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ABSTRACT

Sectoral Structure and Entry Regulations*

The sectoral allocation of labor differs considerably across developed economies, even in the presence of similar patterns of structural change. A general equilibrium model that captures the stylized facts of structural change is presented. In this framework, economy-wide barriers to entry hinder the development of dynamic sectors such as service industries. Moreover, higher service prices and rents in regulated economies reduce labor supply, providing a rationale for the negative association between product market regulations and the employment rate previously found in the literature. Empirical evidence presented shows that regulatory entry barriers help explaining differences in the sectoral allocation of labor across OECD countries.

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1 Introduction

Service industries have absorbed a continuously increasing share of the labour force during the last century in developed countries, while agricultural activities have lost weight dramatically. This process structural change has led researchers to establish the positive (negative) association between the service (agricultural) employment share and GDP per capita as a stylized fact of modern economic growth.¹ However, remarkable differences in the sectoral distribution of employment can still be observed across countries at a similar stage of development. For instance, some European countries such as Austria, Italy and Germany have service employment shares barely exceeding 60 per cent in the second half of the 1990s, 10 percentage points lower than in the Netherlands, Australia or Canada.

Echevarria (1997) and Kongsamut, Rebelo and Xie (2001) develop general equilibrium models consistent with the long-run patterns of structural change. These papers rely on demand (non-homothetic preferences) and supply (differences in the rate of productivity growth across sectors) forces to explain the long-run patterns in the sectoral allocation of resources. This paper considers these two forces as engines of sectoral reallocation, but focuses on their interaction with regulations that raise barriers to entry in explaining persistent cross-country differences in the sectoral structure.

Economy-wide regulations such as screening procedures and tax-related requirements for start-ups and sectoral regulations such as zoning laws or restrictions on shop opening hours constitute barriers to entry for entrepreneurs. Recent studies focus on the effects of different aspects of product market regulations in labour market outcomes. At the cross-country level, the stringency of entry regulations appears negatively associated with employment rates (Nicoletti et al., 2001) and entrepreneurial activity (Fonseca et al., 2001) across OECD countries. At the sectoral level, Bertrand and Kramarz (2002) find that entry regulation hinders job creation in the French retail sector.

The model described herein captures the long-term patterns of structural change: (1) an increase (reduction) in the services (agricultural) sectoral labour share along the growth process; (2) a similar pattern with regard to nominal GDP shares; (3) a less marked increase in the real GDP share of the service sector; (4) a continuous decline of the employment rate associated with the secular fall of employment engaged in agricultural activities. In the presence of economy-wide entry regulations, the market price of services and rents in the economy increase, triggering a reduction of labour supply. This provides a rationale for the negative association between product market regulations and

¹Clark (1957) and Kuznets (1966) study the relationship between sectoral structure and economic growth. For a recent review of the empirical regularities in the growth of service employment see OECD (2000)

the employment rate previously found in the literature, and is also consistent with the gap in marketization of services activities between the US and European economies found in Freeman and Schettkat (2002). Accordingly, European households would respond to tighter entry regulations substituting the purchase of services in the market (e.g. child care, home repairs and leisure activities) by home production, while the Americans, facing lower service prices would supply more hours of work purchasing equivalent services in the market.

The simulations show that economy-wide regulatory barriers to entry obstruct the natural pattern of structural change, hindering the development of those sectors whose demand is income elastic. Thus, countries with tighter restrictions to entry are expected to have a relatively underdeveloped service sector. Empirical evidence presented in the paper supports this negative association, which persists even after controlling for a wide range of factors which might also contribute to shape cross-country differences in the sectoral structure.

The paper is organized as follows. The next section discusses the cross-country patterns in the sectoral allocation of labour and presents suggestive evidence on the role of entry barriers in the sectoral allocation of employment. In Section 3, the model of structural change is outlined. Section 4 presents the main results of the free entry version of the model and Section 5 discusses the effects of the interactions between entry regulations and the forces of structural change in shaping employment patterns. Section 6 assesses the empirical relevance of the relationship between entry regulations and the service employment share and Section 7 concludes.

2 Structural Change and Entry Regulations

The first panel of Figure 1 shows the distribution of the US employment shares in the three main sectors of the economy (agriculture, manufacturing and services) over the last 130 years. It shows a progressive fall in the agricultural share (from 47% in 1870 to 2% in 1996) that goes together with a continuous increase of service employment (from 26 to 70% in the same period).

This pattern of structural change is not a peculiarity of the US, but rather, a common feature across OECD countries. This is illustrated in panels 2 and 3 of Figure 1, which show a positive (negative) cross-sectional correlation between GDP per capita and the service (agriculture) employment share in the 1990s. However, these cross-plots also show important disparities in the snapshot distribution of employment across similar countries. For instance, Italy, Austria, Germany and Japan are relatively underdeveloped in terms of service employment with respect to countries like the Netherlands, Australia or Canada, while all of them lie in a similar income per capita range.

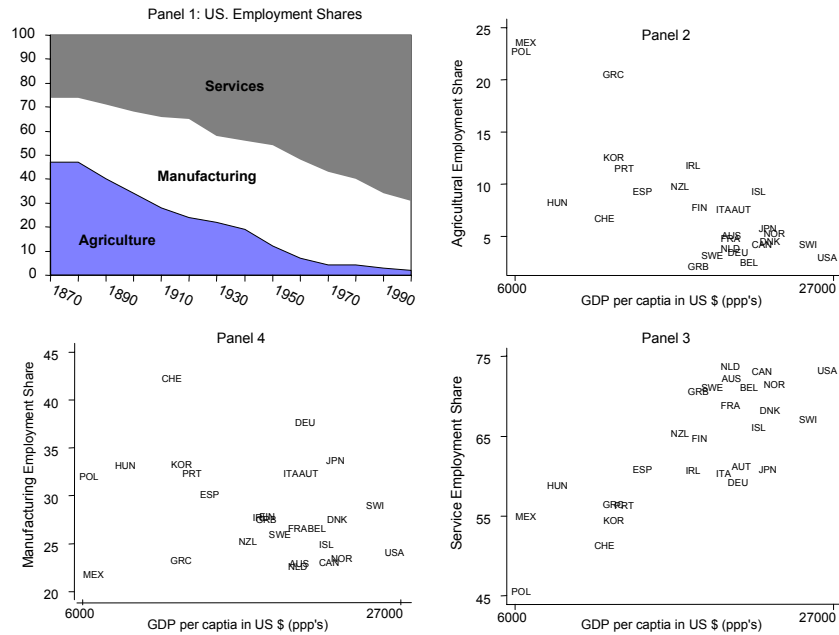


Figure 1: Structural Change and Employment Sectoral Allocation

Two main forces lie behind the process of structural change: (1) a hierarchy in consumer tastes and (2) differences in the rate of growth of technical change between sectors.²

