The Role of Product Market Regulations in the Process of Structural Change

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Abstract

Although cross-country dynamics of structural change show similar patterns, the sectoral allocation of labor differs considerably across countries with similar income per capita. This paper proposes a general equilibrium model in which structural change is driven by two forces: non-homotheticity of preferences and different growth rates of productivity across sectors. Market structure is characterized by monopolistic competition, and product market regulations (PMRs) are modeled as entry costs. The model captures the stylized facts of structural change, and shows that economy-wide PMRs reduce the share of labor engaged in service industries, being able to account for cross-country differences in the sectoral allocation of labor. Moreover, PMRs create rents and increase service prices, inducing a substitution of market activities by home production and reducing the labor suply. Thus, the model supports the negative correlation between PMRs and the employment rate found in Nicoletti et al. (2000) and provides a supply-side rationale for this regularity.

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1 Introduction

A regular pattern within the growth process of a nation is the constant change of its productive structure. Hand in hand with economic growth, service industries have absorbed a continuously increasing share of the labor force during the last century in the OECD countries, while agricultural activities have lost weight dramatically. As a consequence, the service sector has been the sole net employment receiver in the area[1] during the last two decades. Indeed, since this is a common pattern across developed economies, the picture of structural change can be observed also in cross-sectional data of different countries.

However, despite the fact that most empirical and theoretical studies have concentrated on stressing the cross-country regularities in the process of structural change[2], not all OECD countries coincide in the timing and magnitude of these changes. For instance, the manufacturing employment share started to decline in the 60s in most European countries, while in the US it was already falling since the mid 40s, after 30 years of relative stagnation. Even more striking are the remarkable differences in the sectoral composition of employment among countries with similar income per capita. Take Canada and Italy, for example. While the former employs a 73 per cent of its labor force in service activities, in the latter the service employment share does not exceed 60 per cent.

One of the aims of this paper is to develope a model of structural change able to capture both the forces that lie behind trends that are common to many countries and the sources that could explain pronounced cross-country differences in the sectoral distribution of employment. For this purposes, the present paper proposes a general equilibrium model in which market structure is characterized by monopolistic competition and structural change is driven by two forces: differences in the income elasticity of demand for different goods as was originally suggested by Clark (1957); and different growth rates of technical progress between sectors, the mechanism stressed by Baumol (1967) [3]. The model illustrates that taking into account these two elements, if tastes and technology are similar across countries with similar

[1] To be precise, this is the case in all OECD countries apart from Turkey and those recently incorporated to the international organization: Mexico, Czech Republic, Hungary, Poland and the Republic of Korea

[2] See Kongsamut (1998) for a recent discussion of these issues.

[3] Other papers which combine non-homotheticity of preferences with different sectoral productivity growth rates as engines of structural change in a general equilibrium framework are Kongsamut et al. (1997) and Echevarria (1997)

income per capita, a perfect correlation between income per capita and the sectoral allocation of employment should be observed. Therefore, in order to explain cases as those of Canada and Italy I propose a new element in the discussion of structural change: product market regulations (PMRs from now on) .

In spite of the fact that the main theoretical justification for the existence of PMRs is the correction of market failures, there are reasons to believe that in practice[4] these regulations are often not responding any more to the public interest, but to the pressure of organized interest groups. These are the type of regulations I have in mind in this paper. PMRs in continental Europe have often been blamed as a cause of high prices and lower productivity (see for instance OECD, 1997). However, there is little knowledge about the role of PMRs in labor market outcomes[5]. Even less is known about the interaction between PMRs and the forces of structural change. Therefore, modeling PMRs as explicit entry costs, this paper investigates the channels through which these institutions interact with the engines of structural change altering the final sectoral allocation of labor and the employment rate.

The model described herein can predict the long-term patterns of structural change: (1) an increase (reduction) in the services (agricultural) sectoral labor 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. Moreover, the research shows that one of the effects of product market regulations is to delay the "natural" pattern of structural change, hindering the development of the service sector. Therefore, there is a clear implication of the model: countries where PMRs are tighter would tend to have a service labor share lower than that predicted by their income per capita. Another suggestive conclusion of the theoretical model is that PMRs, by creating higher rents and increasing service relative prices, induce a substitution of market activities by home production and consequently reduce labor supply. Thus, the model supports the negative correlation between PMRs and the

[4] The analysis of the different theoretical arguments proposed to explain the emergence and development of PMRs escapes from the scope of this paper. For a review of this issue see Winston et al. (1994) and the references therein.

[5] The issue however, is rising increasing interest in the last few years. Peoples (1998) presents sectoral studies of the effects of product market de-regulation episodes in the evolution of wages and employment. Blanchard (2000) studies the interactions of product and labor market regulations in explaining unemployment in Europe.

employment rate found in Nicoletti et al. (2000) and provides a supply-side rationale for this regularity.

The paper is organized as follows. The next section discusses the cross-country patterns in the sectoral allocation of labor and presents suggestive evidence on the role of PMRs in this process. In Section 3, the model of structural change with PMRs is outlined. Section 4 presents the main results of the free entry version of the model in the long run and Section 5 discusses the interactions between PMRs and the forces of structural change. In Section 6, the robustness of the results are tested for cases in which variety is socially valued as a public good or bad. Finally, Section 7 concludes with the main findings of the paper.

2 Structural Change and Product Market Regulations

The first panel of Figure 1 shows the sectoral evolution of the US employment shares from 1870 to today. The declining share of agriculture in total employment is clear, as is the increasing share of service activities. As was mentioned before, this pattern of structural change is not a peculiarity of the US, but rather, a common feature across OECD countries.

Among the hypotheses that have been proposed in the literature as the main sources of structural change, three must be highlighted: (1) a hierarchy in consumer tastes, (2) differences in the rate of growth of technical change between sectors; and (3) an increasing inter-relation between the productive sectors.

The first is associated with Engel's law; namely, to differences in income elasticities of demand for different goods. As income rises in modern societies, demand should shift away from agricultural goods since a saturation level of consumption will be achieved. Clark (1957) argued that a similar argument will apply to service demand, which once a certain level of development is achieved will benefit from a saturation in the consumption of manufacturing goods. Nevertheless, empirical evidence on the income elasticities of demand for the different sectors is mixed. While it is clear that saturation levels have been surpassed for agricultural demand in OECD countries, evidence on the income elasticity of services suggest that it is either equal to one (Falvey and Gemmell, 1997) or slightly larger (Bergstrand, 1991). However, problems of measurement cast serious doubts on the accuracy of data regarding service output (Gordon, 1996). If output in some service industries such as retail, wholesale trade, finance, real estate or social

services is systematically miss-measured (Griliches, 1994), then estimates of the income elasticity of demand for services would be downward biased.

