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Synchronising Deregulation in Product and Labour Markets

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Abstract

Deregulation typically comes with redistribution of rents and thus with opposition from the loosing interest groups. We show that, by exploiting complementarities, synchronising deregulation across markets makes this opposition lower. Indeed, a particular deregulation may reduce rents for one interest group, but results in gains for another interest group. Synchronising reforms can therefore offer a way out of the "sclerosis" of particularly European markets. For this effect, we build a microeconomic model based on two assumptions: Cournot competition à la Vives (2002) in the product markets and firms hiring workers in accordance with an efficiency wage in the labour markets (Shapiro and Stiglitz, 1984). With particular relevance for European economies, we focus on product market regulation that determines the degree of market integration and labour market regulation that determines the degree of employment protection.

Keywords: Deregulation, Cournot Competition, Efficiency Wages, Complementarities.

JEL Classification: J41, J68, L13, L51

INTRODUCTION

There's a agreement that there exists a strong link between too much regulation, called "market frictions", and economic under-performance. Indeed, a growing body of literature claims market frictions are to blame for the divergent performance in productivity and employment of continental European versus US economies during the 80s and 90s.[1] But, if European markets should be deregulated, why doesn't it happen? While product market reforms are slow-moving in Europe and some sectors are still virtually served by monopolies, labour market deregulation is even less pronounced (Gönenç et al., 2000).

Most explanations stress the role of interest groups in determining government intervention. Any reform that reduces the market power of firms proves difficult to implement.[2] Also the main reason why frictions remain in European labour markets, says Saint-Paul (2000), is that reforms face opposition from employed workers. The high frictions in Europe are said to provoke a "European Sclerosis". Because frictions in European product and labour markets are high, interest groups enjoy high rents and oppose changes more. Thus, the markets that most need a reform, are most stuck.

The contribution of the current paper is threefold. First, it looks for a way out of this impasse by exploiting the complementarities that exist between some deregulatory reforms in product and labour markets. We combine a product market where firms are involved in Cournot competition à la Vives (2002) and a labour market where employers are hiring in accordance with an efficiency wage (Shapiro and Stiglitz, 1984). Using the degree of market integration and employment protection legislation (EPL) as measures for product and labour market regulation respectively,

[1] See e.g. Schiantarelli (2005) for an overview of product market regulation on macro-economic performance. More specifically, Nicoletti and Scarpetta (2001) show that a lack of regulatory reforms in the product market underlies the bad productivity performance of some European countries. For labour markets, e.g. Nickell et al. (2005) discover more rigid labour market institutions to explain a large part of the rise of European unemployment from the 60s to the first half of the 90s. Investigating cross-effects, Bertrand and Kramarz (2002) show that the French regions which regulated firm entry more, experienced slower job growth. Boeri et al. (2000) demonstrate how product market regulation explains part of the divergence in the European and US labour market performances. Griffith et al. (2007) show that more product competition has a positive impact on employment and wages. The effects of labour market institutions on product markets are less investigated; Nicoletti et. al (2001) detect labour market policies to have significant effects on the size distribution of firms.

[2] Kroszner and Strahan (1999) demonstrate for the banking industry that firms influence regulatory reform; Li et al. (2003) reach similar conclusions for the telecom sectors.

we find that the loosing side of one reform is the winning side of the other reform. This means that synchronising reforms across markets makes a more performing economy easier to accomplish. We further claim that when synchronising reforms, higher frictions in the one market make it *easier* to deregulate the other market. Therefore, a sclerosis in one market can cancel out a sclerosis in the other market. Second, we argue that complementarities between reforms can explain the observed high positive correlation between frictions in both markets. Table 1, taken from Nicoletti et. al. (2000) and based on work on the OECD countries, makes the point. The cross-country relation between the two indexes is striking; a positive correlation of 0.73 is found (significant at the 1% level). In countries where product markets are highly regulated, such as Italy and Greece, workers tend to be highly protected. This may be explained by the fact that deregulation in one market might be easier accomplished if it is done in synchronisation with the other market. Third, it is a first theoretical attempt to claim that product market frictions can be removed by the deregulation of labour markets.