The first is associated with Engel's law, that is, with differences in income elasticities of demand for different goods. The Engel's law predicts a progressive fall in the demand for agricultural products as income per capita raises due to a saturation level in agricultural consumption. Clark (1957) argues that a similar argument applies to service demand, which benefits from a saturation in the consumption of manufacturing goods once a certain level of development is reached. Empirical evidence on the income elasticity of demand for agricultural products clearly suggests that saturation levels have been surpassed in all OECD countries. Regarding the service sector, the evidence is less clear-cut, with estimates yielding income elasticities either equal to one (Falvey and Gemmell, 1996) or slightly larger than 1 (Bergstrand, 1991). However, problems of measurement

²There are other forces which to some extent will alter the sectoral structure of the economy along the growth process. Among them, the outsourcing of ancillary activities to specialized service providers is becoming common practice in the manufacturing sector. Although the rationales and consequences of outsourcing are beyond the scope of this paper, it should be noted that in the process of externalization barriers to entry are likely to be important, since more stringent regulatory and administrative barriers might obstruct the creation of the flexible producer service firms that are at the core of the outsourcing process.

cast serious doubts on the accuracy of service output data (Gordon, 1996). If output in some service industries such as retail, wholesale trade, finance, real estate or social services is systematically mis-measured (Griliches, 1994), then estimates of the income elasticity of demand for services would be downward biased.

The second explanation, first put forward in Baumol (1967), highlights supply side forces. Assuming that labour productivity grows more slowly in services than in industry, and that the ratio of real output between both sectors is held constant, “more and more of the total labour force must be transferred to the non-progressive sector (services) and the amount of labour in the other sector will tend to approach zero”.³ Accepting the caveat that problems of measurement might be attributing real output growth to an increase in the relative price of services, evidence on a slower growth rate in service than in manufacturing “measured” productivity is overwhelming.⁴

Product and labour market institutions should influence the process of structural change, either facilitating or obstructing the reallocation of resources. However, their role has been largely ignored in this literature.⁵ On the labour market side of the regulatory framework, Gordon (1997) suggests that relatively high minimum wages in France could be obstructing the creation of low-wage service industries employment in this country. Along these lines, Freeman and Schettkat (2000) find some evidence of wage compression obstructing the expansion of low skilled services in Germany, although the presence of wage floors is able to account for a minor share of the service employment gap of this country with respect to the US.

Figure 2 assesses the relationship between the regulation of entry and the sectoral employment shares across OECD countries. It shows the association between the average sectoral employment shares in the 1990s and the cost of setting up a new business across OECD countries.⁶ The graphs on the left hand side show a clear negative (positive) association between the service (agricultural and manufacturing) employment share and the indicator of entry restrictions. The correlations are clearly significant, ranging from $-.75$ in the case of services to $.52$ with respect to agriculture. Similarly, the partial correlations results (after controlling for GDP per capita) presented on the right hand

³Baumol (1967)

⁴See for instance Gouyette and Perelman (1997) and the references therein.

⁵An exception is Chenery, Robinson and Syrquin (1986), who mention that institutions that set up barriers to the free movement of factors from low to high productivity growth sectors might be a potential source of slower growth and structural slump.

⁶The cost of setting up a new business comprises the fees from the different permits and legal requirements and the imputed opportunity cost of the entrepreneur’s time needed to deal with this process normalized by GDP per capita. For details on the construction of this indicator see Djankov et al. (2002). Although there is information available on a larger number of countries, the graphs are restricted to those OECD countries that are the focus of the empirical analysis presented in Section 6.

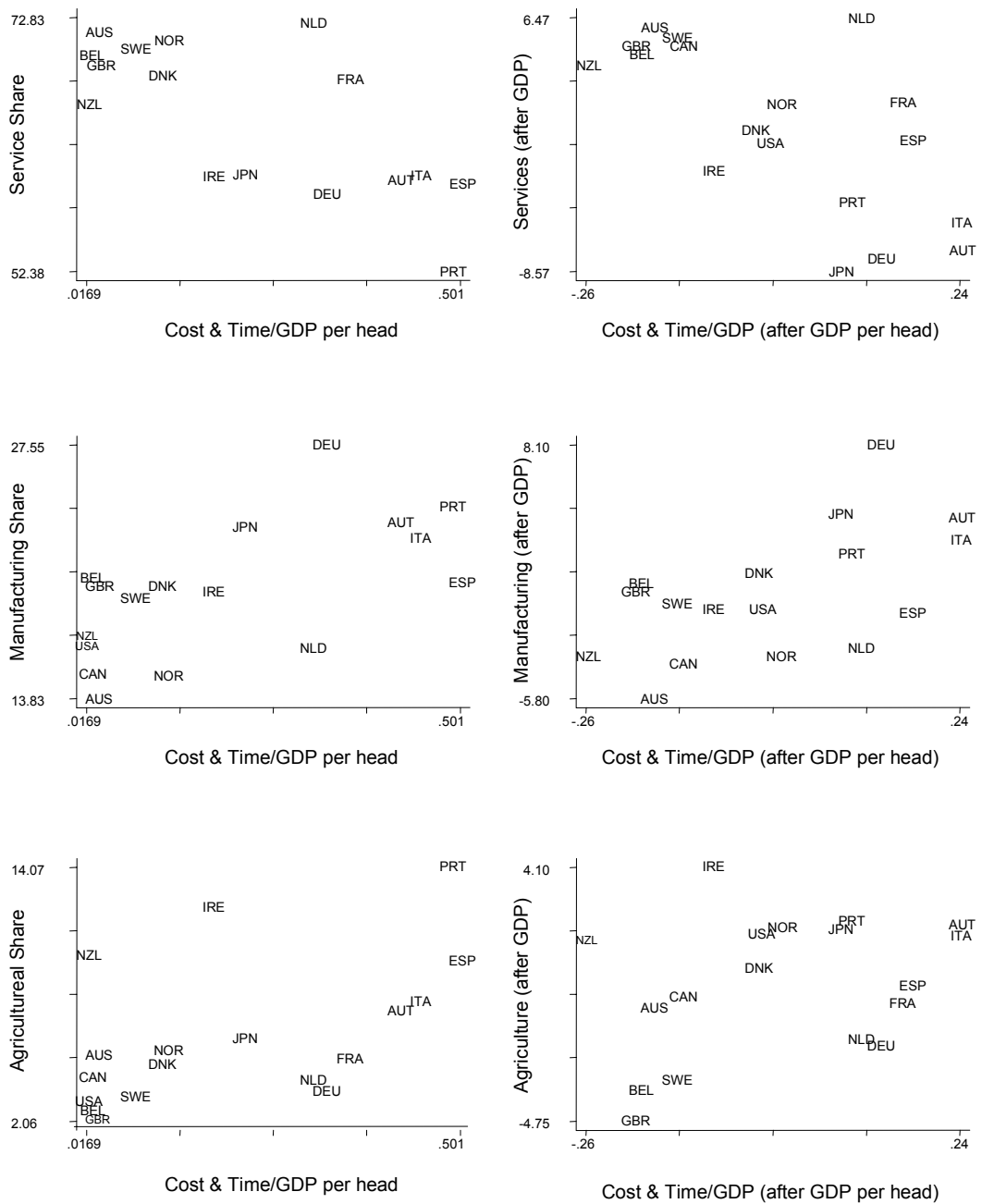


Figure 2: Entry Regulations and Sectoral Employment Shares

panels suggest that these correlations are not due to an association between GDP per capita and the indicator of entry restrictions. Before further discussing the empirical association between entry regulations and the sectoral shares, next section presents a model that spells out the channels through which barriers to entry alter the sectoral allocation of resources in the process of structural change.

