other hand, higher regulation in the labour market also means higher firing costs, making capital more accessible by increasing labour costs relative to capital and thus encouraging the substitution of capital for labour and more capital intensive technologies (Caballero and Hammour, 1998 and Autor, Kerr and Kugler 2007). Which of the two effects on investment dominates is mostly an empirical matter.

Thus, we obtain the following specification:

$$\left(\frac{I_{ic,t+1}}{K_{ic,t+1}}\right) = \beta_0 + \beta_1\left(\frac{I_{ict}}{K_{ict}}\right) - \beta_2\left(\frac{I_{ict}}{K_{ict}}\right)^2 - \beta_3\left(\frac{B_{ict}}{K_{ict}}\right) + \beta_4\left(\frac{L_{ict}}{K_{ict}}\right) + \beta_5\, MR_{ct} + \upsilon_{ic,t+1} \qquad (4)$$

and based on equation (4), the basic empirical specification we consider can be written as:

$$\left(\frac{I_{ic,t}}{K_{ic,t}}\right) = \beta_1\left(\frac{I_{ic,t-1}}{K_{ic,t-1}}\right) - \beta_2\left(\frac{I_{ic,t-1}}{K_{ic,t-1}}\right)^2 - \beta_3\left(\frac{B_{ic,t-1}}{K_{ic,t-1}}\right) + \beta_4\left(\frac{L_{ic,t-1}}{K_{ic,t-1}}\right) + \beta_5 \ln MR_{c,t-1} + \mu_{ic} + d_t + \varepsilon_{ic,t} \qquad (5)$$

with μ_{ic} being effects specific to a region of a country that remain unchanged over time (such as geographical location or distinctive features specific to the region), and d_t the time effects that have an impact on all regions[10]. ε_{ict} is a random disturbance term with the usual properties.

Estimating this dynamic panel model entails various econometric problems, such as the heterogeneity of the sample (in our case unobservable variations among regions) and the presence of the lagged endogenous variable as a regressor (which means that it is correlated with the errors), making the OLS estimator biased and inconsistent.

In order to solve these problems, in line with Arellano and Bond (1991), the Generalized Method of Moments and the estimator in differences – the Difference GMM - can be used. The idea behind the GMM estimator in first differences is to take first differences in

[9] For a survey about regulation effects in labour markets see Young (2003).

[10] We will treat such time effects as fixed – unknown constants – by including a set of time dummies in all regressions. Another possibility would be to express the variables in deviations from their average over time.

order to eliminate the possible source of inconsistency generated by the presence of region-specific effects, and to use the levels of the explanatory variables lagged two or more periods as instruments to correct their endogeneity.[11] The consistency of these estimators lies in their compliance with conditions of orthogonality. In other words, the residuals must be serially uncorrelated and the explanatory variables exogenous. In order to verify the validity of the conditions of orthogonality – if the instruments are exogenous – the overidentification test proposed by Sargan (1958) and Hansen (1982) is used. The tests proposed by Arellano and Bond (1991) are also implemented to confirm the presence of residual serial correlation, the null hypothesis of which is no serial autocorrelation[12].

4. Data description and Estimation results

The database used for most of the variables is the BD.EURS. This database, in year 2000 euros, is disaggregated into six sectors for 121 regions (NUTS 2) for the 1995-2007 period. The basic source of information is the regional series of EUROSTAT, and the existing country information in the AMECO and EU-KLEMS databases in particular, is also used as a reference.

As stated above, this paper addresses investment and capital only in the non-farm business sector, that is, manufacturing, construction and market services excluding real estate and financial, agriculture and non-market services. For more details about regional series of gross fixed capital formation, capital stock, GVA, employment, real wage, user cost of capital, see Appendix 1.

Regarding national indicators of regulation for the 1995-2007 period, two basic sources have been used:

- **OECD**. The synthetic indicators **EPL** (Employment Protection and Legislation) and **PMR** (Product Market Regulation) are used to characterize rigidities in the labour and product markets, respectively. The latter is subdivided into: **STATEC** (State Control), **BE** (Barriers to Entrepreneurship) and **BTI** (Barriers to Trade and Investment). The indicators represent the stringency of regulatory policy on a scale from 0 to 6 with higher numbers being associated with policies that are more restrictive to competition[13]. The OECD's indicators are based on self-assessment questionnaires that are filled in by national administrations in each country. Responses are ranked and aggregated so that assessments can be benchmarked to enable comparisons.

- **Fraser Institute**. The economic freedom index: **LMR** (Labour Market Regulations) and **BR** (Business Regulations) are the two principal synthetic indicators for regulation used. Further disaggregation is considered in the regulation of the labour market: **HIRE**

[11] Arellano and Bover (1995) and Blundell and Bond (1998) proposed the system GMM estimator, which yields gains in efficiency in regard to the estimator in differences when there is a high degree of persistence in the series, or in unit root assumptions. It is not possible to use this estimator in our paper due to the large number of variables to be estimated together with the fact that deeming all variables endogenous does not leave enough degrees of freedom in the estimations.

[12] That is, first-order autocorrelation is expected, AR(1), $\Delta\varepsilon_{it} = \varepsilon_{it} - \varepsilon_{it-1}$ will be correlated to $\Delta\varepsilon_{it-1} = \varepsilon_{it-1} - \varepsilon_{it-2}$, but no autocorrelation of a higher order.

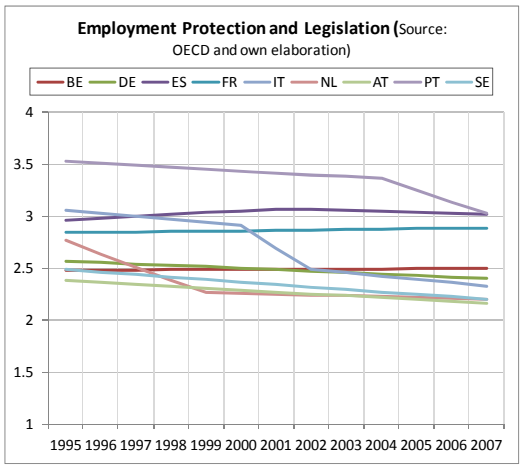
[13] For more details see Nicoletti, Scarpetta and Boylaud (1999), Conway, Janod and Nicoletti (2005), Nicoletti and Pryor (2006).