[Insert Table 1 about here.]

This work confirms the basic result of Blanchard and Giavazzi (2003) on the political economy of deregulation; interactions between product and labour market reforms exist. But ours differs on some important issues. Whereas Blanchard and Giavazzi (2003) argue that deregulation should be done sequentially – i.e. product market deregulation should preclude labour market deregulation – our setup prescribes synchronising reforms. The reason why deregulation should be done sequentially, Blanchard and Giavazzi (2003) claim in their firm-workers bargaining setup, is that more product market competition reduces the rents of firms, which in turn reduces incentives for workers to fight for a share of these rents.[3] But this result is based on the reasoning of having a positive relationship between firms' market power and workers' wages. As Nickell (1999) claimed, however, a universal decrease in market power for firms throughout the economy

[3]Ebell and Haefke (2004) go a step further and endogenise the bargaining regime between workers and firms. They show that when product market competition becomes more intense, workers switch from collective to individual bargaining. They demonstrate in a calibration exercise that the differences between the US low regulation-individual bargaining economy and the EU high regulation-collective bargaining economies may explain their divergences in unemployment.

may lead to *higher* rents for workers in equilibrium.[4] When wages are set according to an efficiency wage rationale and firms face different degrees of Cournot competition through product market integration, we find that this is indeed true.[5] Synchronising reforms, i.e. seeking approval for both reforms in product and labour markets at the same time, is then the better solution, and this for two reasons. First, product market deregulation creates a positive externality on employed workers, which can be used to get their approval for a labour market deregulation. And second, synchronisation helps to win approval from firms to deregulate product markets; there still exist problems to implement deregulatory reforms in (some) product markets, as e.g. Kroszner and Strahan (1999) and Nicoletti et al. (2000) show.

More generally, bargaining models such as Blanchard and Giavazzi's (2003) may render a product market deregulation to result in welfare losses for employed workers. For example, when product market reforms are targeted only in certain sectors, it may then well be that consumer prices do not sink enough to offset lower bargained wages (Blanchard and Giavazzi 2003; Gersbach, 2003).[6] If this is the case, *both* product market and labour market reforms might potentially face opposition by workers and combining reforms therefore offers no way out of the impasse. In contrast, our setup delivers a product market deregulation to unambiguously increase workers' welfare since it increases the wages firms pay. Synchronising deregulation across markets, therefore, always reduces opposition from employed workers. Getting the timing and scope of reforms right is important from a policy point of view, given the political difficulties that exist to implement deregulation; further detailed empirical work is needed in order to asses industries in the dimensions of wage formation, product market competition and, hence, most suitable reforms.

In the next sections, we develop the model and characterise the equilibrium in markets in function of the degree of regulation, i.e. the degree of product market integration and employ-

[4] Firms' lower market power raises the labour demand elasticity, which in turn leads to a higher equilibrium labour demand by increasing the marginal revenue at any given output.

[5] The same positive relationship between product market competition and wages is also found in bargaining models. Padilla et al. (1996) show that if asymmetric firms compete strategically in product markets, then a lower market power for firms may increase workers' rents.

[6] Workers also lose from a product market deregulation in a bargaining setup when there are decreasing returns to labor (Spector, 2004) or when workers have a high discount factor – i.e. workers have a strong preference for short-run effects over long-run effects. See Blanchard and Giavazzi (2003) and Spector (2004) for negative short-run effects of a product market deregulation.

ment protection legislation. In section III, we search for a politically viable deregulation that increases welfare. Section IV discusses extensions to the basic model. The last section concludes. All proofs are presented in the Appendix.

I. Model

In this section, we explain how we model the product market as a replica Cournot economy and how our measure of product market regulation determines the size of the market in which firms operate and the degree of competition they face. We subsequently show the functioning of the labour market, which we model as a slightly modified version of the standard efficiency wage model from Shapiro and Stiglitz (1984). Thereafter, we make clear how our measure of labour market regulation affects general firing regulations, which in turn have an impact on the efficiency wage.