3 The Model

In this economy, structural change is brought about by different income elasticities of demand for every good and different exogenous rates of productivity growth across sectors as in Echevarria (1997) and Kongsamut, Rebelo and Xie (2001). There are three sectors: agriculture (a) manufacturing (m) and services (s), each characterized by a continuum of firms (n_a, n_m, n_s) producing differentiated brands. Product markets are monopolistically competitive,⁷ and entry is restricted due to the existence of regulatory barriers. Thus, the profit function of the a representative firm i in sector r can be defined as follows:

$$\pi_{irt} = P_{irt}C_{irt} - W_tL_{irt} - \kappa \quad , \quad \text{for } r = a, m, s \quad (1)$$

where $P_{irt}C_{irt}$ and W_tL_{irt} are gross output and the wage bill respectively, and κ accounts for barriers to entry. In this setting, entry barriers represent an economy-wide fixed cost of setting up a business that must be paid in every period.⁸ This specification is a reasonable approximation to administrative burdens for corporations, price controls or regulatory and administrative opacities in general which represent yearly costs to incumbent firms. Instead, barriers to entry such as licenses and permits represent a sunk cost. In this case, κ should be interpreted as the annuity payment of those costs. Blanchard and Giavazzi (2002) model this aspect of the regulations in product markets in a similar fashion, considering entry barriers to be proportional to the size of the firm (or firm's output). In this model instead, the cost of regulations is equal for all firms independently of the productive sector in which they operate.

⁷Brunello (1993) incorporates monopolistic competition in product markets and wage bargaining institutions in the unbalanced growth model proposed by Baumol. I differ from him in two fundamental aspects: by allowing for non-homotheticity of preferences and assuming that free entry determines the equilibrium number of firms in each period.

⁸Alternatively, Messina (2003) considers barriers to entry proportional to sectoral prices. The main results of the paper are not altered by this modification.

3.1 Households

The representative household is the owner of the firms and labour supply decisions are made together with consumption. The household utility function is

$$U_t = \left((C_{at} - \bar{A})^\alpha (C_{mt})^\beta (C_{st} + \bar{S})^{1-\alpha-\beta} \right)^\phi (\bar{L} - L_t)^{1-\phi} \quad (2)$$

where C_{at} , C_{mt} and C_{st} are composite bundles that represent the total amount of agricultural, manufacturing and service goods consumed at time t . The parameter \bar{A} is a subsistence level of agricultural goods, implying that the poorer the household is, the more of its income must be devoted to the consumption of food. In other words, given $\bar{A} > 0$ the income elasticity of agricultural demand is lower than 1. On the other hand, \bar{S} can be interpreted as home production of service activities such as cooking, cleaning or home repairs, to name but a few, accounting for the assumption that as GDP grows there is a progressive monetization of these activities.⁹ Thus, given $\bar{S} > 0$ the income elasticity of demand for services is always greater than 1. The second term of the utility function represents leisure, \bar{L} being the household endowment of hours.

In every period, n_{rt} varieties are produced in each sector. The household divides its consumption across these varieties according to the following sub-utility function:

$$C_{rt} = (n_{rt})^{\xi_r} \left(\sum_{i=1}^{n_{rt}} (C_{irt})^{\frac{\sigma_r - 1}{\sigma_r}} \right)^{\frac{\sigma_r}{\sigma_r - 1}} \quad ; \quad \text{for } r = a, m, s \quad (3)$$

where $\sigma_r > 1$ is the elasticity of substitution among varieties in sector r . I follow the original setup proposed by Dixit and Stiglitz (1975), assuming that the number of varieties of each composite good enters explicitly the utility function up to an arbitrary power (ξ_r). Therefore, this specification encompasses several specifications that have been used in the literature. For instance, by setting $\xi_r = \frac{1}{1-\sigma_r}$, taste for variety is cancelled as in Blanchard and Kiyotaki (1987), while $\xi_r = 0$ is the functional form preferred by Dixit and Stiglitz (1977).

Two-stage budgeting is a valid procedure since homogeneous separability applies. Therefore, the household will choose in a first stage the quantities to consume out of every brand taking sectoral expenditures as given, and later select the aggregate consumption

⁹Another secular trend is the progressive substitution of some of these services by goods that carry out similar functions. For instance, washing machines instead of cleaning services or CD players instead of live concerts. The decision between purchasing these services in the market or substituting them by manufacturing goods will depend, among other factors, on the evolution of relative prices. Therefore, the stringency of entry regulations will have an important role in this process as will be discussed later.

bundles and labour supply. In particular, every household will repeat for every sector the maximization of (3) subject to

$$\sum_{i=1}^{n_{rt}} P_{irt} C_{irt} = P_{rt} C_{rt} \quad , \quad \text{for } r = a, m, s$$

This yields the demand for each variety, which is inversely related to its relative price according to the inter-brand elasticity of substitution,

$$C_{irt} = \left(\frac{P_{rt}}{P_{irt}} \right)^{\sigma_r} C_{rt} (n_{rt})^{\xi_r(\sigma_r-1)} \quad , \quad \text{for } r = a, m, s \quad (4)$$

where P_{rt} is the price index for composite good r

$$P_{rt} = (n_{rt})^{-\xi_r} \left(\sum_{i=1}^{n_{rt}} (P_{irt})^{1-\sigma_r} \right)^{\frac{1}{1-\sigma_r}} \quad , \quad \text{for } r = a, m, s \quad (5)$$

In the second stage, sectoral expenditures and labour supply are decided. Therefore, the household maximizes its utility function (2) subject to the budget constraint and non-negativity conditions

$$\begin{aligned} P_{at}C_{at} + P_{mt}C_{mt} + P_{st}C_{st} &\leq W_tL_t + R_t \\ C_{at} \geq 0, \quad C_{mt} \geq 0, \quad C_{st} &\geq 0 \end{aligned} \quad (6)$$

where the right-hand side of the first inequality represents total income of the household, that is composed of labour income (W_tL_t) and the rents (R_t) of the economy which are defined as:

$$R_t = \kappa \sum_{r=a,m,s} n_{rt} \quad (7)$$

This maximization yields the following demand functions

$$C_{at} = \frac{\alpha}{P_{at}} I_t + \bar{A} \quad (8)$$

$$C_{mt} = \frac{\beta}{P_{mt}} I_t \quad (9)$$

$$C_{st} = \frac{1-\alpha-\beta}{P_{st}} I_t - \bar{S} \quad (10)$$

where I_t is the so called full income of the household:

$$I_t = W_tL_t + R_t + P_{st}\bar{S} - P_{at}\bar{A} \quad (11)$$

, and the individual labour supply schedule

$$L_t = \bar{L} - \frac{(1-\phi)}{\phi} \frac{I_t}{W_t} \quad (12)$$

with $\frac{(1-\phi)}{\phi}$ representing the ratio between the elasticities of the marginal utilities of leisure and consumption.