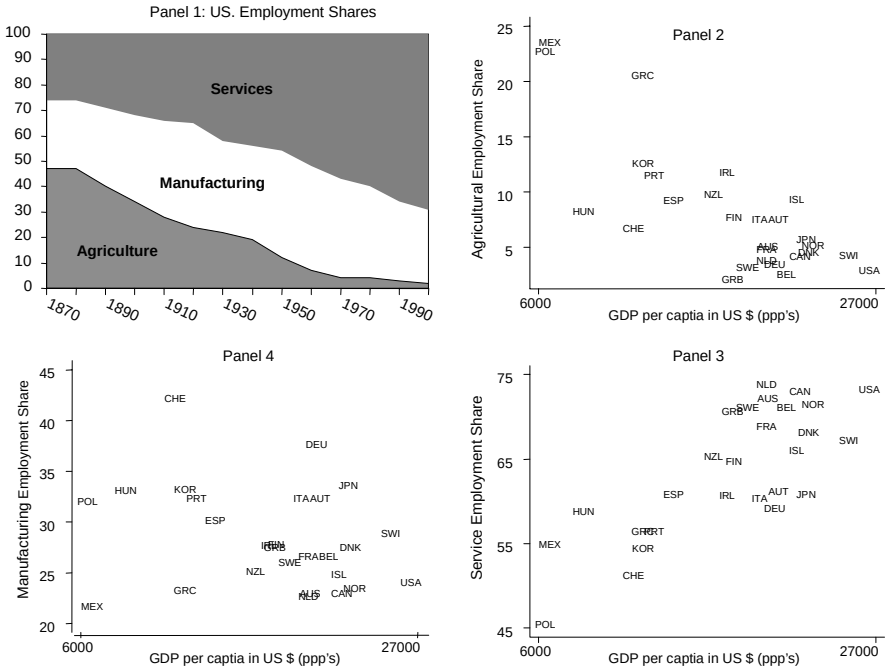


Figure 1: Structural Change and Employment Sectoral Allocation

The second explanation, first put forward in Baumol (1967), highlights supply side forces. Assuming that labor 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 labor force must be transferred to the non-progressive sector (services) and the amount of labor in the other sector will tend to approach zero"[6]. Accepting the caveat that problems of measurement in the service sector might be hiding real output growth as price changes, evidence on a slower growth rate in service than in manufacturing "measured" productivity is overwhelming. Gouyette and Perelman (1997) report estimates of the service productivity lag when measuring sectoral productivity with Divisia indices and frontier analysis. The service productivity lag is found in other sectoral comparisons, even if service sub-sectors such as Transports and Communications, Trade and

[6] Baumol (1967)

Business Services have experienced growth rates of productivity even greater than those of manufacturing in the last decades (Baumol et al, 1989).

The final point stresses that increasing inter-relations between productive sectors allows manufacturing firms to externalize ancillary services previously produced in-house, such as marketing, accounting or legal services. This would enable these firms to take advantage of economies of scale, at the same time reducing their burden of fixed costs. Input-output studies indicate an increasing share of intermediate demand for service activities in the last years. Indeed, Business Services, a sub-sector dedicated almost exclusively to the production of intermediate inputs has been the most dynamic in the Europe-15 area in the last two decades. Its 5.5 annual growth rate of employment during 1980-94 contrasts with the service growth rate of 1.6 for the same period. I will not deal with this issue in this paper. However, in the process of externalization PMRs might be important, since more stringent regulatory and administrative barriers are likely to obstruct the creation of the flexible producer service firms which, in most cases, are of relatively small scale.

To summarize, two types of forces have been proposed in the literature as likely engines of structural change: on the one hand, a demand-side force that highlights changes in tastes associated with the growth of income; on the other hand, two supply-side forces that relate several aspects of technology to the growth process of a nation. Therefore, if tastes and technology are similar across countries with similar income per capita, a similar sectoral distribution of employment should be observed among them. Looking at the correlation between sectoral employment shares and GDP per capita in a cross-section of OECD countries (Panels 2 to 4), it is in fact the case that the service (agricultural) employment share increases (decreases) as income per capita increases. However, there are also important disparities in the snapshot distribution of employment shares. Italy, Austria, Germany and Japan are relatively "underdeveloped" in terms of service employment with respect to countries like the Netherlands, Australia or Canada, even if they all lie in a similar income per capita range.

Product and labor market institutions will certainly influence the process of structural change, easing or making harder the reallocation of labor. However, this role has been largely ignored in the literature on structural change[7]. Some studies have briefly considered the effects of different insti-

[7] A notable exception is Chenery, Robinson and Syrquin (1986) who mention that in the process of structural change, product market 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.

tutions on the sectoral allocation of labor when dealing with different issues. For instance, with respect to labor market institutions Gordon (1997) suggests that relatively high minimum wages in France could be obstructing the creation of low-wage service industries employment in this country.

With respect to PMRs, several papers deal with the relationship between them and labor market performance. The Jobs Study (OECD, 1994) suggests the likely impact of the former on the labor market through rent shearing: either increasing wages and therefore reducing employment or facilitating over-staffing. Case studies on the response of sectoral labor market aggregates after deregulation episodes seem to corroborate this premise. Peoples (1998) shows that deregulated industries in the US have engaged in cost reduction strategies after deregulation. Whether these cost cuts involved lower wages or employment shedding depended on each particular industry. However, the partial equilibrium nature of these studies leave out important aspects of product market reforms that can only be realized in a general equilibrium framework. OECD (1997a) combines case studies with a macroeconomic simulation of the expected effects of regulatory reform in product markets. The main expected benefits of product market reform would come through price reductions and productivity improvement due to increasing competition, while the outcome in terms of employment depend on the assumptions made regarding how wage responds to productivity gains. Finally, Nicoletti et al. (2000) find a negative correlation across countries between several indicators of product market regulations and the employment rate.

Using OECD data on PMRs, I report a first impression of the cross-country correlation between product market regulations and the sectoral employment shares. I have chosen three of the available indicators[8] that rank 27 OECD countries according to: an overall indicator of relative stringency of product market regulations (PRO), an indicator of inward oriented regulations (not related to trade) ($REIN$) and an indicator including barriers entrepreneurial activity (BEA). A low score in any of these three indicators allude to light PMRs. For instance, attending to PRO the UK is the most liberal economy as can be observed in Figure 2.

Since the three employment shares sum up to 1 by definition, it is enough to consider the analysis of two of them: I have chosen the services and the agricultural sector. Figures 2 and 3 show the cross-plots between the

[8] Indicators of PMRs generally refer to 1998. Nicoletti et al. (1999) contains a description of the dataset and the methodology used to construct the indicators of PMRs. This database includes all OECD countries except Iceland and Luxemburg.

average sectoral labor shares (1990-97) and the overall indicator of PMRs. In these two figures a negative (positive) correlation between the service (agricultural) share and the global indicator of PMRs can be observed.

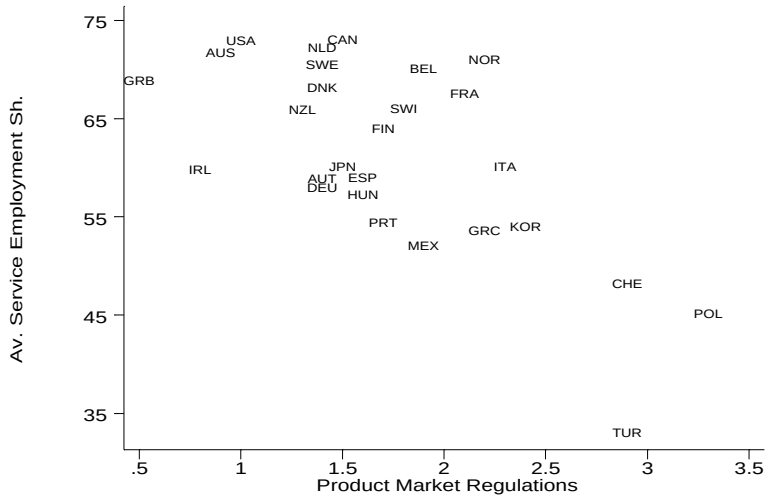


Figure 2: PMRs and the Service Employment Share

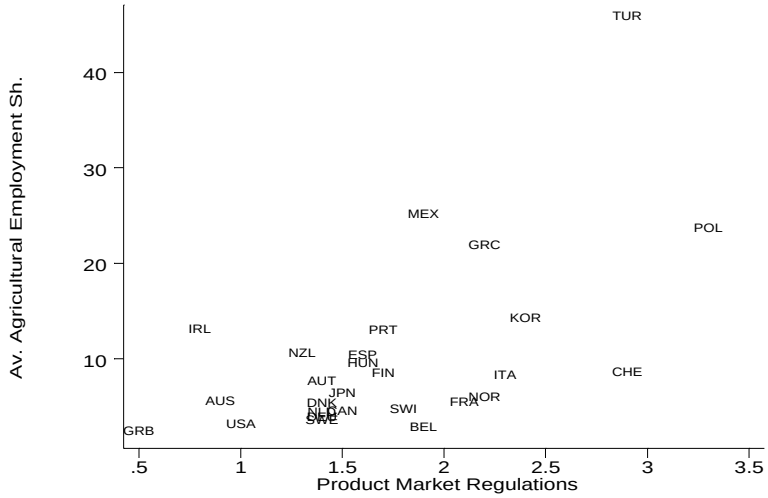


Figure 3: PMRs and the Agricultural Employment Share

Table 1 contains the correlations for the three indicators considered and the agricultural and services employment rates. Since Turkey has a much larger agricultural sector than the other countries in the sample and appears

as a highly regulated economy, I calculated as well the correlations without this country.