PRODUCT DEMAND PER FIRM AND PRODUCT MARKET REGULATION

We model the product market as a replica Cournot economy with N identical firms in an economy of total size Nd, where d is a measure of the number of total potential consumers per firm (Vives, 2002). To keep the analysis simple, it is assumed that demand is linear and that labour is the only factor of production.[7] We explain how this economy works in function of the degree of market integration. Suppose first that markets are "zero-integrated" and each of the N firms can act as a monopoly in its local market. There exist then N (isolated) local markets, each of total size d. Each firm i faces then in its local market a linear inverse demand, $p = d - l_i$, with l_i the amount of labour needed to satisfy the demand. Suppose now, on the other hand, that each market is not isolated, but integrated with exactly one other market. Each firm would then face competition from just one other firm and there exist $\frac{N}{2}$ duopolies, each with a total potential market of $2d$. Firms can thus operate in a larger market, but have to take into account one other firm when deciding on optimal production. The price p is then jointly determined by the production of two firms i and j, $l_i + l_j = 2(d - p)$, and therefore $p = d - \frac{l_i + l_j}{2}$. Generalising

[7] The firm's other production factors are assumed to be fixed and at full capacity. More importantly, the firm produces at constant returns to scale. But firms compete in a product market where price depends negatively on production. Its demand for labour is thus downward sloping and this assumption has therefore no qualitative consequences.

this reasoning for all degrees of integration, we can write the inverse product demand for an individual firm as

$$p = d - \left(\frac{l_i}{m} + \sum_{i \neq j}^{m-1} \frac{l_j}{m}\right), \tag{1}$$

where $m \in [1, \infty[$ indicates the degree of market integration, and it must of course necessarily hold that $m \leq N$. The competition firms face lies between the one extreme ($m = 1$) where a firm can behave as a monopoly in its local product market of size d, and the other extreme ($m \to \infty$) where firms face perfect competition in the global market of size ∞ (naturally, this can only occur when $N \to \infty$). As m increases, firms thus become smaller in relation to the market in which they operate and consequently face more competition. Since this is a non-standard way of modelling intensity of competition, we stress again that m is *not* the number of firms present in a market of size d. Having two previously isolated markets integrated would lead to two competing firms operating in a market size of $2d$. This means that if each duopolist here produced the same as a monopoly firm in its isolated market of size d, prices would be the same. In the optimum, however, the Cournot competition effect makes it so that firms produce more in duopoly and equilibrium prices will be lower.

Although we will fully characterise the equilibrium in both product and labour markets in Section II, we derive here the Nash equilibrium for firms in the product market, which can be found as the intersection of directly competing firms' best response functions. Of course, a firm i's best response function is characterised as $\frac{\delta \pi_i}{\delta l_i} = 0$, where π_i is firm i's profit. Given the specified price p in equation (1) and w being the cost per unit of labour, the profit for firm i can be written as $\pi_i = [d - (\frac{l_i}{m} + \sum_{i \neq j}^{m-1} \frac{l_j}{m}) - w] l_i$. Therefore, the optimal production per firm i is

$$l_i = (d - w)\frac{m}{m + 1}, \tag{2}$$

which depends positively on the number of direct competitors m and the size parameter d, and negatively on the to be paid wage w.

We can now define our measure of product market regulation. In the context of European integration, one may think of those aspects of product market regulation that determine the intensity of competition between firms present in the European market. In particular, we focus on those frictions that influence the degree of market integration through their influence on the legal barriers to entry, since we think of these as particularly relevant for the European economies (see also Griffith et al., 2007). Indeed, legal barriers to entry still remain high in certain sectors such as services, transport, energy and water (see Nicoletti et al., 2000). Therefore reforms in these sectors may (i) be used as a "carrot" for labour market reforms and (ii) be easier to reform when done in synchronisation with labour market reforms For instance, the gradual integration of the various national markets into a single European internal electricity market may be seen as an example of an attempt to induce more competition through a higher integration.[8] Therefore,

Definition 1 *The degree of product market regulation determines the degree of market integration, m. In particular, a less regulated product market leads to a higher market integration, i.e. a higher m.*