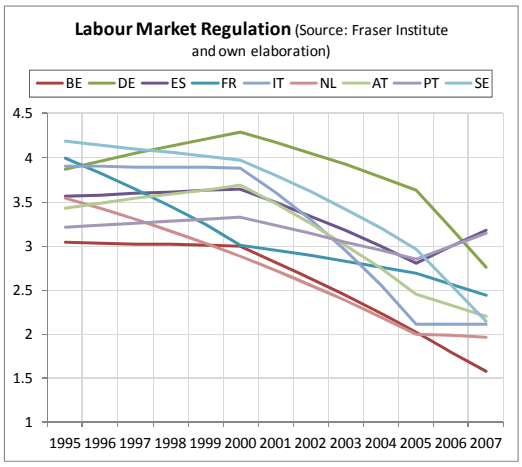
(Hiring Regulations and minimum wage), **HFR** (Hiring and Firing Regulation), **CC** (Centralized Collective bargaining) and **HOURRE** (Hours Regulations). Also considered are components of Business Regulations: **BC** (Bureaucracy Costs), **START** (Starting a Business), **EXTPAY** (Extra payments / bribes / favouritism). Like all the ratings in the index, these are values out of 10; 10 is the highest possible rating and zero (0) is the lowest. A higher rating indicates a greater degree of economic freedom[14]. In order to normalize all the variables have been adjusted to the same index scale as those of the OECD: 6 indicates greater regulation and the lower values greater freedom and competitiveness[15].

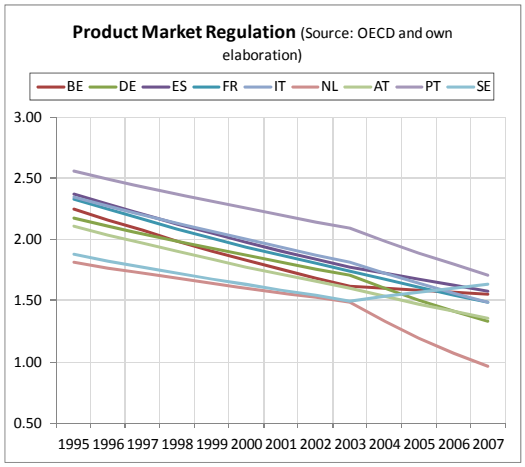
Figure 6 shows the evolution for 1995-2007 of some regulatory indices elaborated by the OECD and the Fraser Institute. Figures in the left-hand column report the objective measures of employment protection and legislation (to measure the cost implications of regulatory provisions for employers) and objective measures of product market regulation compiled both by the OECD. Figures in the right-hand column report the Fraser Institute Economic Freedom Index scores. Its components include subjective survey assessments of aspects of institutions and policy such as regulation of business and labour. All indexes are normalized so that 6 indicates increased regulation and smaller values represent more liberalization. According to both the Fraser Institute and the OECD, the countries with the fewest restrictions on competition in the product market are the Netherlands and Sweden. In general, all indices show a general trend in the direction of greater liberalization; only the Fraser Institute's Business Regulation indicator shows an upturn since the beginning of the 2000s. However there are differences between the OECD and the Fraser Institute, as is clearly shown in Figure 7, when the different situations in 1995 and 2007 are compared.

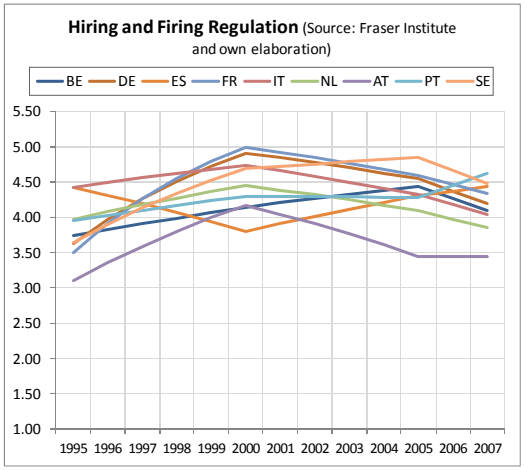
[14] For more details see Block (1993).

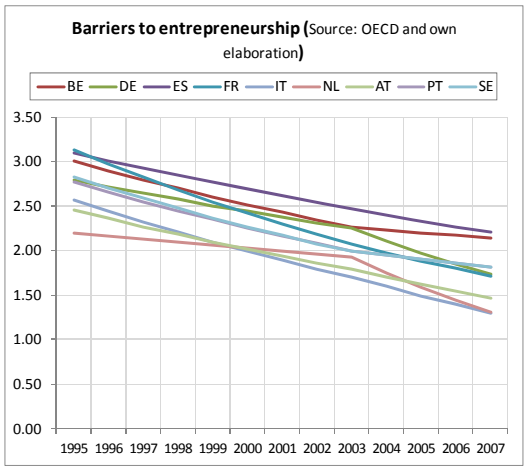
[15] Both OECD and FRASER indices show little variation over time, their variability is due to interpolation as used by different authors. See Calcagnini, Ferrando and Giombini (2014).











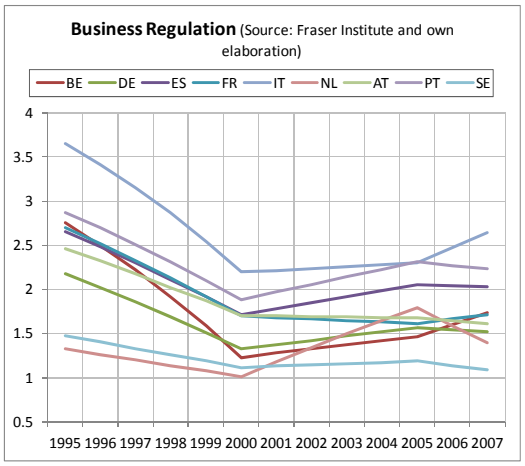
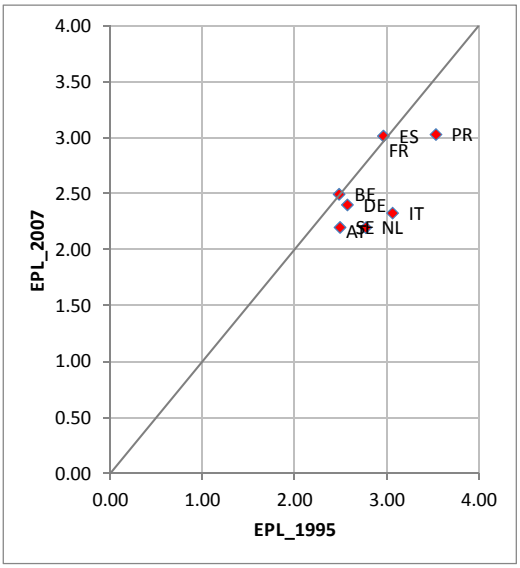
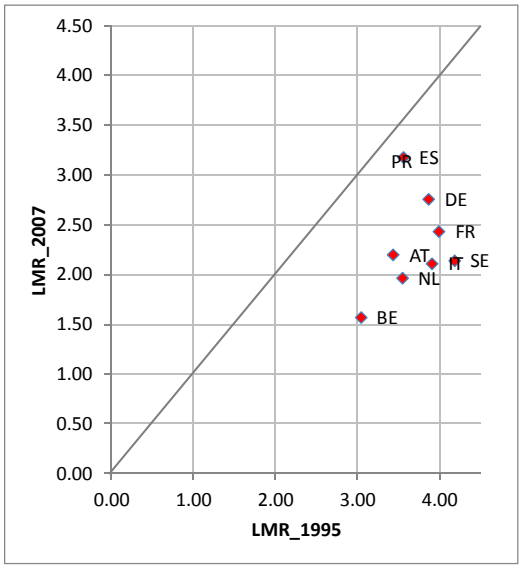