3.2 Price Rules

Technology is the same across sectors and firms, but the exogenous rate of productivity growth g_r is allowed to vary across sectors according to the following law of motion

$$\dot{\lambda}_{rt} = g_r \lambda_{rt} \quad , \quad \text{for } r = a, m, s \quad (13)$$

where λ_{rt} is the productivity level at time t in sector r and a dot over a variable denotes a derivative with respect to time.

The production function of a representative firm i that operates in sector r is characterized by

$$O_{irt} = L_{irt} \lambda_{rt} - \psi_r \quad , \quad \text{for } r = a, m, s \quad (14)$$

where the parameter ψ_r represents a fixed cost of production that is allowed in principle to vary across sectors and O_{irt} is the output of firm i in a given period.

Taking into account the demand for each particular brand and the available technology, the monopolistic firms set prices and labour demand to maximize profits. We assume that the number of firms (and therefore brands) is so large that every firm neglects the indirect effects of its price decisions on aggregate variables. The goods produced are non-storable.

Profit maximization of firm's i profits (1) subject to its demand (4) and supply function (14) yields the price rule and labour demand. Accordingly, the price rule is:

$$P_{irt} = \mu_r \frac{W_t}{\lambda_{rt}} \quad , \quad \text{for } r = a, m, s \quad (15)$$

where

$$\mu_r = \frac{\sigma_r}{\sigma_r - 1} \quad , \quad \text{for } r = a, m, s$$

is the markup of prices over marginal costs.

After some manipulations, labour demand of firm i in sector r can be expressed as

$$L_{ir} = \left(\frac{P_{rt}}{P_{irt}} \right)^{\sigma_r} \frac{\left((n_{rt})^{\xi_r (\sigma_r - 1)} C_{rt} + \psi_r \right)}{\lambda_{rt}} \quad , \quad \text{for } r = a, m, s \quad (16)$$

3.3 Equilibrium

Note that in the light of the assumptions made about technology and preferences, the inter-brand equilibrium will be symmetrical:

$$P_{jrt} = P_{krt} \quad \forall j, k \quad , \quad \text{for } r = a, m, s$$

Symmetry allows us to work with aggregate variables. Thus, according to (5) the aggregate sectoral price index becomes

$$P_{rt} = (n_{rt})^{\left(\frac{1 + \xi_r \sigma_r - \xi_r}{1 - \sigma_r} \right)} P_{irt} \quad , \quad \text{for } r = a, m, s \quad (17)$$

which implies that, as long as taste for variety is not cancelled (if $\xi^r > \frac{1}{1-\sigma^r}$), sectoral prices *decrease* when the number of varieties in the sector *increases*. Introducing (17) into (15) an expression for aggregate sectoral prices is obtained:

$$P_{rt} = (n_{rt})^{\left(\frac{1+\xi_r\sigma_r-\xi_r}{1-\sigma_r}\right)} \mu_r \frac{W_t}{\lambda_{rt}}, \quad \text{for } r = a, m, s \quad (18)$$

Demand for every brand from (4) and (17) becomes

$$C_{irt} = (n_{rt})^{\left(\frac{\sigma_r\xi_r+\sigma_r-\xi_r}{1-\sigma_r}\right)} C_t^r, \quad \text{for } r = a, m, s \quad (19)$$

Similarly, introducing (17) into (16) yields an expression for the behavior of sectoral employment in equilibrium

$$(L_{rt}) = \frac{1}{\lambda_{rt}} \left((n_{rt})^{\left(\frac{1+\sigma_r\xi_r-\xi_r}{1-\sigma_r}\right)} C_{rt} + n_{rt}\psi_r \right), \quad \text{for } r = a, m, s \quad (20)$$

The labour market clearing condition is derived from individual labour supply (12) and the sectoral labour demands summarized in (20):

$$L_{at} + L_{mt} + L_{st} = L_t = \phi\bar{L} - (1-\phi) \frac{(R_t + P_{st}\bar{S} - P_{at}\bar{A})}{W_t} \quad (21)$$

Finally, an expression for the equilibrium number of firms in every sector closes the model. I assume free entry once the regulatory costs are satisfied. Thus, combining (1), (18) and (19), the zero profit condition and market clearing set the number of varieties in every sector according to the next expression

$$C_{rt} (\mu_r - 1) - (n_{rt})^{\left(\frac{\sigma_r\xi_r+\sigma_r-\xi_r}{\sigma_r-1}\right)} \psi_r - \frac{\mu_r n_{rt} \kappa}{P_{rt}} = 0 \quad \text{for } r = a, m, s \quad (22)$$

The Equilibrium is defined by the three demand rules (8), (9), (10), the three price rules and labour demand equations summarized in (18) and (20) respectively, the three zero profit conditions summarized in (22) and the labour market clearing condition (21), which constitute a system of 13 equations in 13 unknowns. Labour is set as the numeraire, such that aggregate wages are equal to 1. Non linearities in the system oblige to find numerical solutions by an iterative process.

3.4 Parameterization

All parameters are set in advance to match certain long-run averages observed in the US economy of the last century. Thus, a model period corresponds to one year and is simulated for 100 periods.

Table 1 summarizes the parameters used in the benchmark simulations. The expenditure shares (α, β) represent the actual sectoral value added as a percentage of GDP in the

US in 2000. \bar{A} and \bar{S} are set together with the initial levels of technology (g_{a0}, g_{m0}, g_{s0}) in order to obtain an income elasticity of demand for every good consistent with empirical estimates. Accordingly, the average income elasticity of service demand in a mature economy (during the last 20 periods of the simulation) is 1.1, consistent with available estimates for the 1980s (Bergstrand, 1991). Over the whole period, the income elasticity of demand for services is larger than one, and decreases monotonically as productivity increases. Consistent with the empirical evidence, the income elasticity for manufactures is smaller than for services but larger than for agriculture.

Oliveira, Scarpetta and Pilat (1996) find an average mark-up of 1.15 for US manufacturing, while estimates for service sub-sectors range from 1.24 to 1.68. I introduce the same markups in the three sectors in the benchmark simulation to isolate the effects of entry regulations on the sectoral structure. Therefore, the elasticity of substitution across brands in every sector is set to 6, which implies a markup of 1.2.

The value of ϕ is set to $1/3$ such that in the absence of entry regulations and income effects due to non-homothetic preferences the representative household would work a third of its time endowment. The fixed costs of production in every sector and time endowment of the household are normalized to 1.

The growth rates of sectoral productivity (g_a, g_m, g_s) are calculated using data described in Broadberry (1998). This data represent yearly average annual growth rates of output per employee in the three main sectors of the US economy for the period 1900-1990.¹⁰ According to these estimates, service productivity growth lags behind the other two sectors as put forward by Baumol's cost-disease model.