EFFORT DECISION PER WORKER AND LABOUR MARKET REGULATION

We model the effort decision per worker and the functioning of the labour market as a slightly modified version of the standard efficiency wage model from Shapiro and Stiglitz (1984).[9] We refer for the full derivation to Shapiro and Stiglitz (1984), but give here briefly the reasoning. There is a fixed number of Nn identical workers, who all dislike putting forth effort.[10] A worker is risk neutral and his utility function per period is separable in wage and effort: $U(y, Ef) = y - Ef$, where y is the payment a worker gets and Ef his effort. An unemployed individual receives no unemployment benefit, $y = 0$, and does not supply any effort, $Ef = 0$, which means that his utility is $U_u(y, Ef) = 0$. An employed worker receives a real wage $y = w_r$ and decides to shirk, $Ef = 0$, or to provide some fixed positive level of effort, $Ef = e > 0$. If the worker supplies effort for his job, only exogenous factors can cause a separation. This exogenous separation rate can be relocation, recession, etc. and is a probability $b \in [0, 1]$. If an employed worker shirks, there is an added probability $sq \in [0, 1]$ that he will be fired when discovered shirking, where $q \in [0, 1]$ is the probability of being caught and $s \in [0, 1]$ the probability of being fired when caught shirking. For simplicity, it is assumed that probabilities b, q and s are uncorrelated. The worker selects an effort level to maximise his total expected utility. Following the notation of Shapiro and Stiglitz

[8] See http://ec.europa.eu/energy/electricity/legislation/index_en.htm, for a detailed explanation on the liberalisation of the European electricity market.

[9] For empirical evidence on efficiency wages, see for example Konings and Walsh (1994), Krueger and Summers (1988) and Levine (1992).

[10] This means that if all of the N firms present would pay identical wages, each firm could hire at most n workers.

(1984), we define V_e^s as the expected utility of an employed worker who shirks, V_e^n the expected utility of an employed non-shirker and V_u as expected utility of an unemployed individual. The flow equation for a non-shirker is given by $rV_e^n = w_r - e + b(V_u - V_e^n)$, while for a shirker, it is represented by $rV_e^s = w_r + (b + sq)(V_u - V_e^s)$, where r is the discount rate. The worker will choose not to shirk if and only if $V_e^n \geq V_e^s$, which leads us to the individual *no-shirking condition*

$$w_r \geq rV_u + (r + b + sq)\frac{e}{sq} \equiv w^n, \tag{3}$$

in which w^n is the critical no-shirking wage. The real wage w_r that matters for workers' effort can be written as $w_r = \frac{w}{\tilde{p}}$, where w is the nominal wage that matters for firms' hiring and production decisions – as specified in the derivation of the labour demand in the previous section – and $\tilde{p}$ is the consumer price index, i.e. the average price at which consumers buy their goods. Throughout most of the paper, for simplicity, we will assume that both are equivalent, $w_r = w$. This means that we leave the consumer price constant; and without loss of generality, we normalise this constant consumer price to one, i.e. $\tilde{p} = \bar{p} = 1$. As we explain below in section IV on 'Reforms targeted in some sectors versus economy-wide reforms', this assumption implies that reforms take place only in targeted sectors so that they do not affect the consumer price index $\tilde{p}$. We show there that, although a changing price index makes a quantitative difference, results do not change in the qualitative sense; the main message of the paper – synchronising reforms across markets reduces opposition from interest groups – is independent of how much the consumer price index $\tilde{p}$ is affected by reforms.

We can now define our measure of labour market regulation, based on the legislation that protects employment ("Employment Protection Legislation" or EPL). EPL is an important labour market institution that affects a large number of countries and refers generally to the set of rules and legislation that limit in some way the ability of an employer to dismiss a worker (OECD, 1999). Botero et al. (2003) argue that these rules are often not the result of optimal intervention into the market place, but a function of the legal culture and history of the country. EPL may then be a serious drag on efficiency by preventing the breakup of bad matches and by making less severe the threat of firing as a tool to discourage workers from shirking (Epstein, 1984). Like Garibaldi (1998), we therefore consider a setup which includes EPL as a general parameter that reflects the difficulties of firing a worker. In particular, we assume that not all workers caught shirking can be easily dismissed or that a dismissed worker must be reinstated when having won his case in court. Indeed, the existence of EPL effectively introduces uncertainty over the actual costs and timing of firing.[11] Therefore,