Table 1: Simple Correlations between Product Market Regulations and the Average (1990-97) Sectoral Labor Shares. 27 OECD Countries.

	Services			Agriculture		
	PRO	*REIN*	*BEA*	*PRO*	*REIN*	*BEA*
	Correlations					
All Countries	$-.68^{*}$	$-.57^{*}$	$-.44^{*}$	$.57^{*}$	$.48^{*}$	$.41^{*}$
Except Turkey	$-.62^{*}$	$-.47^{*}$	$-.36^{**}$	$.50^{*}$	$.34^{**}$	.10
	Spearman Rank Correlations					
All Countries	$-.58^{*}$	$-.52^{*}$	$-.37^{**}$	$.51^{*}$	$.39^{*}$	.18
Except Turkey	$-.53^{*}$	$-.46^{*}$	$-.30$	$.46^{*}$	.32	.09

*Significant at a 5% level

**Significant at a 10% level

The results confirm the negative (positive) correlation between the relative stringency of product market regulations and the service (agricultural) labor share observed in the graphs. Concentrating on the service sector, rank correlations which are less sensitive to extreme values yield similar results to the simple correlations. However, when leaving out the observation for Turkey that is an outlier in the sample due to its high concentration of employment in agricultural activities, the indicator that covers Barriers to Entrepreneurial Activity loses significance, but the other two remain almost unaltered.

It should be noted that the bivariate correlations presented here can be seen at best as suggestive, since other factors might be behind the reported correlations. However, Messina (2000) shows that the negative correlation between PMRs and the service employment share is robust to different specifications and to the introduction of other controls that might explain cross-country differences in the sectoral allocation of labor.

Regarding the agricultural share, results depend more on the observation of Turkey, although the signs are always the expected and the correlations with the overall indicator are always significant. In any case, this lower significance in the correlations for the agricultural case are not surprising. Other national or supranational policies, like the Common Agricultural

Policy, are certainly more relevant than PMRs for explaining the relative importance in a country of the agricultural labor share. However, PMRs are expected to affect the Agricultural labor share indirectly, through its effects on the services' counterpart. These channels will become clearer once a model of structural change is at hand. Therefore, I will now describe a model of structural change where PMRs are present.

3 A Benchmark Model

In recent years, several papers have tried to formalize the cross country regularities of structural change. Echevarria (1997) relies on non-homotheticity of preferences and different rates of productivity growth across sectors. A further step can be found in Kongsamut, Rebelo and Xie (1997) who show that a neoclassical growth model including these two forces can be consistent with the stylized facts of structural change and the Kaldor facts.

The economy modeled here will also assume that structural change is brought about by different income elasticities of demand for different goods and a different exogenous rate of sectoral productivity growth, but in this paper products and labor markets are monopolistically competitive[9]. Product market regulations are introduced as a friction that prevents entry from the unrestricted equilibrium, reducing the number of firms and creating rents which are redistributed to the households.

3.1 Labor Demand

There are three sectors in this economy, agriculture (a) manufacturing (m) and services (s) each characterized by monopolistic competition. Therefore, there is a continuum of firms (n^r) in each sector r, each of them producing a single differentiated brand, and not taking into account the effects of its actions on the behavior of its competitors. Technology is the same across sectors and firms, but the exogenous rate of productivity growth g^r will be allowed to vary across sectors according to the following law of motion

$$\dot{\lambda}_t^r = g^r \lambda_t^r \quad , \quad \text{for} \quad r = a, m, s \tag{1}$$

[9] Brunello (1993) incorporates monopolistic competition in product markets and wage bargaining institutions in the unbalanced growth model proposed by Baumol. We differ from him in two respects which are crucial for our purposes: by allowing for non-homotheticity of preferences and for a variable number of firms and therefore varieties over time.

where λ_t^r is the productivity level at time t in sector r and a dot over a variable denotes a derivative with respect to time.

There are M types of labor (L_j), each of which is an imperfect substitute of each other. Therefore, the production function of a representative firm i that operates in sector r can be characterized as

$$O_{it}^r = M^{\frac{1}{1-\theta}} \left[\sum_{j=1}^{M} \left(L_{ijt}^r \right)^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \lambda_t^r - \psi^r \quad , \quad \text{for} \;\; r = a, m, s \tag{2}$$

The parameter ψ^r represents a fixed cost of production that is allowed to vary across sectors but not across firms, while θ is the elasticity of substitution across the different types of labor. Finally, O_{it}^r is the output of firm i in a given period. The first term on the right hand side is a correction factor that controls for the "taste for diversity in production". It implies that the size of the labor force does not increase aggregate production per se.

The problem of the firm can be divided into two subproblems: a labor demand decision and a price decision. Lets consider first the determination of its labor demand. The firm takes the wages of every worker as given, and chooses the optimum amount of labor according to technology to minimize its cost function. The solution of this maximization determines labor demand of every particular type of labor j, which is inversely related to its wage depending on the elasticity of substitution across different types of labor (θ)

$$L_{ijt}^r = \frac{1}{M \lambda_t^r} \left(\frac{W_t}{W_{jt}} \right)^{\theta} (O_{it}^r + \psi^r) \tag{3}$$

in which W_t is the aggregate wage

$$W_t = \left(\frac{1}{M} \sum_{j=1}^{M} (W_{jt})^{1-\theta} \right)^{\frac{1}{1-\theta}} \tag{4}$$

Aggregation across brands and sectors yields total labor demand for labor type j :

$$\begin{aligned} L_{jt} &= \sum_{i=1}^{n_t^a} L_{ijt}^a + \sum_{i=1}^{n_t^m} L_{ijt}^m + \sum_{i=1}^{n_t^s} L_{ijt}^s = \\ &= \frac{1}{M} \left(\frac{W_t}{W_{jt}} \right)^{\theta} \sum_{r=a,m,s} \left[\left(\sum_{i=1}^{r} O_{it}^r + n_t^r \psi^r \right) (\lambda_t^r)^{-1} \right] \end{aligned} \tag{5}$$

3.2 Households

There is a finite number of identical households M, with non-homothetic preferences among the three consumption goods as in Kongsamut, Rebelo and Xie (1997). Each household is the monopolist supplier of a particular type of labor[10], choosing optimally among consumption and leisure according to the maximization of the utility function

$$U_{jt} = \left(\left(C_{jt}^a - \bar{A} \right)^{\alpha} \left(C_{jt}^m \right)^{\beta} \left(C_{jt}^s + \bar{S} \right)^{1-\alpha-\beta} \right)^{\phi} \left(\bar{L} - L_{jt} \right)^{1-\phi} \tag{6}$$

where C_t^a, C_t^m and C_t^s 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 smaller than 1. On the other hand, $\bar{S}$ can be interpreted as home production of service activities like cooking, cleaning or home repairs, to name but a few, accounting for the assumption that as GDP grows, there is a progressive monetization of this activities[11]. 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. The budget constraint and non negativity conditions for the household utility maximization are the following:

$$\begin{aligned} P_t^a C_{jt}^a + P_t^m C_{jt}^m + P_t^s C_{jt}^s &\leq W_j L_{jt} + R_{jt} \\ C_{jt}^a &\geq 0, \quad C_{jt}^m \geq 0, \quad C_{jt}^s \geq 0 \end{aligned} \tag{7}$$

where P_t^a, P_t^m and P_t^s are the agriculture, manufacturing and service price indices that will be defined below. The right hand side of the inequality in (7) represents total disposable income of the household, that is composed by labor income ($W_{jt}L_{jt}$) and a share in the rents of the firms (R_{jt}). The non-negativity constraints guarantee that the utility function is well defined.