The degree of taste for variety (ξ_r) is set to zero in all sectors. Therefore, as in Dixit and Stiglitz (1977) variety is neither a public good nor a bad. Finally, κ is set to 0.005, implying that when entry regulations are present rents account for 12% of annual GDP in a mature economy.

4 Long-Run. The Free Entry Case

Let us first concentrate on the dynamics of the model in the long run free entry case; thus, when barriers to entry are absent ($\kappa = 0$ in eq. (22)). Figure 3 shows the simulated evolution of the real and nominal sectoral GDP shares, sectoral employment shares and employment rate for a period of 100 years. First, note that the sectoral employ-

¹⁰The service sector productivity growth rate is a weighted average of Distribution, Transport and Communications, Utilities, Finance and Other Services rates of productivity growth. Government Services are left out of the analysis, since output measurement rules out the possibility of productivity growth in this sector.

Table 1:
Parameters in the Baseline Model

g_{a0}	g_{m0}	g_{s0}	α	β	\bar{A}	\bar{S}	ϕ	L	θ
1000	200	300	0.02	0.025	260	50	1/3	1	6
ξ	g_a	g_m	g_s	μ_a	μ_m	μ_s	ψ_a	ψ_m	ψ_s
0	0.034	0.022	0.011	1.2	1.2	1.2	1	1	1

ment shares follow a remarkably similar pattern to the one observed in the US economy during the last century (reported in Figure 1). A massive reallocation of employment from agricultural to service industries takes place, while the manufacturing employment share stays relatively constant. In early stages of production (when productivity is low), the subsistence level of agricultural consumption requires a large share of employment engaged in this sector. However, the important growth rate of productivity in the agricultural sector frees up so much employment that initially both manufacturing and service employment shares increase. This pattern remains stable during the first 50 years of the simulation. Afterwards, the income elastic demand for services together with the low rate of productivity growth in this sector brings about a continuously increasing share of services in employment and nominal GDP, which starts drawing resources even from the manufacturing sector.

Even if the service share increases in nominal terms, following the same pattern of the employment shares, the effects of the productivity gap can be observed from the evolution of the real GDP shares.¹¹ As income rises, the gap between productivity in manufacturing and services grows, and consequently the relative price of services increase with respect to manufacturing. Thus, given the constant raise of the relative price of services, the evolution of the real GDP shares illustrates the so-called cost-disease evolution of the service sector, which suggests that a non-negligible part of the expansion of services nominal GDP shares is due to this price differential.

The evolution of the employment rate can be easily understood from the market clearing condition in the labour market (21) which, taking into account that in the free entry case rents are zero ($R_t = 0$) becomes :

$$L_t = \phi \bar{L} - (1 - \phi) \frac{P_{st} \bar{S} - P_{at} \bar{A}}{W_t} \quad (23)$$

¹¹Real GDP shares are defined as sectoral output evaluated at prices in period 80 divided by real GDP as obtained using a Paasche price index. Thus, the expression for the real GDP share in sector r becomes: $\left(\frac{P_{r80} C_{rt}}{\sum_r P_{rt} C_{rt}} \right) \left(\frac{\sum_r P_{rt} C_{r80}}{\sum_r P_{r80} C_{r80}} \right)$

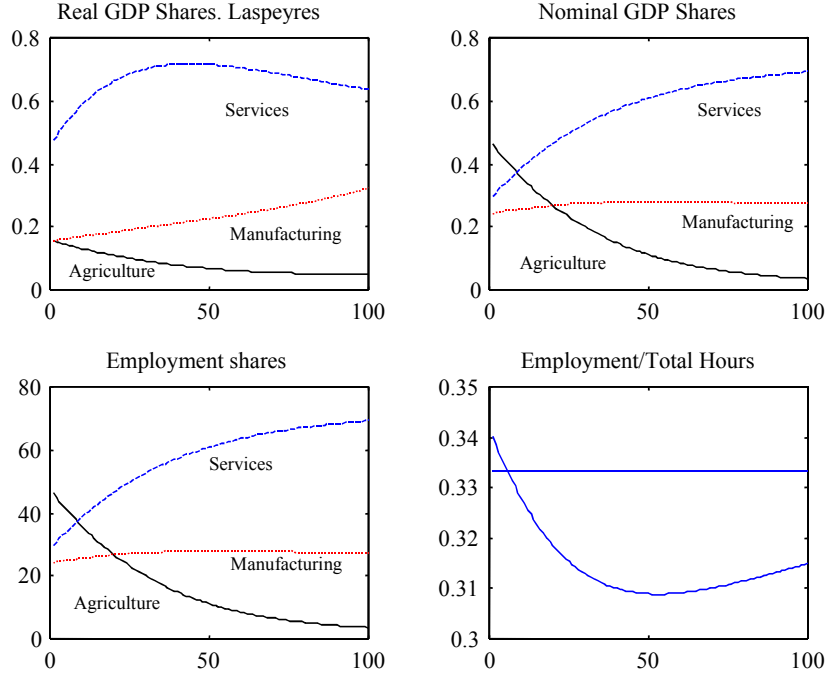


Figure 3: Long-run. Free Entry Case

Therefore, if preferences were homothetic ($\bar{A} = \bar{S} = 0$), the second term in this equation would be zero and the employment level would be fixed over time at $\phi\bar{L}$ (horizontal line in the graph). In our case, productivity improvements reduce prices and therefore the relative importance of this second term as time evolves, which implies that structural change progressively faints and the employment rate tends to this value in the long run.

However, along the structural change path the same forces that explain the sectoral labour shares drive the evolution of labour supply. At early stages of development (small t) the need to fulfill the subsistence level of agriculture consumption together with a low labour productivity in the three sectors explains that the hours worked are above $\phi\bar{L}$. As income grows, the household progressively reduce its working hours, since productivity growth means that the subsistence level of food consumption can be reached with fewer hours of work. This decline in per capita hours worked coincides with the shift away from employment engaged in agricultural production, as observed in the early decades of the twentieth century in the US (Costa, 1994). At some point, the value of home production of services equals the agricultural subsistence requirement, and the employment rate crosses the long-run equilibrium level of leisure. Finally, the continuous reduction of service prices implies a fall in the relative value of home production with respect to

market purchase of services that explains the rise in labour supply.

5 Entry Regulations and Structural Change

Last section showed that the model can capture the stylized facts of structural change. However, non-homotheticity of preferences and different sectoral productivity growth rates are not enough to explain cross-country variability of sectoral labour shares as long as preferences and technology are similar across a pool of relatively homogenous countries.

In the next simulation, we introduce entry regulations and study their effects on the sectoral allocation of labour. Since the empirical motivation of this paper is to explain the divergence in the sectoral employment rates across mature economies, the time span of the next simulation is limited to the last 20 years.