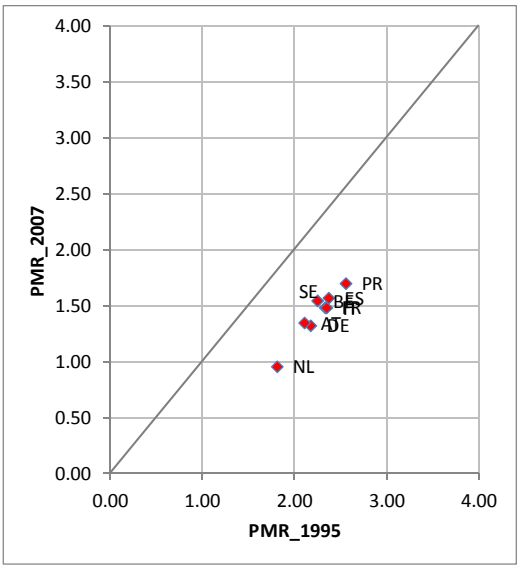
Figure 6. Evolution of Regulation Indices.



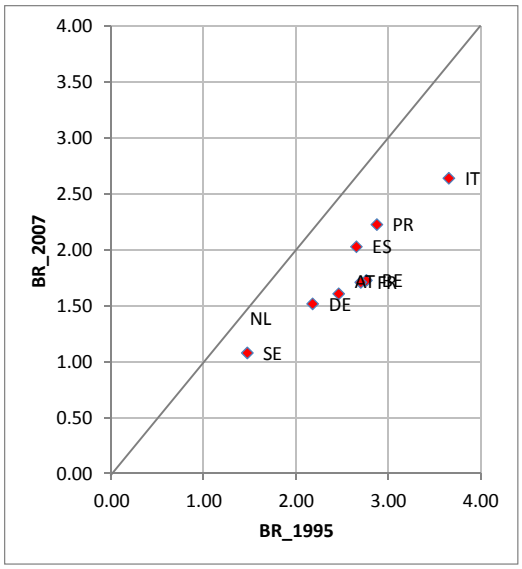
EPL: Employment Protection and Legislation.
Source: OECD and own elaboration



LMR: Labour Market Regulation.
Source: Fraser Institute and own elaboration



PMR: Product Market Regulation
Source: OECD and own elaboration



BR: Business Regulation
Source: Fraser Institute and own elaboration

Figure 7. National regulation indicators.

Table 1 shows mean statistics (whether national or regional) of the variables used in the estimation and the number of observations available.

Table 1. Descriptive Statistics of variables used in estimation. (Period 1995-2007)

Variable	Obs	Mean	Std. Dev.	Min	Max
$\left(\frac{I_{it}}{K_{it}}\right)$	1573	0.096	0.017	0.043	0.188
$\left(\frac{I_{it}}{K_{it}}\right)^2$	1573	0.010	0.003	0.002	0.035
$\left(\frac{B_{it}}{K_{it}}\right)$	1573	0.062	0.050	-0.079	0.311
$\left(\frac{Q_{it}}{K_{it}}\right)$	1573	0.536	0.130	0.265	1.358
$\left(\frac{L_{it}}{K_{it}}\right)$	1573	0.013	0.004	0.006	0.037
Labour market regulation (Fraser Institute)					
LMR	1573	3.207	0.631	1.570	4.290
HIRE	1573	3.177	0.998	0.001	4.902
HFR	1573	4.310	0.373	3.110	5.000
CC	1573	3.375	0.604	1.780	4.610
HOURRE	1573	3.291	0.826	1.200	4.860
Business regulation (Fraser Institute)					
BR	1573	1.912	0.542	1.010	3.650
BC	1573	1.883	0.629	0.540	3.860
START	1573	1.874	1.121	0.110	3.940
EXTPAY	1573	1.498	0.790	0.420	4.250
Labour and market regulations (OECD)					
EPL	1573	2.664	0.319	2.170	3.530
PMR	1573	1.825	0.290	0.962	2.555
STATEC	1573	2.704	0.538	1.440	4.045
BE	1573	2.229	0.431	1.300	3.128
BTI	1573	0.520	0.218	0.141	1.157

Estimation Results

Table 2 presents the results of estimating regional non-farm business investment determinants in European regions during the 1995-2007 period, following equation (3). That is, where the investment rate depends on its lag, on its square root, on the lagged profit rate and lagged output-capital ratio. Different estimation methods are employed, including Ordinary Least Squares (OLS, first column) and Fixed Effects (FE, second column), which we know will yield biased and inconsistent estimators, as indicated in the previous section, along with the Generalized Method of Moments (in differences, DIFF-GMM in column [3]) which corrects those problems. These estimations have two purposes: firstly, showing the results of the various estimation methods used allows us above all to compare the estimated coefficient of

the lagged endogenous variable to test "finite sample bias"[16]; and secondly, they allow us to estimate a reduced form of a Euler equation as estimated in the majority of papers that use the model proposed by Bond and Meghir (1994).