In each sector, n_t^r varieties are being produced every period, and each household will choose among these varieties according to the following sub-

[10] As Blanchard and Kiyotaki (1987) point out, each household can be seen as a craft union, monopolizing a particular type of labor.

[11] Another secular trend is the progressive substitution of some of these services by goods that cope with the same functions, like washing machines and dish-washers. The decision between purchasing these services in the market or substituting them by machines will depend on the evolution of relative prices. Therefore, the stringency of PMRs will have an important role in this process as will be discussed later.

utility function:

$$C_{jt}^r = (n_t^r)^{\xi^r} \left(\sum_{i=1}^{n_t^r} \left(C_{ijt}^r\right)^{\frac{\sigma^r - 1}{\sigma^r}} \right)^{\frac{\sigma^r}{\sigma^r - 1}} \quad ; \quad \text{for } r = a, m, s \tag{8}$$

where σ^r is the elasticity of substitution among varieties in sector r which is restricted to be greater than one. I follow Dixit and Stiglitz (1975), by assuming that an argument n_t^r enters directly the definition of the composite consumption good. This assumption will be important for the analysis later, inasmuch as it allows variety to be, in principle, a public good in sector r ($\xi^r > 0$) or bad ($\xi^r < 0$). It therefore encompasses several specifications that have been used in the literature. So, by setting $\xi^r = \frac{1}{1-\sigma^r}$, the test for variety is cancelled as in Blanchard and Kiyotaki (1987), while $\xi^r = 0$ was 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. In particular, every household will repeat for every sector the maximization of (8) subject to

$$\sum_{i=1}^{n_t^r} P_{it}^r C_{jit}^r = P_t^r C_{jt}^r \ , \quad \text{for } r = a, m, s$$

This yields the demands for every variety, that are inversely related to its relative prices according to the inter-brand elasticity of substitution,

$$C_{jit}^r = \left(\frac{P_t^r}{P_{it}^r} \right)^{\sigma^r} C_{jt}^r \, (n_t^r)^{\xi^r(\sigma^r - 1)} \ , \quad \text{for } r = a, m, s$$

where P_t^r is the price index for composite good r

$$P_t^r = (n_t^r)^{-\xi^r} \left(\sum_{i=1}^{n_t^r} (P_{it}^r)^{1-\sigma^r} \right)^{\frac{1}{1-\sigma^r}} , \text{ for } \ r = a, m, s \tag{9}$$

Aggregating across households, total demand of good i will be

$$C_{it}^r = \sum_{j=1}^{M} C_{jit}^r = \left(\frac{P_t^r}{P_{it}^r} \right)^{\sigma^r} (n_t^r)^{\xi^r(\sigma^r - 1)} \sum_{j=1}^{M} C_{jt}^r, \quad \text{for } \ r = a, m, s \tag{10}$$

In the second stage, sectoral expenditures and labor supply are decided. Therefore, the household maximizes its utility function (6) subject to the budget constraint (7) and labor demand for its particular type of labor (5). This yields the following demand functions

$$C_{jt}^{a} = \frac{\alpha}{P_t^a} I_{jt} + \bar{A} \tag{11}$$

$$C_{jt}^{m} = \frac{\beta}{P_t^m} I_{jt} \tag{12}$$

$$C_{jt}^{s} = \frac{1-\alpha-\beta}{P_t^s} I_{jt} - \bar{S} \tag{13}$$

where I_{jt} is the full income which is defined as follows:

$$I_{jt} = W_{jt} L_{jt} + R_{jt} + P_t^s \bar{S} - P_t^s \bar{A} \tag{14}$$

Every household is the owner of an equal share of the firms, such that total rents in the economy are defined as $R_t = MR_{jt}$. Finally, the individual labor supply schedule is

$$L_{jt} = \bar{L} - \frac{(1-\phi)}{\phi} \frac{\theta}{(\theta-1)} \frac{I_{jt}}{W_{jt}} \tag{15}$$

where $\frac{\theta}{(\theta-1)}$ is a markup over the marginal utility of leisure and $\frac{(1-\phi)}{\phi}$ is the ratio between the elasticities of the marginal utilities of leisure and consumption.

3.3 Price Rule

Taking into account the demand for each particular brand and the available technology, the monopolistic firms will choose prices to maximize profits. I 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.

Using labor demand of every type of labor (3) and the definition of aggregate wages (4), firms' i cost function can be defined as

$$\sum_{j=1}^{M} W_{jt} L_{ijt}^{r} = W_t \left(O_{it}^{r} + \psi_t^{r} \right) \left(\lambda_t^{r} \right)^{-1} \tag{16}$$

The firm will maximize profits according to the following profit function

$$\pi_{it}^r = P_{it}^r C_{it}^r - \sum_{j=1}^{m} W_{jt} L_{ijt}^r - P_t^r \kappa \tag{17}$$

The last term of the right hand side in (17) accounts for PMRs, and κ is a parameter that captures their relative stringency. As was mentioned above, when PMRs are present entry is restricted and incumbent firms extract rents from production. PMRs are best viewed as a fixed real amount that must be paid by the incumbents every year in order to be able to produce. Therefore, PMRs imply that there is a cost of setting up a business which is measured in terms of output[12]. This specification of PMRs is a good approximation to administrative burdens for corporations, price controls or regulatory and administrative opacities in general which represent yearly costs to incumbent firms. Instead, PMRs such as licenses and permits are sunk cost for the firms. In this case, the term $P_t^r \kappa$ could be interpreted as the annuity payment of those costs.

Profit maximization of firms' i profits (17) subject to its demand (10) and cost function (16) yield the price rule

$$P_{it}^r = \mu^r \frac{W_t}{\lambda_t^r} \quad , \quad \text{for} \quad r = a, m, s \tag{18}$$

where

$$\mu^r = \frac{\sigma^r}{\sigma^r - 1} \quad , \quad \text{for} \quad r = a, m, s \tag{19}$$

is the markup of prices over marginal costs.

3.4 Equilibrium

Free entry in every sector will determine the number of firms in equilibrium at every point in time. However, first note that in the light of the assumptions made about technology and preferences, the inter-brand equilibrium will be symmetrical:

$$\begin{aligned} P_{jt}^r &= P_{kt}^r \quad \forall\, j,k \quad , \text{ for } \; r = a, m, s \\ W_{jt} &= W_{kt} = W_t \quad \forall\, j,k \end{aligned}$$

[12] Alternatively, PMRs could be modeled as overhead labor, by introducing another fixed cost of production. I tried this specification, and the qualitative results of the simulations, available upon request, did not differ from those presented in the paper.