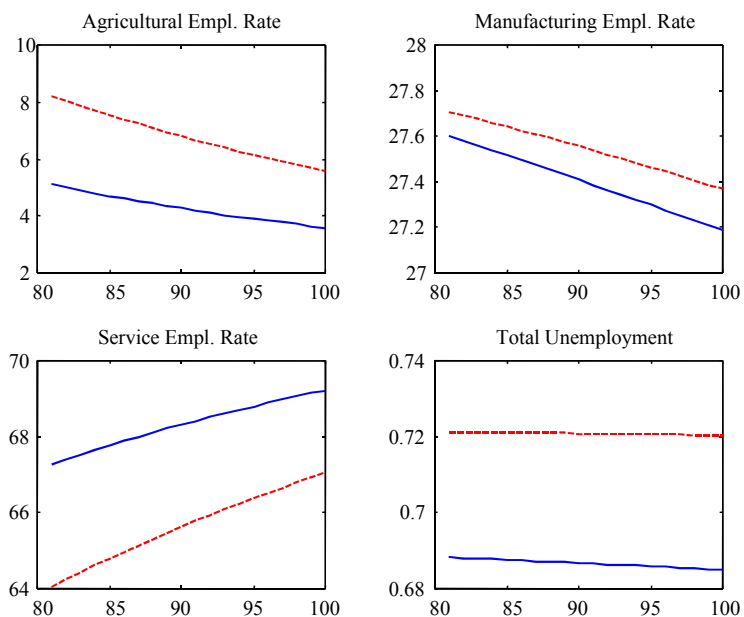


Figure 4: Employment Shares and Working Hours in a Mature Economy

Figure 4 shows the employment rate and sectoral labour shares for the unrestricted entry model (straight lines) and the regulated model (dashed lines). The comparison of the employment rates in the regulated and free entry economies clearly shows that more stringent regulatory barriers reduce labour supply. The intuition behind this result is

quite simple. Total differentiation of (21) yields:

$$\frac{d(L_t)}{d\kappa} = (\phi - 1) \left(\frac{dR_t}{d\kappa} + \bar{S} \frac{dP_{st}}{d\kappa} - \bar{A} \frac{dP_{at}}{d\kappa} \right) \quad (24)$$

The first term in the second parenthesis is positive, indicating that barriers to entry reduce labour supply directly (recall that $\phi < 1$), through the raise in the size of the rents in the economy. The other two terms show that entry barriers alter labour supply through changes in the value of the subsistence requirements. Since tighter entry restrictions reduce the number of firms in equilibrium, the prices of agricultural and service products increase according to eq. (18). The raise in the value of home production of services ($P_t^s \bar{S}$) in the presence of barriers to entry acts as an income effect that further reduces labour supply. This is partially offset by the increasing cost of the subsistent requirement of food (third term). However, this is a second order effect in relatively wealthy societies, where the consumption expenditure in agricultural products is very modest and the fast productivity experienced in this sector guarantees a low relative price for food. Thus, the first two effects outweigh the latter and labour supply falls in regulated economies.¹²

Nicoletti et al. (2001) find a negative correlation between product market regulations and the employment rate in a cross-country study for OECD economies. While they discuss several demand-side channels that could drive this finding, the model presented here proposes an alternative explanation. As barriers to entry become more stringent, the reduction of varieties increases rents and service prices and favor home production of service activities against their purchase in the market, reducing labour supply. Similarly, Freeman and Schettkat (2002) find that once home production of services is accounted for, there are no sizable differences in the employment rate between the US and Germany. As the authors put forward, differences in the tax wedge and skills distributions between both countries partly explain the gap. Additionally, according to the insights discussed above the lower labour supply of German households might be the response to more stringent entry regulations (and therefore higher service prices).¹³

The first three panels of Figure 4 show the responses of the sectoral employment shares to the presence of regulatory barriers. They show that economy-wide barriers to entry exert asymmetric effects on the productive structure of an economy characterized by structural change. They reduce the labour engaged in service activities, increasing the sectoral labour shares of manufacturing and agriculture.

The rationale behind this result is the following. First, entry regulations reduce the number of firms and increase prices of all goods. Since service demand is income

¹²Alternative simulations where barriers to entry represent a dead-weight loss show that these institutions reduce the employment rate in a mature economy even in the absence of rents.

¹³Our indices of barriers to entry indicate highly unregulated markets in the US while German obstacles to the creation of new firms appear in the mean of the distribution of countries.

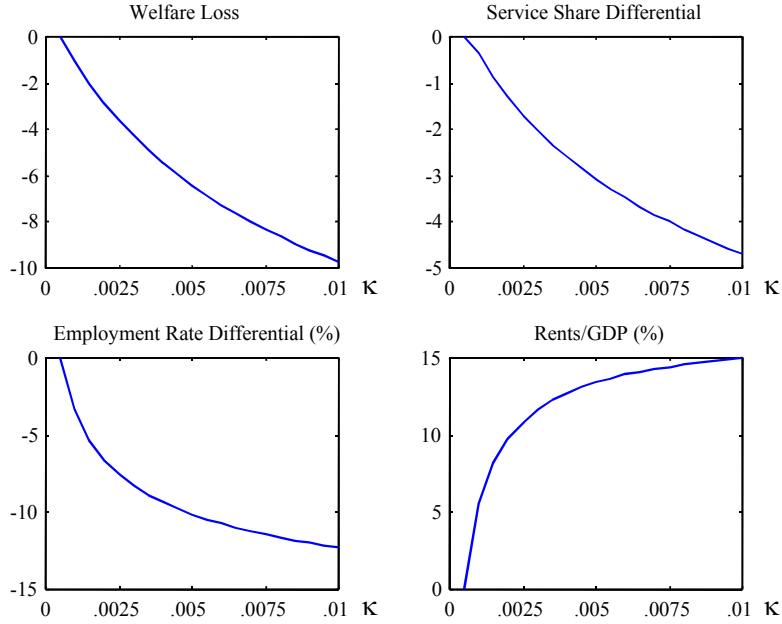


Figure 5: Barriers to Entry and Aggregate Outcomes. Differences (in percentage points) with Respect to the Free Entry Case.

elastic, as long as the introduction of entry restrictions reduces real income this will cause a reduction in consumption that is stronger for the service sector.¹⁴ Second, the higher market price of services and larger size of rents in the regulated economy triggers an additional income effect via reduction of labour supply which constrains further the service employment share.