Definition 2 *The degree of labour market regulation determines the probability that a worker can be effectively fired when caught shirking, s. In particular, a less regulated labour market leads to a higher probability of being able to fire a worker when caught shirking, i.e. a higher s.*

The stochastic parameter s thus reflects the difficulties firms face due to general firing regulations, which has an upward effect on efficiency wages even though workers do not shirk in equilibrium. Indeed, the lower the flexibility of the labour market, s, the more the no-shirking condition (3) pushes up wages, since it is now harder (more expensive) for firms to induce workers to exert effort. Hence, employees' rents are magnified by legal restrictions in the labour markets, which is confirmed by Boeri and Jimeno (2005, p2058), who observe that "[...] insofar EPL negatively affects disciplinary layoffs, it increases the efficiency wage".[12] This increases inefficiencies and therefore aggravates the distortions in the labour market that come from the asymmetric information. Therefore, EPL plays a role in our economy through its effect on employed workers' rents, which in turn will create inefficiencies in employment, production and prices, as becomes clear in the next section.[13] It must further be noted that, modelling EPL as a firing cost, as Galdón-Sánchez and Güell (2003) do, leads to the same basic effect; firing costs increase efficiency wages through the no-shirking condition. We provide in section IV on '*Equivalence between probability of firing and cost of firing*' a micro-foundation for the firing probability, s, based on a firing cost.

[11] Employment contracts are incomplete, and hence there are always cases involving disputes regarding contract interpretation that need to be settled, either by a dispute resolution tribunal, or in a court of law. In such cases, the more EPL rules and procedures exist, the more uncertain the outcome. For example, the existence of a "just clause" rule in European legislations as Italy allows the worker to appeal against dismissal and can result in reinstatement of the dismissed worker (see OECD, 1999, for a detailed overview).

[12] As in Lazear (1990), the effect of employment protection on redundancies, variable b in our model, is assumed to be neutral.

[13] Nevertheless, we further provide a more general setup in section IV on 'A more general model where workers may shirk in equilibrium'.

II. EQUILIBRIUM IN MARKETS

We derive first the equilibrium in the labour market and refer again to Shapiro and Stiglitz (1984) for a similar reasoning. As specified in the previous section, there are N identical firms. Each firm can induce workers to exert effort once working in the firm, and finds it optimal to fire shirkers if it can, since the only other punishment, a wage reduction, would simply induce the disciplined worker to shirk again. Since a firm will not have difficulties attracting labour (in equilibrium), each firm will then optimally set its wage w sufficient to induce workers to exert effort, that is, $w = w^n$ to meet the no-shirking condition (3). A firm's labour demand is given by equating the marginal product of labour to the cost of hiring an additional employee and the optimal labour demand for a firm i is then simply given by

$$\begin{aligned} &\max_{l_i} \;\; \pi_i \\ &s.t. \quad\; w = w^n. \end{aligned}$$

Solving for the Nash equilibrium where firms optimise their production (and hence their use of labour), the labour demand for firm i can be characterised by $l_i = (d - w)\frac{m}{m+1}$ and $w = w^n$ (see the derivation of equation (2) in Section I). Summing over all N firms and writing in function of the wage, total inverse labour demand in function of product market parameters is then characterised by

$$w^n = (d - \frac{(m+1)\sum^N l_i}{mN}). \tag{4}$$

We now turn to the determination of the equilibrium wage in function of the labour market parameters. Equilibrium occurs when each firm, taking the wages and employment levels at other firms as given, finds it optimal to offer the going wage rather than a different wage. The key market variable is V_u, the expected utility of an unemployed worker. An employer will pay the minimum allowable wage in order to meet the no-shirking condition, which means that in equilibrium $V_e^s = V_e^n = V_e$. This yields

$$V_e = V_u + \frac{e}{sq}. \tag{5}$$

Assuming firms to be small relative to the size of the labour market so that they take job flows as given – see footnote 27 on page 23 for further justification of this assumption – and using the relation between the value of the unemployed and employed workers, then $V_u = a(V_e - V_u) =$