The dependent variable considered in the estimations reported in Table 2 is investment term I/K. As regards the comparison of the lagged endogenous variable, it is positive, greater than one and highly significant in the various estimations. In the case of the DIFF-GMM estimator, the expected results are obtained, as the coefficient falls between that estimated by OLS (overestimated) and that estimated by Fixed Effects (underestimated). For that reason, the difference Generalized Method of Moments estimator (Arellano and Bond, 1991) is considered more appropriate. Therefore, by using the GMM estimate, consistent estimators would be obtained providing the validity of the orthogonality (Sargan or Hansen's overidentification test) is accepted and there is no residual autocorrelation. As can be observed in the lower part of Table 2, the validity of the instruments chosen is accepted as are the no second-order correlation, the AR(2) test and the Hansen Difference Test.

For the period dating from 1995 to 2007, the coefficient on the lagged investment term is correctly signed and greater than one, as is suggested by the derivation of this model. The coefficient on the lagged squared term is negative and greater than one in absolute value – as it is derived by the structural adjustment costs model. The coefficient on the lagged economic profit term is positive and significantly different from zero, which represents a divergence from the basic theoretical structure. The theoretical model implies a negative coefficient, under the assumption that the firm can raise as much finance as it desires, at a given cost. If this assumption is incorrect then the cash-flow term may reflect liquidity constraints as well as marginal profitability (see Bond and Meghir, 1994 p. 211). The coefficient of the lagged productivity of capital (output-capital ratio) is positive and significant, which is consistent with the presence of imperfect competition in the product market.

[16] Bond, Hoeffer and Temple (2001) page 7 suggests this as a test of whether the estimators suffer from "finite sample bias". An estimate of the lagged endogenous variable will be considered consistent if the coefficient falls between the OLS and Fixed Effects estimations, since it is well known that the coefficient of the lagged endogenous variable will be overestimated by OLS and underestimated by Fixed Effects.

Table 2. Results of the Estimation 1995-2007. The Euler Equation

Dependent variable $\left(\frac{I_{it}}{K_{it}}\right)$			
Method of estimation	OLS	FE	Diff-GMM
	[1]	[2]	[3]
$\left(\frac{I_{ic,t}}{K_{ic,t}}\right)_{-1}$	1.613***	1.025***	1.210***
	(0.107)	(0.129)	(0.403)
$\left(\frac{I_{ic,t}}{K_{ic,t}}\right)^2_{-1}$	-4.460***	-3.092***	-4.390***
	(0.537)	(0.617)	(1.906)
$\left(\frac{B_{ic,t}}{K_{ic,t}}\right)_{-1}$	0.033***	0.045***	0.057**
	(0.009)	(0.018)	(0.028)
$\left(\frac{Q_{ic,t}}{K_{ic,t}}\right)_{-1}$	-0.004	0.021***	0.046**
	(0.003)	(0.008)	(0.022)
R^2	0.65	0.68	
Time dummies	Yes	Yes	Yes
Obs.	1452	1452	1331
Regions	121	121	121
Sargan or Hansen Test			[0.237]
AR(1) Test			[0.000]
AR(2) Test			[0.642]

Note: Standard errors in brackets; figures in column (3) are for a two-step estimator and standard errors have been adjusted in line with Windmeijer (2005). *Values significant at 10%, ** Values significant at 5% and *** Values significant at 1%. The figures reported for the Hansen test are the *p-values* for the null hypothesis, valid specification. The figures reported for the AR(1) and AR(2) test are the *p-values* for the null hypotheses, zero first-order and second-order autocorrelation. The instruments used for the estimation in first differences (column [3]) are the levels of the endogenous explanatory variables $[\left(I_{it}/K_{it}\right)_{-1}; \left(I_{it}/K_{it}\right)^2_{-1}; \left(B_{it}/K_{it}\right)_{-1}; \left(Q_{it}/K_{it}\right)_{-1}]$ lagged two periods and all the lags up to a maximum of five.

Table 3 reports results for the Diff-GMM estimation of equation (5). This equation includes the variables that approximate market regulations; we are interested in estimating their effect on the future investment rate through change in productivity of capital. Table 3 shows variables of regulations significantly different from zero. Measures of market regulation compiled by the OECD are: *EPL* (Employment Protection and Legislation) for the labour market (MRL_{ct}), and *BE* (Barriers to Entrepreneurship) and *BTI* (Barriers to Trade and Investment) for the product market (MRP_{ct}). As regards the Fraser Institute, the economic index relating to the labour market regulation is *HFR* (Hiring and Firing Regulation), with *BR* (Business Regulations)

and *EXTPAY* (Extra payments / bribes / favouritism) for the product market. The validity of the instruments used in the Hansen test is accepted for all columns along with the absence of second-order autocorrelation, as can be observed in the lower part of the table. We consider the explanatory variables that include regulatory variables and the lagged investment rate, the lagged labour/capital ratio, and the lagged economic profit rate to be endogenous.

The coefficients of the lagged investment rate, the lagged investment rate squared and the lagged profit rate are significant, although the lagged labour/capital ratio coefficient is not. The coefficients of the lagged investment rate and the lagged investment rate squared display the correct sign and are greater than one. The coefficient of the lagged profit rate is positive. This result is to be expected if there are liquidity constraints. As regards the coefficients of our variables of interest, both the *employment protection and legislation* (column [1]) and *Hiring and firing regulation* (column [4]) are positive and significant. That is, (MRL_{ct}) variables have a positive effect on the productivity of capital and, therefore, on the rate of non-farm business investment. Greater employment protection legislation and higher hiring and firing costs increase the substitution of capital for labour and more capital intensive technologies. Cingano et al.(2014) found similar results for Italian regions. Conversely, studies on European countries (Calcagnini, Giombini and Saltari, 2009; Cingano et al. 2010) find a negative relationship between *EPL* and, respectively, investment and capital-labour ratios[17].

The results in columns (2), (3), (5) and (6) of Table 3 refer to the estimation using product market regulation variables. The results show that both *Barriers to entrepreneurship* (column (2)) and *Barriers to trade and investment* (column (3)) coefficients are negative and statistically significant. That is, over the period 1995-2007, regulation regarding *BE* and *BTI* had a negative effect on productivity of capital and accumulation of capital in regional non-farm business. The results do not change, as can be observed in columns (4) and (5), when business regulation variables from the Fraser Institute are used. The coefficients of *BR* and *EXTPAY* are negative and statistically significant. Business regulation has a negative impact on regional non-farm business investment, and more specific sub-components (Extra payments / bribes / favouritism) can affect the cost to the firm when expanding their productive capacity.