Although in the present parameterization entry regulations are always welfare decreasing (see footnote 14), it is useful to measure how important these welfare losses are. Let us define ϑ as the percentage variation in leisure that an individual in a regulated economy has to experience to be as well off as in the free entry case, leaving consumption constant. If superscripts r denote variables in the regulated equilibrium and superscripts

¹⁴Note that the reduction in real income will not always take place. The reduction of varieties introduced by the presence of entry regulations increases sectoral prices but also saves fixed costs of production. As Dixit and Stiglitz (1977) showed, when $\xi = 0$ the market outcome is equal to the second best social optimum in which lump-sum subsidies are not available to overcome the inefficiency introduced by monopolistic competition. Thus, any restriction to the number of varieties will reduce income and welfare. However, if variety is considered a public bad ($\xi < 0$), the output and welfare consequences of restricting the number of varieties is undetermined. Messina (2003) shows that the results presented here hold in a similar framework even if variety is considered a public bad, as long as entry regulations are welfare decreasing.

f are meant for the free entry parameterization, the welfare losses ($-\vartheta$) are implicitly defined as:

$$U_t(C_{at}^f, C_{mt}^f, C_{st}^f, (\bar{L} - L_t^f)) = U_t\left(C_{at}^r, C_{mt}^r, C_{st}^r, (\bar{L} - L_t^r) \left(1 + \frac{\vartheta}{100}\right)\right) \quad (25)$$

Figure 5 shows a monotonic relation between κ and the compensating variation in leisure. It also plots the differentials between the regulated and the free entry benchmark economies in the employment rate and the service share. These results highlight the relative importance of regulatory barriers to entry, predicting welfare losses of almost 10% with respect of the free entry case and sizable reductions of the service share and the employment rate when the size of rents represent 10% of GDP. Finally, note that we have assumed economy-wide barriers to entry. To the extent that in reality barriers to entry are concentrated in service industries, their effects on the employment rate and service employment share will be underestimated in the simulations presented here.

6 Service Employment Share and Entry Regulations

This section investigates the association between barriers to entry and the service employment share from an empirical perspective. The model presented in the previous sections leads to the following reduced-form specification:

$$L_{jt} = \alpha_0 + \beta_1 Y_{jt} + \beta_2 Z_{jt} + \gamma R_j + \varepsilon_{jt} \quad \text{for } j = 1, 2 \dots n \text{ and } t = 1, 2 \dots T_i \quad (26)$$

where L_{jt} denotes the service employment share in country j and period t , Y_{jt} represents GDP per capita and its square, Z_{jt} is a set of control variables and R_j denotes the different time-invariant indicators of barriers to entry. Consistent with the predictions of the model, the main hypothesis to be tested is $\gamma < 0$. Three indicators of entry regulations are taken from Djankov et al. (2002), who collected information on the regulation of entry by start-up companies in 1999. These include the time devoted to obtain all the necessary permits and to notify and file with all requisite authorities (*Time* in the tables), and the official costs (*Cost*) of this process (normalized by GDP per capita). The third variable measures “full costs” (*Time/Cost*), adding to the official costs the imputed opportunity cost of the entrepreneur’s time. Data limitations on entry regulations require the assumption of constancy of the regulatory environment throughout the period. Although some institutional changes in product markets took place within the period, this is unlikely to be an unreasonable assumption given the strong inertia of institutions.¹⁵

¹⁵Studies focusing on the effects of labour market institutions have found very persistent idiosyncratic factors which might explain the better performance of time invariant institutional measures over time varying indicators in cross-country regressions (e.g. Blanchard and Wolfers, 2000).

Table 2:
Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max	Obs	Countries
<i>Service Empl Sh.</i>	59.69	9.09	33.43	73.83	98	18
<i>GDP per head</i>	12.17	6.49	2.22	27.96	98	18
<i>Government Consumption</i>	17.89	4.37	8.19	27.96	98	18
<i>Investment Rate</i>	22.07	4.12	14.67	35.01	98	18
<i>Urbanization</i>	75.62	13.51	28.4	97	98	18
<i>Secondary Education</i>	93.96	18.42	43.2	145.5	98	18
<i>Union Density</i>	0.424	0.191	0.09	0.90	98	18
<i>EPL</i>	1.11	0.575	0.10	2	98	18
<i>Coordination</i>	2.03	0.626	1	3	98	18
<i>Time</i>	27.04	25.40	2	82	98	18
<i>Cost</i>	0.102	0.080	0.005	0.273	98	18
<i>Cost/Time</i>	0.199	0.175	0.017	0.501	98	18

Entry restrictions are not the only factor behind cross-country differences in the relative development of the service sector. Z_{jt} contains a set of time-varying variables that aim to capture these additional factors, which are extensively reviewed in Messina (2002) and summarized in the following three groups:

Exogenous demand shifts. These include the relative size of the public sector, the investment rate and the degree of urbanization. Regarding the former, the government is not only a consumer but also an important supplier of services. To the extent that the supply of public services outweighs private demand, countries with larger public sectors are expected to have a larger service employment share. On the contrary, if investment is intensive in manufacturing goods as Rowthorn and Ramaswamy (1999) suggest, countries with higher investment rates are expected to have a relatively underdeveloped service sector. The urbanization rate (measured as the share of urban population in the total population) accounts for exogenous demand shifts associated with the development of urban cultures, such as the expansion of leisure related services.

Labour market institutions. Unions might interfere in the process of structural change by obstructing the reallocation of resources from shrinking to expanding sectors, reducing

the size of the service sector. Similarly, wage floors and wage compression are expected to cut back jobs in the lower extreme of the wage distribution. To the extent that these jobs are more important in some service sub-sectors (e.g. restaurants and retail) than in the rest of the economy these institutions are expected to reduce the share of service employment. The regressions include union density rates and the degree of coordination of wage-setting institutions, this last factor being previously found a significant predictor of wage compression across OECD countries (OECD, 1999). As in the case of entry regulations and unions, firing and hiring costs are expected to difficult the reallocation of resources and consequently impact negatively on the development of the service sector. Thus, an indicator of the strictness of employment protection legislation is included.

Trade specialization. Saegler (1997) tests the role of human capital endowments in the sectoral allocation of labour, finding that OECD countries with a more educated labour force tend to have a lower share of manufacturing employment. This is consistent with a pattern of trade specialization in which countries with a larger endowment of human capital specialize in the production of human capital intensive goods (such as most tradable services). Other sources of comparative advantage that might induce trade specialization such as the availability of natural resources might affect the sectoral distribution of employment. However, experimentation with some of these variables yielded non-statistically significant results.

The dataset covers the period 1970-1997 for 18 OECD countries, which is the maximum amount of countries for which a complete set of information is available.¹⁶ Five year averages are constructed to minimize the impact of business cycle fluctuations.¹⁷ Table 2 presents summary statistics of the data.

In the presence of country unobserved heterogeneity, OLS standard errors of the parameters in eq. (26) are invalid. Thus, I assume that this unobservable time-invariant characteristics are random and estimate the model following FGLS.¹⁸ Table 3 presents random effects estimates of the determinants of the service employment share across 18

¹⁶The service employment share (ISIC 6 to 9), GDP per head at current prices and PPP exchange rates and Government Consumption share over GDP are from the OECD Statistical Compendium (1999). The Investment rate (Gross investment/GDP), Urbanization rate (urban population as percentage of total population), Secondary enrollment rate (% gross) are from the World Development Indicators (1999). The EPL indicators, union density rates and coordination indices are from Nickell and Nunziata (2001).

¹⁷The data were collapsed in five periods covering five-year intervals: 1970-1974, 1975-1979, 1980-1984, 1985-1989, 1990-1994 and one period of three years: 1995-1997.

¹⁸A strong assumption of the random effects model is the absence of correlation between the country effects and the covariates. An alternative that does not require this assumption is to estimate eq. (26) by OLS and calculate robust to country clustering standard errors. The results regarding entry regulations, available upon request, are qualitatively the same as those presented in the paper.