Symmetry allows to work with aggregate variables. First notice that aggregate wages are equal to individual wages, but the preferences structure chosen implies that this is not true in general with respect to aggregate sectoral prices. Taking into account the symmetry in brand prices, according to (9) the aggregate sectoral price index becomes

$$P_t^r = (n_t^r)^{\left(\frac{\xi^r\sigma^r+1-\xi^r}{1-\sigma^r}\right)} K_t^r \quad , \text{ for } \; r = a, m, s \tag{20}$$

which implies that, as long as variety is valued per se $\left(\xi^r > \frac{1}{1-\sigma^r}\right)$, sectoral prices *decrease* when the number of varieties in each sector increases. Introducing (20) into (18) an expression for aggregate sectoral prices is obtained:

$$P_t^r = (n_t^r)^{\left(\frac{\xi^r\sigma^r+1-\xi^r}{1-\sigma^r}\right)} \mu^r \frac{W_t}{\lambda_t^r} \quad , \text{ for } \; r = a, m, s \tag{21}$$

Combining (10) and (20), demand for every brand becomes

$$C_{it}^r = (n_t^r)^{\left(\frac{\xi^r\sigma^r+\sigma^r-\xi^r}{1-\sigma^r}\right)} \sum_{j=1}^{M} C_{jt}^r = (n_t^r)^{\left(\frac{\xi^r\sigma^r+\sigma^r-\xi^r}{1-\sigma^r}\right)} C_t^r \quad , \quad \text{for } \; r = a, m, s \tag{22}$$

Similarly, using symmetry and market clearing in (3), an expression for the behavior of sectoral employment in equilibrium is found

$$(L_t^r)^D = \frac{1}{\lambda_t^r}\left((n_t^r)^{\left(\frac{\xi^r-\xi^r\sigma^r-1}{\sigma^r-1}\right)} C_t^r + n_t^r \psi^r\right) \quad , \text{ for } \; r = a, m, s \tag{23}$$

while individual labor supply (15) becomes

$$(L_{jt})^S = \phi\frac{1-\theta}{\phi-\theta}\bar{L} - \frac{(1-\phi)}{\theta-\phi}\frac{\theta}{W_t}\left(R_{jt} + P_{st}\bar{S} - P_{at}\bar{A}\right) \tag{24}$$

Define E_t as the employment rate,

$$L_t^a + L_t^m + L_t^s = ML_{jt} = E_t$$

Then, using (15) labor markets clear according to

$$L_t^a + L_t^m + L_t^s = M\left(\phi\frac{1-\theta}{\phi-\theta}\bar{L} - \frac{(1-\phi)}{\theta-\phi}\frac{\theta}{W_t}\left(R_{jt} + P_{st}\bar{S} - P_{at}\bar{A}\right)\right) \tag{25}$$

Sectoral employment shares can be simply defined as

$$E_t^r = \frac{L_t^r}{L_t^a + L_t^m + L_t^s} \qquad \text{for} \quad r = a, m, s$$

Aggregating over households, once symmetry is applied to the demand equations, (11), (12) and (13) become

$$C_t^a = \frac{\alpha M}{P_t^a} \left(W_t L_{jt} + R_{jt} + P_t^s \bar{S} - P_t^s \bar{A} \right) + M\bar{A} \tag{26}$$

$$C_t^m = \frac{\beta M}{P_t^m} \left(W_t L_{jt} + R_{jt} + P_t^s \bar{S} - P_t^s \bar{A} \right) \tag{27}$$

$$C_t^s = \frac{(1-\alpha-\beta)\, M}{P_t^s} \left(W_t L_{jt} + R_{jt} + P_t^s \bar{S} - P_t^s \bar{A} \right) - M\bar{S} \tag{28}$$

An expression for the equilibrium number of firms in every sector closes the model. Combining (17), (21) and (22), the zero profit condition and market clearing set the number of varieties in every sector according to the next expression

$$C_t^r \left(\mu^r - 1 \right) - \left(n_t^r \right)^{\left(\frac{\xi^r \sigma^r + \sigma^r - \xi^r}{\sigma^r - 1} \right)} \psi^r - \mu^r n_t^r \kappa = 0 \qquad \text{for} \quad r = a, m, s \tag{29}$$

4 The Free Entry Case

Equilibrium can be defined by the three demand rules (26), (27), (28), the three price equations summarized in (21), three labor demand equations (23), three zero profit conditions (29) and the labor market clearing condition (25) which constitute a system of 13 equations in 13 unknowns. Aggregate wages were set as the numeraire. Nevertheless, non linearities in the system obliged to find numerical solutions by an iterative process.

I will concentrate first in the dynamics of the model when PMRs are absent ($\kappa = 0$ in expression (29)). It will be shown that the model can capture the stylized facts of structural change observed over the last century in a representative OECD country. For that purpose, I consider the US economy as a mature economy, and use US data when available for the baseline parameterization.

Expenditure shares (α, β) are taken from OECD (1997b), representing the actual sectoral value added as a percentage of GDP in the US in 1996.

$\bar{A}$ and $\bar{S}$ were set with the initial levels of sectoral technology (g_0^r) taking into account the non negativity constraints of the static maximization and aiming to obtain an income elasticity of demand for services in line with empirical estimates. The average income elasticity of service demand during the last 20 periods of the simulation is 1.1, consistent with available estimates for the last two decades. Over the whole period, the income elasticity of demand for services is larger than one and decreases monotonically over time. Indeed, Fogel (1999) suggests that the income elasticity of demand for several services would be well above those reported in empirical studies if a longer time span were considered.

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. Since measuring mark-ups at a sectoral level raises a number of difficulties that imply very different estimates depending on the technique used, I preferred to introduce the same markups in the three sectors in the benchmark simulation in order to isolate the effects of PMRs later. Therefore, the elasticity of substitution across brands and types of labor was set to 6 such that markups in both product and labor markets were 1.2. The value of ϕ implies that in an unrestricted labor market (where market clearing wages would reflect the marginal disutility of labor) the agents would work a third of their time endowment. The household time endowment was set to 2, and the number of households to 50, so that the employment rate could be easily expressed as a percentage. Fixed costs of production were set to 50 in the three sectors[13]. Productivity measures are calculated from Broadberry (1998) data. They represent yearly average annual growth rates of sectoral output per employee for the period 1900-1990[14].

The final choice that needed to be made was the degree in which variety is valued in terms of utility (ξ). For the benchmark simulations, ξ was set to zero. Therefore, as in Dixit and Stiglitz (1977), in the baseline simulation variety is neither a public good nor a bad.

In Figure 4, the evolution of the real and nominal GDP shares, employment shares and the employment rate for 100 periods are shown.

[13] This choice will become relevant when I measure the quantitative effects of PMRs. The consequences of the relative size of the fixed costs with respect to the costs of regulations will be discussed in the next section.

[14] The service sector productivity growth rate was calculated from a weighted average of Distribution, Transport and Communications, Utilities, Finance and Other Services. Government Services were left out since output in this sector is simply measured by labor input, ruling out the possibility of productivity growth.

Table 2. Parameter Values Used in the Simulation

g_0^a	g_0^m	g_0^s	α	β	$\bar{A}$	$\bar{S}$	ϕ	$\overline{L}$	θ	ξ
1000	200	300	0.02	0.25	600	100	1/3	2	6	0

g^a	g^m	g^s	μ^a	μ^m	μ^s	ψ^a	ψ^m	ψ^s
0.033	0.021	0.01	1.2	1.2	1.2	50	50	50

First, notice that as regards to the evolution of the employment shares, a similar pattern to the one observed for the actual US shares in the last 100 years (reported in Figure 1) can be found. The nominal GDP follow the same path over time as the employment shares. Initially, the subsistence level of agricultural goods requires a large share of employment engaged in this sector. The same happens with real and nominal shares of production. The important growth rate of productivity in the agricultural sector frees up so much employment in a first stage that both manufacturing and service employment shares increase. As time evolves, the higher income elasticity of demand in the service sector brings about an increasing share of services in employment and nominal GDP, to the extent that after a certain point this sector becomes the only net employment receiver.