Extra payments / bribes / favouritism indicates the existence of corrupt practices in the product market. There is a vast empirical literature on the effect of corruption on investment[18]. Our results are in agreement with the macro approach taken by de Shleifer and Vishny (1993), Mauro (1995 and 1996), and Campos, Lien and Pradhan (1999)). Corruption leads to increased operational costs, creates uncertainty and thereby deters investment. Furthermore, models of firm investment under uncertainty show that if capital is partially irreversible, then greater uncertainty about future returns on investment increases the likelihood of opting to wait before making an irreversible investment.

[17] These differences may be reconciled by adopting the approach proposed by Janiak and Wasmer (2013) of an inverse U-shaped relationship between EPL and the capital-labour ratio, positive at low levels of EPL and negative at high levels of EPL. See Cingano et al (2014).

[18] Shleifer and Vishny (1993), Mauro (1995 and 1996), Campos, Lien and Pradhan (1999) and Asiedu and Freeman (2009), Swaleheen, (2011), report that much of corruption's effect on growth takes place through the effect on investment.

Table 3. Results of estimation 1995-2007. A Euler equation.

Dependent variable $I_{ic,t}/K_{ic,t}$					***Two-step Diff-GMM***	
Diff-GMM	[1]	[2]	[3]	[4]	[5]	[6]
$\left(\frac{I_{ic,t}}{K_{ic,t}}\right)_{-1}$	1.447***	1.545***	1.477***	1.191***	1.123***	1.100***
	(0.392)	(0.481)	(0.493)	(0.358)	(0.420)	(0.384)
$\left(\frac{I_{ic,t}}{K_{ic,t}}\right)^2_{-1}$	-5.488***	-5.615***	-5.495***	-4.242***	-3.838**	-3.619**
	(1.991)	(2.369)	(2.392)	(1.771)	(2.052)	(1.856)
$\left(\frac{B_{ic,t}}{K_{ic,t}}\right)_{-1}$	0.118***	0.088***	0.083***	0.115***	0.113***	0.140***
	(0.024)	(0.026)	(0.026)	(0.027)	(0.026)	(0.027)
$\left(\frac{L_{ic,t}}{K_{ic,t}}\right)_{-1}$	0.077	0.639	1.187*	0.441	0.270	0.745
	(0.529)	(0.590)	(0.626)	(0.596)	(0.541)	(0.612)
$(EPL_c)_{-1}$	0.015***					
	(0.005)					
$(BE_c)_{-1}$		-0.010**				
		(0.004)				
$(BTI_c)_{-1}$			-0.016***			
			(0.005)			
$(HFR_c)_{-1}$				0.003**		
				(0.001)		
$(BR_c)_{-1}$					-0.004**	
					(0.002)	
$(EXTPAY_c)_{-1}$						-0.002**
						(0.001)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1331	1331	1331	1331	1331	1331
Regions	121	121	121	121	121	121
Hansen Test	[0.284]	[0.333]	[0.316]	[0.325]	[0.210]	[0.146]
AR(1) Test	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR(2) Test	[0.762]	[0.498]	[0.614]	[0.702]	[0.641]	[0.586]

Note: This is a two-step estimator and standard errors have been adjusted in line with Windmeijer (2005). *Values significant at 10%, ** Values significant at 5% and *** Values significant at 1%. The figures reported for the Hansen test are the *p-values* for the null hypothesis, valid specification. The figures reported for the AR(1) and AR(2) test are the *p-values* for the null hypotheses, zero first-order and second-order autocorrelation. The instruments used for the estimation in first differences are the levels of the endogenous explanatory variables lagged two periods and all the lags up to a maximum of three for market regulations variables and to a maximum of four for all other variables.

In Table 4 we present the results of estimating a Euler equation including two indicators of regulation (one of product market regulation and the other of labour market regulation). The lagged L/K variable has been eliminated from the estimations due both to the large number of variables to be estimated and to the fact that deeming all variables endogenous does not leave enough degrees of freedom in the estimation. The idea is to be able to test the robustness of the results if different regulation indicators are used in the same estimation, moreover the lagged labour/capital ratio coefficient is not statistically significant, as can be observed in Table 3.

The Hansen test confirms the validity of the instruments used and also the absence of second-order autocorrelation, as shown in the lower part of the table 4. The coefficients of regulation variables do not change. That is, the coefficients of the product market regulation variables are negative and the coefficients of the labour market regulation variables are positive. The coefficient of the lagged dependent variable and the lagged investment rate squared are significant and greater than one, although their magnitudes change slightly. The lagged profit rate is positive and significant.

Table 4. Results of estimation 1995-2007. A Euler equation.

Dependent variable $I_{ic,t}/K_{ic,t}$					***Two-step Diff-GMM***	
	[1]	[2]	[3]	[4]	[5]	[6]
$\left(\frac{I_{ic,t}}{K_{ic,t}}\right)_{-1}$	1.216***	1.725***	1.084***	1.018***	1.207***	1.168***
	(0.386)	(0.415)	(0.379)	(0.305)	(0.328)	(0.309)
$\left(\frac{I_{ic,t}}{K_{ic,t}}\right)^2_{-1}$	-4.493***	-6.621***	-3.870**	-3.407**	-3.959***	-4.118***
	(1.903)	(2.121)	(1.848)	(1.508)	(1.631)	(1.512)
$\left(\frac{B_{ic,t}}{K_{ic,t}}\right)_{-1}$	0.114***	0.108***	0.115***	0.122***	0.078***	0.110***
	(0.025)	(0.004)	(0.025)	(0.024)	(0.026)	(0.025)
$(EPL_c)_{-1}$	0.018***	0.010***	0.011***			0.012***
	(0.005)	(0.004)	(0.003)			(0.003)
$(PMR_c)_{-1}$	-0.012**					
	(0.006)					
$(BE_c)_{-1}$					-0.012***	
					(0.004)	
$(BTI_c)_{-1}$		-0.009**				
		(0.004)				
$(HFR_c)_{-1}$				0.003**	0.003**	
				(0.001)	(0.001)	
$(BR_c)_{-1}$			-0.005***	-0.004***		
			(0.002)	(0.001)		
$(EXTPAY_c)_{-1}$						-0.002**
						(0.001)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1331	1331	1331	1331	1331	1331
Regions	121	121	121	121	121	121
Hansen Test	[0.198]	[0.234]	[0.222]	[0.231]	[0.322]	[0.241]
AR(1) Test	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR(2) Test	[0.771]	[0.654]	[0.799]	[0.678]	[0.413]	[0.672]

Note: Standard errors have been adjusted in line with Windmeijer (2005). *Values significant at 10%, ** Values significant at 5% and *** Values significant at 1%. The figures reported for the Hansen test are the *p-values* for the null hypothesis, valid specification. The figures reported for the AR(1) and AR(2) test are the *p-values* for the null hypotheses, zero first-order and second-order autocorrelation. The instruments used for the estimation in first differences are the levels of the endogenous explanatory variables lagged two periods and all the lags up to a maximum of three for market regulation variables and to a maximum of four for all other variables.