$a\frac{e}{sq}$, where a is the endogenous probability of obtaining a job per unit of time. Substituting the expression for V_u in the no-shirking-condition yields the aggregate no-shirking condition $w \geq e + (r + b + a)\frac{e}{sq}$. The rate a itself can be related to more fundamental parameters of the model. The flow into the unemployment pool is $b\sum^N l_i$, where $\sum^N l_i$ is the aggregate employment and b the exogenous separation rate. The flow out of the unemployment pool is $a(nN - \sum^N l_i)$, where nN is the total labour supply. In equilibrium, these must be equal, so $b\sum^N l_i = a(nN - \sum^N l_i)$, or $a = \frac{b\sum^N l_i}{Nn - \sum^N l_i}$. Therefore, the aggregate no-shirking condition can be written as

$$w \geq e + (r + \frac{b\sum^N l_i}{nN - \sum^N l_i})\frac{e}{sq} \equiv w^n. \tag{6}$$

The equilibrium wage and employment are now easy to identify. Each firm, taking the aggregate job acquisition rate, a, as given, finds that it must offer at least the wage w^n. The firm's demand for labour determines how many workers are hired at that wage. Equilibrium occurs then where the aggregate demand for labour, equation (4), intersects the aggregate no-shirking condition (6). The equilibrium wage w^* and employment per firm l^* can then be found by

$$(d - \frac{(m+1)\sum^N l_i}{mN}) = e + (r + \frac{b\sum^N l_i}{nN - \sum^N l_i})\frac{e}{sq}. \tag{7}$$

This equilibrium in the labour market determines at the same time the optimal production in the product market as is shown in the Appendix, since the labour demand is derived from profit maximisation in the product market. The following Lemma specifies the equilibrium in function of our parameters of interest.

LEMMA 1 ***(i)*** *The equilibrium is unique.*

(ii) *Equilibrium employment/production increases for a higher market integration, $\frac{\partial l^*}{\partial m} \geq 0$, but its marginal effect decreases. The equilibrium wage increases for a higher market integration, $\frac{\partial w^*}{\partial m} \geq 0$, but its marginal effect decreases.*

(iii) *Equilibrium employment/production increases for a more flexible labour market, $\frac{\partial l^*}{\partial s} \geq 0$, but its marginal effect decreases. The equilibrium wage decreases when the labour market becomes more flexible, $\frac{\partial w^*}{\partial s} \leq 0$, but its marginal effect decreases.*

As can be seen from Figure 1, when the product markets become more integrated, i.e. m increases, the demand for labour becomes more elastic. For a given labour supply, the equilibrium wage and employment will therefore increase (Part (ii) of Lemma 1). While at the individual firm level a decrease in market power for a firm could lead to a decrease in wages, this does not necessarily carry over to economy-wide changes. Indeed, we find that a higher integrated economy leads to all firms operating in larger markets and at the same time experiencing a universal drop in market power. The combination of these two effects leads to an increase in labour demand elasticity and therefore, by increasing the marginal revenue at any given output, to a higher equilibrium labour demand, which is empirically confirmed by Griffith et al. (2007). The marginal effect of a higher market integration on equilibrium wage and employment decreases however.

[Insert Figure 1 about here]

As can be seen from Figure 2, when the labour market becomes more flexible, i.e. when s increases, wages decrease and therefore employment increases, but at a decreasing marginal rate (Part (ii) of Lemma 1). The result that a more flexible labour market leads to lower efficiency wages and a higher employment is important. The reason for these effects is, similar to Diaz-Vázquez and Snower (2003) and Galdón-Sánchez and Güell (2003), that a more flexible labour market leads to less insider power and hence a lower efficiency wage, which increases therefore equilibrium employment. Ljungqvist (2002) explains (in the context of lay-off costs) that the main mechanism driving this result is the fact that in an efficiency wage context, the parameter s effectively influences the division of surplus between workers and employers.[14]

[Insert Figure 2 about here]

III. DEREGULATION AND ITS SUPPORT

We look at reforms that remove rigidities in product markets so that markets become more integrated (see definition 1), and reforms in labour markets that make these more flexible in