Real GDP shares were defined as follows

$$\text{Sector } r \text{ Real Share } (t) = \frac{P_0^r C_t^r}{\sum\limits_r P_0^r C_t^r} \quad \text{for } r = a, m, s$$

Even if the service share increases in nominal terms, the effects of the productivity lag can be seen from the evolution of the real GDP shares. As income rises, the gap between productivity in manufacturing and services increases, to reach a point in which the manufacturing real GDP share actually overtakes the services one. This is consistent with the observation that the real GDP share of services have remained roughly constant in the last decades in most OECD counties, while the nominal GDP share has continually increased.

The evolution of the employment rate can be easily understood from the individual labor supply equation (24). Recall that in the free entry case rents are cero ($R_{jt} = 0$). Therefore, if preferences were homothetic $\left(\bar{A} = \bar{S} = 0\right)$, the second term in this equation would be zero and the employment level would be fixed over time at $\phi \frac{1-\theta}{\phi-\theta} \bar{L}$. This is the horizontal line in the fourth panel. As time evolves, productivity growth progressively reduces prices and

therefore the relative size of the subsistence requirements. This implies that structural change will progressively faint and the employment rate will tend to this value.

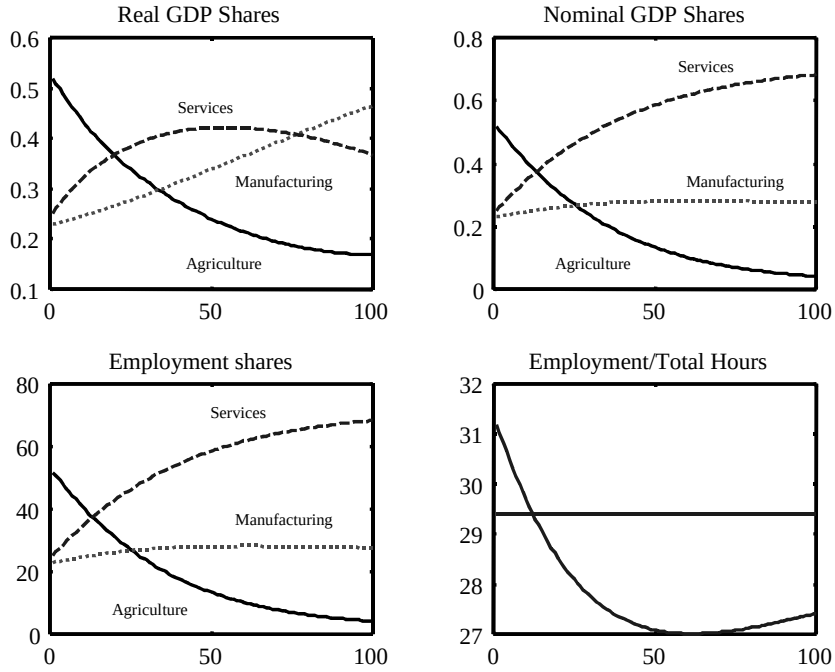


Figure 4: Long Run Evolution. Free Entry Case

However, along the structural change path the same forces that explain the sectoral labor shares drive the evolution of labor supply. On the one hand, the subsistence level of food consumption must be achieved, generating a higher labor supply. On the other hand, the household is endowed with a certain quantity of home production of services. The higher the value of home production of these goods, the lower the labor supply will be.

Returning to the graph that plots the evolution of the employment rate, at early stages of development (small t) the need to fulfill the subsistence level of agriculture consumption together with a low labor productivity (and therefore income) in the three sectors explains that the hours worked are above $\phi\frac{1-\theta}{\phi-\theta}\bar{L}$. As income grows, the household progressively reduces 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 labor force participation is coincident with the shift away from agriculture, as happened in the early decades of the twentieth century in the US (Costa, 1994). As time evolves, productivity improvements reduce progressively the burden of the subsistence level of agricultural consumption, generating a reduction in labor supply. At one point, the value of home production of services equals the agricultural minimal requirement, and the employment rate crosses the long-run equilibrium level of leisure. Finally, the progressive reduction of service prices ends up inducing a substitution of home production of services by market activities, and therefore labor supply starts rising again. In reality, the substitution of home production by market activities and the consequent progressive increase of labor supply along the development process could be one of the factors behind the substantial rise in female labor participation that the US economy has experienced in the last three decades[15]

Since time in the model is an indicator of the relative level of technology, another way of interpreting these graphs would be taking time as an indicator of income per capita. In this case, the simulations presented could be seen as the fitted values of a cross-section of countries, such that in the low values of t the backward economies will be concentrated, with a high share of employment in agriculture and where the number of hours worked is very high but productivity is low. On the other side of the distribution, the most developed countries ($t = 100$) would have a high share of labor engaged in service activities and a lower participation rate.

5 Introducing Product Market Regulations

It was shown in the last section that the model can capture the stylized facts of structural change. However, as was mentioned before, non homotheticity of preferences and different sectoral productivity growth rates are not enough to explain cross-country variability of sectoral labor shares for countries with similar GDP per capita. Indeed, if time is interpreted as an indicator of GDP per head the model would predict a perfect correlation between GDP per capita and the sectoral labor shares

In the next simulation, I introduce PMRs and study their effects on the sectoral allocation of labor. Since the main interest and empirical motivation of this paper is to explain the divergence in the sectoral employment rates

[15] See Mottey (1998) for a description of the main trends in US labor supply for that period

across mature economies, the time span of the next simulation was limited the last 20 years. The parameterization is the same as in the previous section apart from the parameter for PMRs (κ). When PMRs are present, every firm in sector r is paying a cost for producing of equal size: $P_t^r \kappa$. Therefore, aggregate rents in the economy can be defined as

$$R_t = \kappa \sum_r P_t^r n_t^r$$

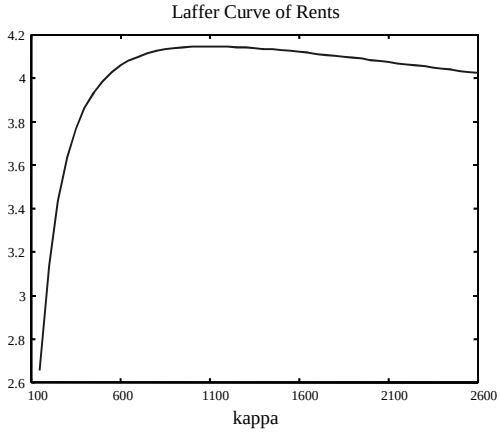


Figure 5: Rents as a function of κ when $t = 80$

As can be seen in Figure 5, there is a Laffer curve with respect to rents. The reason for this is that as κ increases the number of firms in each sector r decreases. Then, after a certain point this factor outweighs the direct effect of κ on rents, and further increases in κ generate a reduction in the size of R_t. In this model, it is assumed that the rents caused by PMRs are equally redistributed to the households. It will be shown that, in the benchmark specification ($\xi = 0$), even if all agents own an equal share of the firms, the introduction of PMRs reduce aggregate and consequently individual welfare. However, in a more realistic world with heterogeneous agents, the existence of PMRs might well be the result of political support from rentier groups. Even in this case, PMRs will probably not find support on the downward sloping side of the rents schedule. Therefore, $\kappa = 300$ was choose as a plausible indicator of the size of product market regulations in a given country. It implies that, on average, rents account for 12 per cent of the GDP.