5. Conclusions.

The objective of this paper is to analyse the role played by national regulations of product and labour markets in explaining the trend observed in investment in the European regional non-farm business sector during the period dating from 1995 to 2007. In order to achieve this, we derived and estimated a Euler equation specification based on an extension of the version proposed by Bond and Meghir (1994) and using dynamic panel and GMM methods. The dynamic panel data model is estimated using panel data techniques (Arellano and Bond, 1991). This method controls for biases due to unobserved specific effects and endogenous explanatory variables.

Results coincide with the standard investment model of the Euler equation. The coefficients on the lagged investment rate and the lagged investment rate squared are greater than one and have the correct sign, as expected. The coefficient on the lagged economic profit term is positive and significantly different from zero, which represents a divergence from the basic theoretical structure. The theoretical model implies a negative coefficient, under the assumption that the firm can raise as much finance as it desires, at a given cost. If this assumption is incorrect then the cash-flow term may reflect liquidity constraints. The coefficient of the lagged output-capital ratio is positive and significant, which is consistent with the presence of imperfect competition in the product market.

When this Euler equation is extended to include the role played by regulation indicators that affect productivity of capital (Q/K) through the regional capital-intensive technologies, mark-up and adjustment cost, the coefficients of standard variables estimated do not present any changes. The lagged investment rate and the lagged investment rate squared display the negative sign and the coefficient on the lagged economic profit term is positive.

Our empirical findings show that investment is negatively correlated with the level of national product market regulation. Product market regulations (barriers to entrepreneurship and to trade and investment) decrease the productivity of capital and increase the adjustment costs and mark-up, which have negative effects on European regions' investment. Our results show that the existence of corrupt practices in the product market has a negative impact on investment in European regions. Corruption leads to increased operational costs, creates uncertainty and thereby deters investment.

As regards labour market regulation and employment protection and legislation, our results show a positive impact on investment, suggesting that in European regions between 1995 and 2007, there was a substitution effect of labour with capital, with the consequence of likely higher capital accumulation growth rates.

Continental European economies are currently suffering from the low levels of market liberalization compared to the UK and US. This paper provides empirical evidence to support the efforts made by the EU to liberalize markets, ensure better transparency and to improve the functioning of its institutions.

References

Alesina, A., S. Ardagna, G. Nicoletti, and F. Schiantarelli (2005): ”Regulation and investment”. *Journal of the European Economic Association* 3, 791–825.

Almeida, R. and P. Carneiro (2005): ”Enforcement of regulation, informal labor and firm performance”. IZA DP 1759, 47 pages.

AMECO. Annual macro-economic database of the European Commission’s Directorate General for Economic and Financial Affairs (DG ECFIN).

Arellano, M. and S. Bond (1991): “Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations”, *The Review of Economic Studies* 58, pp. 277-97.

Arellano, M. and O. Bover (1995): “Another look at the instrumental variable estimation of error-components models”, *Journal of Econometrics* 68, pp. 29-51.

Asiedu, E. and J. Freeman (2009): “The effect of corruption on investment growth: evidence from firms in Latin America, sub-Saharan Africa and Transition countries”, *Review of Development Economics*, 13(2), 200-214.

Autor, D. H., W. Kerr and A. Kugler (2007): “Do Employment Protections Reduce Productivity? evidence from U.S. States”, *The Economic Journal*, 117, F189-F271.

BD.EURS (NACE Rev.1). Ministerio de Hacienda y Administraciones Públicas. Dirección General de Presupuestos. Bases de datos macroeconómicos. http://www.sepg.pap.minhap.gob.es/sitios/sepg/es-ES/Presupuestos/Documentacion/Paginas/BasededatosBDEURS.aspx

Blanchard, O., F. Giavazzi (2003): “Macroeconomic effects of regulation and deregulation in goods and labor markets”. *Quarterly Journal of Economics* 118 (3), 879–907.

Block, W.E (1993): *Economic Freedom. Toward a Theory of Measurement.* Background Economic Freedom Publications. Fraser Institute.

Blundell, R. and S. Bond (1998): “Initial conditions and moment restrictions in dynamic panel data models”, *Journal of Econometrics* 87, 115–143.

Bond, S., A. Hoeffler and J.Temple (2001): “GMM Estimation of empirical growth models”, CEPR Discussion Paper Series, No.3048

Bond, S. and C. Meghir (1994): “Dynamic investment models and the firm's financial policy”, *Review of Economic Studies* 61, 197–222.

Caballero, R. J. and M. Hammour (1998): “Jobless Growth: Appropriability, Factor Substitution and Unemployment”, *Carnegie-Rochester Conference Proceedings*, 48, pp. 51-94.

Calcagnini, G., A. Ferrando and G. Giombini (2013): “Multiple market imperfections, firm profitability and investment”, Paper prepared for the 34th Italian Conference on Regional Science of AISRe, september.

Calcagnini, G., A. Ferrando and G. Giombini (2014): “Does employment protection legislation affect firm investment?”, *Economic Modelling*, 36, 658-665.

Calcagnini, G., G. Giombini and E. Saltari (2009): "Financial and labour market imperfections and investment", *Economics Letters*, 102(1), 22-26.

Cambini C. and Y. Spiegel (2011): "Investment and capital structure of partially private regulated firms", CEPR Discussion paper No. DP8508.

Cambini C. and L. Rondi (2012): "Capital structure and investment in regulated network utilities: evidence from EU Telecoms", *Industrial and Corporate Change*, 21 (1), 31-71

Campos, J.E., D. Lien and S. Pradhan (1999): "The impact of corruption on investment: predictability matters", *World Development*, 27(6), 1059-1067.