Table 3: Determinants of Service Employment Share in 18 OECD Countries. Random Effects Estimation⁽¹⁾

<i>Dep. Var</i>	<i>Service Employment Share</i>					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Intercept</i>	32.282 (5.07)	0.000 (0.0)	30.032 (4.59)	45.732 (6.09)	27.881 (4.58)	38.882 (5.92)
<i>GDP/h</i>	1.359 (9.18)	0.672 (1.78)	1.357 (9.07)	0.578 (1.57)	1.350 (9.05)	0.899 (2.20)
<i>(GDP/h)²</i>	-0.027 (-5.73)	-0.024 (-2.64)	-0.027 (-5.68)	-0.023 (-2.65)	-0.027 (-5.64)	-0.027 (-2.68)
<i>Gov. Cons. Share</i>	0.558 (4.52)	0.592 (5.07)	0.539 (4.23)	0.580 (4.84)	0.557 (4.43)	0.570 (4.63)
<i>Investment Rate</i>	-0.103 (-1.10)	-0.061 (-0.70)	-0.114 (-1.19)	-0.070 (-0.82)	-0.091 (-0.96)	-0.050 (-0.53)
<i>Urbanization</i>	0.123 (2.05)	0.155 (2.87)	0.159 (2.69)	0.20 (3.52)	0.167 (2.92)	0.195 (4.04)
<i>Secondary Enrol.</i>	0.059 (3.32)	0.016 (0.81)	0.056 (3.14)	0.010 (0.50)	0.060 (3.33)	0.026 (1.16)
<i>EPL</i>	-1.042 (-1.05)	-1.029 (-1.13)	-0.990 (-0.93)	-0.886 (-0.93)	-1.377 (-1.40)	-1.552 (-1.68)
<i>Union Density</i>	-8.583 (-3.09)	-7.355 (-2.84)	-8.398 (-2.97)	-6.775 (-2.60)	-7.548 (-2.70)	-5.783 (-2.16)
<i>Coordination</i>	0.710 (1.02)	0.662 (0.99)	0.418 (0.60)	0.483 (0.73)	0.842 (1.17)	0.580 (0.81)
<i>Cost/Time</i>	-16.859 (-2.99)	-20.008 (-3.91)	-	-	-	-
<i>Time</i>	-	-	-0.094 (-2.32)	-0.121 (-3.10)	-	-
<i>Cost</i>	-	-	-	-	-28.993 (-2.46)	-30.476 (-3.13)
<i>Period Dummies</i>	No	Yes	No	Yes	No	Yes
<i>N.Obs</i>	98	98	98	98	98	98
<i>Breusch Pagan Test</i>	69.44	41.19	74.41	52.31	76.07	37.60
<i>R²</i>	0.903	0.87	0.888	0.852	0.886	0.858

⁽¹⁾ t-statistics in parenthesis.

Table 4: Sensitivity Analysis. Dropping 1, 2 and 3 Countries at a Time⁽¹⁾

<i>Variable</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Regressions</i>	<i>p < 0.5</i>	<i>Countries</i>
<i>Time</i>	-0.150	-0.101	18	100	17
<i>Time</i>	-0.239	-0.096	153	100	16
<i>Time</i>	-0.290	-0.129	816	96.2	15
<i>Cost</i>	-41.5	-25.7	18	100	17
<i>Cost</i>	-53.8	-28.0	153	99.3	16
<i>Cost</i>	-59.7	-26.8	816	87.7	15
<i>Cost/Time</i>	-24.2	-17.3	18	100	17
<i>Cost/Time</i>	-28.8	-16.9	153	100	16
<i>Cost/Time</i>	-32.6	-16.1	816	100	15

⁽¹⁾Same specification as in Table 3 including time effects.

OECD countries. Note that Breusch-Pagan lagrange multiplier tests for random effects presented at the bottom of the table overwhelmingly suggest the presence of country effects in the data.

Note the strong negative and significant relation between the relative strictness of entry regulations and the share of service employment. This association is robust to the indicator of entry restrictions considered and the introduction of a large set of controls, and shows a stable magnitude across the different specifications. These results are consistent with those discussed in Messina (2002) for a broader set of indicators of product market regulations. For the purpose of illustration, the point estimate presented in Column (1) suggests that if countries like Italy or Germany deregulated their product markets to become as regulated as the US, their service employment share would increase by more than 8 and almost 6 percentage points respectively. Effects of similar magnitude are found for the variables measuring the time spent in dealing with entry regulations and the mixed indicator *Time/Cost*.

Concerning the other variables included in the regression, the expected positive association between the service employment share and GDP per capita is found in this sample. The negative sign on the square of GDP per head points to a non-linear relation between income per capita and the service employment share which, according to the estimates of Column (1) suggests a turning point when income per capita reaches 19,911

\$. This is below the figures of the richest countries in the last period of the sample, suggesting that mature economies might have entered a saturation point in the expansion of service employment.

There is evidence of a statistically significant and positive association between the size of the public sector and the service employment share. Similarly, the positive and statistically significant effect of the degree of urbanization suggests that the development of certain services (e.g. leisure and business services) is tightly associated with the concentration of the population in urban areas. The negative and significant effect of union density is also the expected, as the negative (although non-statistically significant) role of employment protection legislation. However, the suggested role for wage compression in cutting back low skilled service jobs is not supported by the positive (although insignificant) coefficient of wage-setting coordination.

Table 4 presents a sensitivity check with respect to the number of countries included in the analysis. It repeats the regressions displayed on Table 3 dropping 1, 2 and 3 countries at a time to assess the impact of particular sample compositions on the significance of the relationship between entry regulations and the service employment share. The results confirm that the negative association found is not due to a particular composition of countries in the sample, but instead very robust to the countries included in the analysis. The indicator of *Time* and the mixed *Time/Cost* measure of regulations are significant in more than 95 per cent of the regressions regardless the countries selected. Only the cost of regulations becomes statistically insignificant in 12 per cent of the regressions when draws dropping 3 countries are considered. Given the usual weakness of this type of cross-country regressions and the limited sample size at hand, I consider this evidence as supportive of the negative association between the service employment share and entry regulations.

7 Conclusions

The service sector is the main engine of employment creation in developed economies. In spite of this wide-spread phenomenon, the dynamism of innovative service firms differs considerably across countries, and the lack of services jobs might be one of the sources of poor employment performance in some European countries.

I have shown that economy-wide regulatory barriers to entry interact with the sources of structural change obstructing the development of sectors with income elastic demand, within a fairly standard general equilibrium model. Thus, stringent regulations affecting product markets are expected to hamper employment creation in the service sector. Empirical evidence presented in the paper supports this result, showing that countries

with more stringent barriers to entry have lower service employment shares. These results are robust to different indicators of entry regulations within a number of different specifications.

The model additionally suggests a supply-side rationale for the cross-country negative association between entry regulations and employment rates previously found in the literature. These institutions, by increasing rents and service prices might favor a substitution of market activities by home production that reduces labour supply.

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