Figure 6 plots the employment rate and sectoral labor shares for the unrestricted entry model (straight lines) and the regulated model (dashed lines).

Lets first concentrate on the evolution of the employment rate in the free entry and regulated economies. The fourth panel in Figure 6 clearly shows that *an economy where PMRs are present will have lower employment rates*

The intuition behind this result is quite simple. Total differentiation of (24) yields:

$$\frac{dL_{jt}^{s}}{d\kappa} = -\chi\left(\frac{dR_{jt}}{d\kappa} + \bar{S}\frac{dP_{t}^{s}}{d\kappa} - \bar{A}\frac{dP_{t}^{a}}{d\kappa}\right) \tag{30}$$

where χ is an unimportant positive constant. The first term in the parenthesis indicates that PMRs affect the employment rate directly, since a higher κ increases rents, inducing a reduction in the number of hours worked. The other two terms show that PMRs alter the labor supply also indirectly, through price-effects. On the one hand, the reduction of the working hours induced by the existence of rents is reinforced by a substitution of market activities through home production of services, since service prices increase after PMRs are introduced. This effect is captured by the second term in expression (30). On the other hand, PMRs increase agricultural prices, making the burden of the subsistence level of agricultural consumption heavier. While this last channel would be relevant in a backward economy, it is of less relevance for a mature one, where the agricultural expenditure share is already very low. Therefore, it is not surprising that the first two effects outweigh the latter. Moreover, to the extent that in reality PMRs are concentrated in service sectors, their effects on the employment rate will be underestimated in this last simulation.

Nicoletti et al. (2000) find a negative correlation between PMRs and the employment rates in a cross-country study for OECD economies. While they discuss several demand-side channels that could drive these results, this paper proposes an alternative explanation. As PMRs become more stringent, the reduction of varieties in the market increase service prices and favor home production of service activities instead of market purchases, reducing labor supply. In fact, during the constant growth of female labor participation that most OECD countries have observed in the last few years, PMRs might have played an important role. By increasing prices of service activities that are substitutes of home production and at the same time reducing the dynamism of the service sector which traditionally has been the most important receiver of female labor supply, tight PMRs might have hindered the female incorporation into the labor force in highly regulated OECD countries.

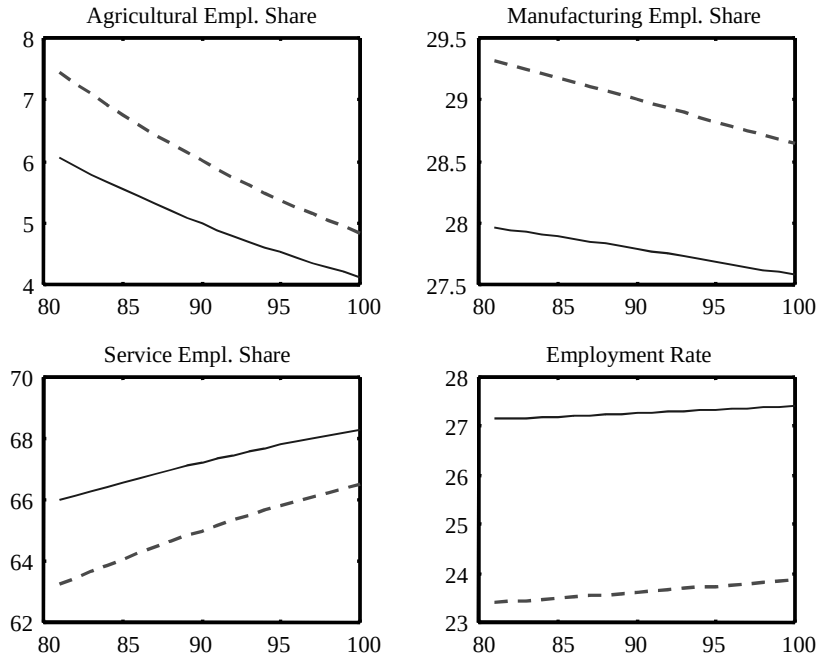


Figure 6: Employment Shares and Working Hours in a Mature Economy

The existence of economy-wide PMRs affects unevenly the productive structure of the economy. It reduces the labor engaged in service activities, increasing the sectoral labor shares of manufacturing and agriculture.

Since service demand is income elastic, as long as the introduction of PMRs reduces real income this causes a reduction in consumption that is stronger for the service sector. Therefore, even economy-wide PMRs will reduce the labor shares engaged in service activities favoring the other two.

It can also be seen in Figure 6 that the difference between the unrestricted and regulated economies shrinks progressively. Notice that if preferences where homothetic $\left(\bar{A} = \bar{S} = 0\right)$ the utility function would become Cobb-Douglas and the standard result of constant labor shares equal to the budget shares will apply. Therefore, the movement of the sectoral labor shares across time depends on the relative importance of these two parameters, in other words, to the degree in which income elasticities of demand differ from 1. When productivity increases, income rises and sectoral prices

fall. Then, the relative weight of the subsistence levels with respect to the labor income in the composition of full income (14) decrease, and the income elasticities of demand for every good become closer to 1. In the limit, when t goes to infinity income elasticities of demand become 1 and the sectoral labor shares are constant and unaltered by PMRs.

It is well known from Dixit and Stiglitz (1977) that when $\xi = 0$ the number of varieties in market equilibrium is equal to the second best social optimum (where lump-sum subsidies are not possible). It can be shown that this result still holds when preferences are non-homothetic, and therefore it is straight forward that the introduction of PMRs will reduce welfare. It is interesting however to see how important these welfare losses are. In order to measure the magnitude of the welfare losses introduced by PMRs, lets define ϑ as the percentage variation in leisure that an individual has to experience to be as well off as in the free entry case, leaving consumption constant. If subscripts p denote variables in the regulated equilibrium and subscripts f are meant for the free entry parameterization, omitting individual subscripts for simplicity, the welfare losses $(-\vartheta)$ are implicitly defined as:

$$U_t(C^a_{ft}, C^m_{ft}, C^s_{ft}, (\bar{L} - L_{ft})) = U_t\left(C^a_{pt}, C^m_{pt}, C^s_{pt}, (\bar{L} - L_{pt})\left(1 + \frac{\vartheta}{100}\right)\right)$$

Figure 7 shows a monotonic relation between κ and the compensating variation in leisure. It also plots the differentials, as κ increases, between the regulated and the free entry benchmark economies with respect to the employment rate and the service share.

These results highlight the relative importance of PMRs, predicting sizable reductions of the service share and the employment rate when the size of rents represent around 10 per cent of the GDP.