Cingano, F., M. Leonardi, J. Messina and G. Pica (2010): "The Effect of Employment Protection Legislation and Financial Market Imperfections on Investment: Evidence from a Firm-Level Panel of EU Countries", *Economic Policy*, 25 (61), 117-163.

Cingano, F., M. Leonardi, J. Messina and G. Pica (2014): "Employment Protection Legislation, capital investment and access to credit: evidence from Italy", Working papers 4. Department of the Treasury. Ministry of Economy and Finances.

Chirinko, R.S. (1993): "Business fixed investment spending: modeling strategies, empirical results, and policy implications", *Journal of Economic Literature* XXXI, 1875–1911.

Conway, P., V. Janod, and G. Nicoletti (2005), "Product Market Regulation in OECD Countries: 1998 to 2003", OECD Economics Department Working Papers No. 419.

Denny, K. and S. Nickell (1992): "Unions and investment in British industry". *The Economic Journal* 102, 874–887.

Escribá, F.J and M.J. Murgui (2009): "Government policy and industrial investment determinants in Spanish regions", *Regional Science and Urban Economics*, 39, 479-488.

Escribá, F.J and M.J. Murgui (2014a): "La base de datos BD.EURS (NACE Rev.1)", *Investigaciones Regionales*, 28, 173-194.

Escribá, F.J and M.J. Murgui (2014b): "New estimates of capital stock for european regions (1995-2007)", *Revista de Economía Aplicada*, 66 (vol. XXII), 113-137.

EU-KLEMS: *Growth and Productivity Accounts: November 2009 Release.* http://www.euklems.net/

EUROSTAT, REGIO database, General and regional Statistics, Regions and cities. http://epp.eurostat.eC.E.uropa.eu/portal/page/portal/region_cities/regional_statistics/data/database

FRASER Institute. http://www.fraserinstitute.org/programs-initiatives/economic-freedom.aspx

Griffith, R. and R. Harrison (2004): "The link between product market reform and macro-economic performance", European Commission Economic Papers, 209, 153 pages.

Griffith, R., R. Harrison and H. Simpson (2006): "The link between product market reform and EU macroeconomic performance", European Commission Economic Papers, 243, 124 pages.

Hansen, L.P. (1982): “Large sample properties of Generalized Method of Moments estimators”, *Econometrica* 50, 1029–1054.

Hirsch, B. (2004): “What Do Unions Do for Economic Performance?”, *Journal of Labor Research,* 25 (3), Summer, 415-55.

Janiak, A. and E. Wasmar (2013): “EPL and Capital-Labor ratios”, Documento de trabajo, serie Economía Nº 288, 39 pages. University of Chile.

Klapper, L., L. Laeven and R. Rajan (2006): “Entry regulation as a barrier to entrepreneurship”, *Journal of Financial Economics*, 82, 591-629.

Mauro, P. (1995): “Corruption and Growth”, *Quarterly Journal of Economics* 110 (1995):681–712.

Mauro, P. (1996): “The effects of corruption on growth, investment and government expenditure*”, IMF Working paper.*

Metcalf, D. (2002): “Unions and productivity, financial performance and investment”, International evidence”, Centre for Economic Performance, LSE, 539.

Nicoletti, G. and S. Scarpetta (2003), “Regulation, Productivity and Growth”, *Economic Policy*, Vol. 36, pp. 11-72.

Nicoletti, G., and F. Pryor (2006), "Subjective and Objective Measures of Governmental Regulations in OECD Nations", *Journal of Economic Behavior and Organization* 59, No. 3: 433-449.

Nicoletti, G., S. Scarpetta and O. Boylaud (1999), “Summary Indicators of Product Market Regulation with an Extension to Employment Protection Legislation”, OECD Economics Department Working Papers, No. 226.

OECD http://www.oecd.org/eco/growth/indicatorsofproductmarketregulationhomepage.htm

OECD http://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection.htm

Rendon, S. (2004): “Job Creation and Investment in Imperfect Capital and Labor Markets”, Economic Working Papers at Centro de Estudios Andaluces E2004/35.

Sargan, J.D. (1958): “The estimation of economic relationships using instrumental variables”, *Econometrica* 26, 393–415.

Shleifer, A. and R. W. Vishny (1993): “Corruption”, *Quarterly Journal of Economics* 108, 599–617.

Swaleheen, M. (2011): “Economic growth with endogenous corruption: an empirical study”, *Public Choice* 146, 23-41.

Wasmer, E. and P. Weil (2004): “The macroeconomics of labour and credit market imperfections”, *American Economic Review* 94 (4), 944–963.

Windmeijer, F. (2005): “A finite sample correction for the variance of linear efficient two-step GMM estimators”, *Journal of Econometrics,* 126, pp. 25-51.

Young, D. (2003):” Employment protection legislation: its economic impact and the case for reform”, European Commission, Economic Paper No. 186.

APPENDIX 1. BD.EURS Database (NACE Rev. 1)

The basic data for the 121 European regions for the period 1995-2007, are taken from the BD.EURS database (NACE Rev.1) base year 2000. This basis is the result of analysing the quality and consistency of the different statistical sources available on the basic macroeconomic variables - GVA in current and constant prices, employment, gross fixed capital formation and capital stock- for countries and at the NUTS 2 level. The level of regional disaggregation corresponds to NUTS 2 in the Eurostat nomenclature of territorial units for statistics (NUTS) and the level of industry disaggregation corresponds to six major sectors: agriculture and fisheries; industry (manufacturing and energy); construction; wholesale and retail trade services including hotels and restaurants and transport; financial, real estate and other business services; and finally, public administration.

In this version of the database, only information about 121 regions from nine European countries is presented, representing the regions which provide higher quality and quantity of information for the period 1995-2007. They are: the regions of Belgium, Germany, France, Italy, Netherlands, Austria, Portugal, Sweden and Spain.

The series of gross fixed capital formation, capital stock, GVA, employment, real wage, user cost of capital are:

Gross value added. GVA at current prices from EUROSTAT includes production of goods and services at factor costs produced in the region by the six sectors. GVA deflators are obtained from EU-KLEMS. Series in PPS (purchasing power standards)

Number of employees. National information from the series provided by AMECO and EUROSTAT, sectoral disaggregation from EUROSTAT and EU-KLEMS, and the regional disaggregation from EUROSTAT.

Gross earnings. The gross earnings of each regional industry is calculated using the EU-KLEMS and EUROSTAT as a reference. The real wage in each region is calculated as gross earnings of each region divided by the number of employees.