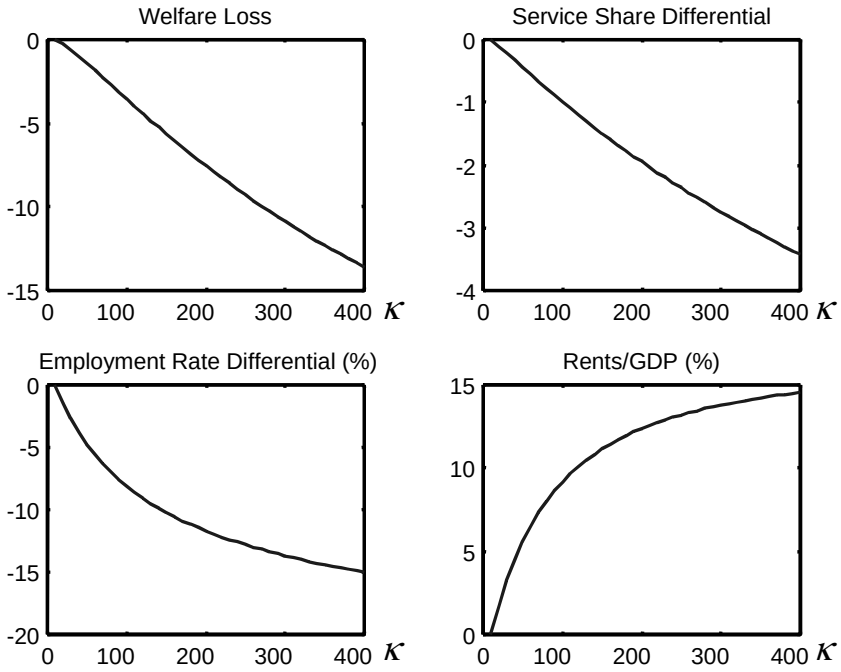


Figure 7: Relative Stringency of PMR and Aggregate Outcomes

6 Taste for variety as a public good

So far, I have analyzed only the Dixit and Stiglitz (1977) case ($\xi = 0$), in which taste for variety is neither a public good nor a bad. The whole issue of the optimal number of varieties essentially points out to the trade-off between economies of scale and how variety is socially valued. It was mentioned before that the reduction of varieties that occurs when PMRs are present increase sectoral prices according to (21). The magnitude of this effect depends crucially on how variety is valued in preferences. For instance, in the case in which variety is a public good ($\xi > 0$) the reduction of varieties after the introduction of PMRs will induce even larger price increases that the ones described in the previous sections, reinforcing the main conclusions

However, if variety is a public bad, ($\xi < 0$) no general conclusions can be achieved. In the limit case in which taste for variety is cancelled $\left(\xi = \frac{1}{1-\sigma}\right)$ it can be easily seen from eq. (20) that sectoral prices do not depend on the number of varieties. Therefore, since PMRs reduce the number of firms and

consequently of fixed costs, they are always welfare improving. In fact, the optimum number of varieties in every sector would be trivially equal to one in this case. Moreover, since PMRs increase income when taste for variety is ruled out, they would also increase the relative size of the service labor share. In general, in the $\frac{1}{1-\sigma} < \xi < 0$ region, the effects of PMRs on welfare and the services labor share will be ambiguous, depending on the relative size of the fixed costs of production (ψ^r) and stringency of PMRs (κ).

A signal of the public debate regarding the "desirable" level of variety can be extracted from the current discussion in Europe about the regulatory framework in the retail distribution sector. On the one hand, a sector of the population desires a movement towards a less tight regulation regarding shop opening hours and restrictions on large-scale outlets. Among other arguments, they claim that these regulations are limiting the expansion of large stores which through economies of scale and scope would be able to offer a similar range of services at lower prices. On the other hand, the supporters of more stringent regulations sustain that by protecting small retail outlets these type of regulations are actually increasing the range of services offered (for instance proximity services) and therefore increasing the number of varieties available in the economy.

Sensitivity analysis with respect to ξ is reported in the Appendix 1. Starting from $\xi = \frac{1}{1-\sigma}$ and $\kappa = 0$, taste for variety and the stringency of PMRs are increased progressively, comparing welfare and the service labor share always with respect to the free entry case.

The service employment share shows a similar pattern than welfare when the stringency of regulations and the taste for variety change. For sufficiently small κ and enough dislike of variety as a public bad, PMRs actually increase income, rising demand and therefore the service labor share with respect to the free entry case. What sensitivity analysis shows is that in an economy where PMRs reduce welfare they also reduce the labor engaged in service activities. Therefore, a reduction in welfare after the introduction of economy-wide PMRs is a sufficient condition for a reduction in the service employment share.

7 Conclusions

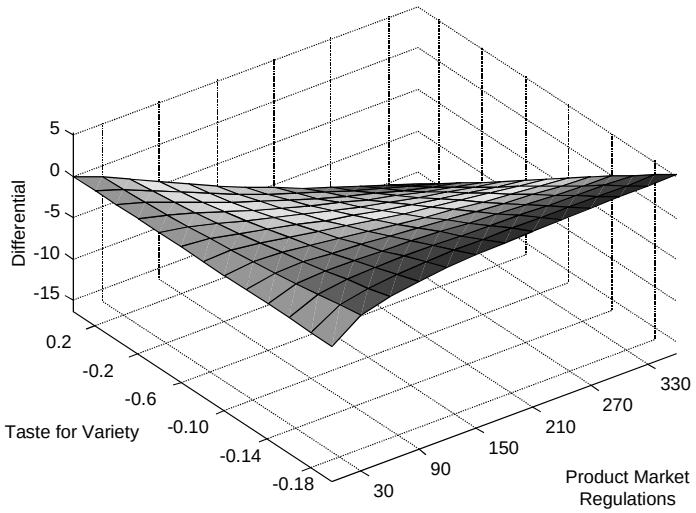
This paper studies the role of product market regulations in the process of structural change. PMRs interact with the forces of structural change by shifting resources from the growing to the contracting sectors. Therefore, non-homothetic preferences proved essential to capture not only the stylized facts of structural change in the long run, but also for the understanding of cross-country differences in the sectoral allocation of labor. The more stringent the PMRs are in a given country, the less developed will be its sectors where demand is income elastic (services in this paper). Sensitivity analysis showed that these results are robust even if variety is considered as a public bad.

In addition, the model offers a supply-side rationale for the negative correlation between PMRs and employment rates found in Nicoletti et al (2000). PMRs, by increasing rents and service prices, bring about a substitution of market activities by home production and therefore tend to reduce the employment rate in regulated economies.

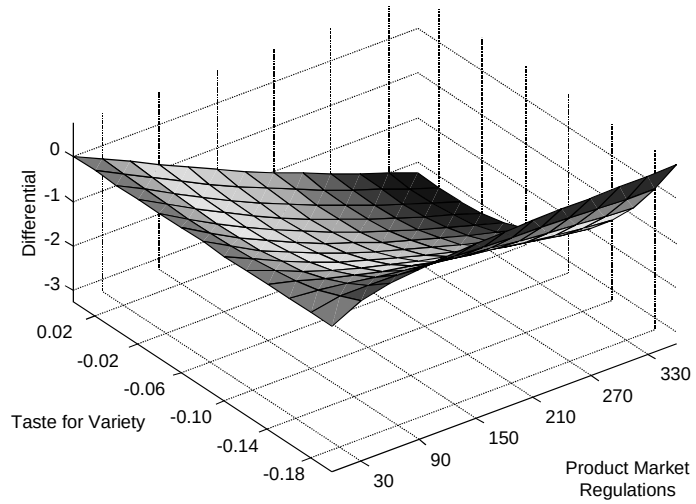
Two factors indicate that the negative effects of PMRs on the service employment share and employment rate will probably be underestimated in the simulations presented. First, equal sectoral mark-ups were set. To the extent that markups in the service sector are higher than in the other two as empirical estimates suggest, the introduction of PMRs will reduce even further the number of firms there, causing a higher fall in the service employment share. Similarly, a large part of PMRs has a sectoral component that is basically concentrated on service industries. Thus, allowing for tighter PMRs in service activities with respect to the other sectors would simply strengthen the results, reducing even further the service share and employment rate.

If a distinction was made between rentier and non-rentier agents, the model could be easily modified to tackle distributional issues. Then, endogenizing PMRs would be a natural extension, constituting one line for further research. Another promising extension of the model presented in the paper would be to make the growth process endogenous. In this case, the interaction of PMRs and the engines of unbalanced growth are likely to have not only level but also growth effects on output.

8 Appendix 1



Welfare Variations with Respect to the Free Entry Case



Service Employment Variation (percentage points) with Respect to the Free Entry Case

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