Gross fixed capital formation (GFCF). Regional series of GFCF are taken from EUROSTAT - expressed in current prices- and the AMECO and EU-KLEMS databases are used to obtain GFCF series at constant prices.

Capital stock. Net stock of capital in the region by the six branches of activity for 121 regions in nine European countries for the period 1995-2007. Figures are calculated using the Perpetual Inventory Method (PIM). Regional series of GFCF taken from EUROSTAT are the basic inputs of the estimation, while the criteria followed to prioritize regional comparability consists, on the one hand, of using the same sectoral depreciation rates for all the countries and regions in the sample and, on the other, of constructing sectoral regional capital stocks under identical criteria for all the regions in the different countries. Capital stock series provide a sectoral disaggregate similar to that used by EUROSTAT (NACE Rev. 1) for regional GFCF.

User cost of capital. The user cost of capital in each region is computed as $\left(\frac{v_{it}}{P_{it}} = \frac{p_{it}^I}{P_{it}} \left(r_t^n - \hat{p}_{it}^I + \delta_{it} \right) \right)$

where p_{it}^I is the regional investment deflator, p_{it} is the output deflator in each region, r_t^n is a

long run interest nominal rate, δ_{it} is the capital depreciation rate in each region, and $\hat{p}_{it}^{I}$ is the rate of growth of the capital investment regional deflator. Long run interest nominal rates are taken from AMECO.

APPENDIX 2. European Regions

Table A2.1. NUTS 2 Codes and Regional I/K average 1995-2007

Code	Region	I/K average	Code	Region	I/K average
BE1	Région de Bruxelles	0.103	ES22	Navarra	0.113
BE21	Prov. Antwerpen	0.104	ES23	La Rioja	0.121
BE22	Prov. Limburg (B)	0.095	ES24	Aragón	0.117
BE23	Prov. Oost-Vlaanderen	0.099	ES3	Comunidad de Madrid	0.121
BE24	Prov. Vlaams Brabant	0.100	ES41	Castilla y León	0.100
BE25	Prov. West-Vlaanderen	0.098	ES42	Castilla-la Mancha	0.091
BE31	Prov. Brabant Wallon	0.102	ES43	Extremadura	0.077
BE32	Prov. Hainaut	0.096	ES51	Cataluña	0.098
BE33	Prov. Liège	0.094	ES52	Comunidad Valenciana	0.102
BE34	Prov. Luxembourg (B)	0.103	ES53	Illes Balears	0.102
BE35	Prov. Namur	0.104	ES61	Andalucia	0.102
DE1	Baden-Württemberg	0.093	ES62	Región de Murcia	0.118
DE2	Bayern	0.091	ES7	Canarias (ES)	0.106
DE3	Berlin	0.099	FR1	Ile de France	0.074
DE4	Brandenburg	0.087	FR21	Champagne-Ardenne	0.076
DE5	Bremen	0.096	FR22	Picardie	0.072
DE6	Hamburg	0.100	FR23	Haute-Normandie	0.076
DE7	Hessen	0.095	FR24	Centre	0.073
DE8	Mecklenburg-Vorpommern	0.100	FR25	Basse-Normandie	0.070
DE9	Niedersachsen	0.093	FR26	Bourgogne	0.073
DEA	Nordrhein-Westfalen	0.090	FR3	Nord - Pas-de-Calais	0.071
DEB	Rheinland-Pfalz	0.092	FR41	Lorraine	0.071
DEC	Saarland	0.089	FR42	Alsace	0.074
DED	Sachsen	0.093	FR43	Franche-Comté	0.070
DEE	Sachsen-Anhalt	0.083	FR51	Pays de la Loire	0.080
DEF	Schleswig-Holstein	0.098	FR52	Bretagne	0.078
DEG	Thüringen	0.106	FR53	Poitou-Charentes	0.073
ES11	Galicia	0.106	FR61	Aquitaine	0.083
ES12	Principado de Asturias	0.083	FR62	Midi-Pyrénées	0.080
ES13	Cantabria	0.089	FR63	Limousin	0.081
ES21	Pais Vasco	0.097	FR71	Rhône-Alpes	0.079

FR72	Auvergne	0.080	NL23	Flevoland	0.090
FR81	Languedoc-Roussillon	0.081	NL31	Utrecht	0.098
FR82	Provence-Alpes-Côte d'Azur	0.085	NL32	Noord-Holland	0.096
FR83	Corse	0.094	NL33	Zuid-Holland	0.091
ITC1	Piemonte	ITC1	NL34	Zeeland	0.088
ITC2	Valle d'Aosta/Vallée d'Aoste	ITC2	NL41	Noord-Brabant	0.089
ITC3	Liguria	ITC3	NL42	Limburg (NL)	0.089
ITC4	Lombardia	ITC4	AT11	Burgenland (A)	0.090
ITD1	Prov Auton Bolzano-Bozen	ITD1	AT12	Niederösterreich	0.091
ITD2	Prov. Trento	ITD2	AT13	Wien	0.091
ITD3	Veneto	ITD3	AT21	Kärnten	0.094
ITD4	Friuli-Venezia Giulia	ITD4	AT22	Steiermark	0.088
ITD5	Emilia-Romagna	ITD5	AT31	Oberösterreich	0.087
ITE1	Toscana	ITE1	AT32	Salzburg	0.098
ITE2	Umbria	ITE2	AT33	Tirol	0.095
ITE3	Marche	ITE3	AT34	Vorarlberg	0.092
ITE4	Lazio	ITE4	PT11	Norte	0.108
ITF1	Abruzzo	ITF1	PT15	Algarve	0.117
ITF2	Molise	ITF2	PT16	Centro (PT)	0.109
ITF3	Campania	ITF3	PT17	Lisboa	0.090
ITF4	Puglia	ITF4	PT18	Alentejo	0.100
ITF5	Basilicata	ITF5	SE11	Stockholm	0.103
ITF6	Calabria	ITF6	SE12	Ostra Mellansverige	0.113
ITG1	Sicilia	ITG1	SE21	Småland med öarna	0.105
ITG2	Sardegna	ITG2	SE22	Sydsverige	0.102
NL11	Groningen	0.096	SE23	Västsverige	0.103
NL12	Friesland (NL)	0.093	SE31	Norra Mellansverige	0.111
NL13	Drenthe	0.098	SE32	Mellersta Norrland	0.103
NL21	Overijssel	0.092	SE33	Ovre Norrland	0.112
NL22	Gelderland	0.091			