[14] This is in contrast to, for example, matching models with the assumption of a constant relative split of the match surplus between firms and workers. A less flexible labour market would then lead employment to increase by reducing labour reallocation. However, if one assumes an exogenous length of job tenure or a matching model where workers' relative share of the match surplus increases with the labour market flexibility, also matching models would find a negative relationship between job protection and employment (see Ljunqvist, 2002).

terms of EPL (see definition 2). As in Blanchard and Giavazzi (2003), the owners of the firms in our setup are assumed to be "entrepreneurs" that are different from the contracted (unskilled) workers. Moreover, for simplicity, these entrepreneurs are taken to be identical to the firms. One should ideally also include capital and make a distinction between skilled and unskilled labour, since reforms will have a different impact on the utilisation of these factors, but this is beyond the scope of this paper.

Reforms are approved when firms, employed and unemployed workers do not lose from a reform. We suppose that groups have veto power, that is, each group can independently block a reform. Probably this is not true in reality. Reforms are a result of a decision process -or voting procedure- where interest groups have the power to influence decisions. However, in assuming veto power for each group, we establish a lower bound in finding approval. It must further be noted that –given that we give firms considerable power in the political process– our setup is most suited for situations where firms can weigh heavily on the decision process of E.U. product market reform, which seems indeed to be the case for legal barriers to entry in national markets.[15] On the other hand, our setup may be less suited to reflect e.g. national barriers to trade inside the E.U.; these are normally solely decided upon through supra-national institutions in Europe, where firms have relatively less clout, and therefore also easier to implement. This is consistent with the relatively low values for trade barrier indicators in European countries (Nicoletti et al., 2000).

We first develop welfare measures for workers, firms and total welfare, and check that deregulation leads to a higher total welfare in our setup. We then investigate how reforms influence each interest group separately, which determines their support for a reform. From equation (5), the per-period welfare for employed workers is

$$rV_e = rV_u + \frac{re}{sq} = (r+a)\frac{e}{sq}. \tag{8}$$

In comparison with unemployed workers, employed workers thus enjoy a rent $\frac{re}{sq}$. Then, as Saint-Paul (2000, p8) confirms "The existence of these rents acts as a 'catalyst' for labour market institutions, because they increase the employed's support for such rigidities." Indeed,

[15] Sectors with high legal barriers to entry are often characterised by a high degree of state-control and influenced by domestic regulatory policies. The fact that regulators can also be owners is not explicitely modelled in the paper, but one can think of firms being owned by regulators being equivalent to firms entering in the regulator's utility function in such a way that a regulator only reforms when firms win – which is what the model assumes.

when rents exist, losing one's job is associated with a welfare loss in proportion to that rent. The employed will therefore have an incentive to defend a low likelihood of job loss by means of an EPL that prevents firms from freely reducing their workforce. This incentive is greater, the greater the rent, i.e. the more regulated the labour market is through a low firing probability s. Therefore, inefficiencies that create rents – i.e. asymmetric info and shirking – will more easily lead to employed workers defending other rigidities that protect rents – i.e. firing difficulties by firms. In other words, EPL reduces exposure to unemployment and makes that the employed's rent is greater and, therefore, "[...] rent-creating and rent-protecting institutions reinforce each other" (Saint-Paul, 2000 p9).[16] This can be easily seen from the above expression for the welfare of an employed worker: a higher EPL (a lower s) leads to higher rents $\frac{e}{sq}$, and therefore to a more fierce opposition of a deregulation.

The existence of these rents also means that an increase in labour market flexibility, s, will hurt employed workers more than unemployed workers, which in turn leads employees to oppose more an increase in s. A product market reform that leads to a higher market integration, on the other hand, will only increase the probability of obtaining a job per unit of time, a, and therefore unambiguously increases the welfare of both the employed and unemployed in exactly the same manner. In sum, unemployed workers always agree with a reform that is approved by the employed workers; this also means that no separate welfare measure needs to be developed for the unemployed workers.

The welfare for a firm is $\pi = (p - w)l$.[17] Using the results from Lemma 1, the equilibrium profit can be written as

$$\pi = \frac{(l^*)^2}{m}. \tag{9}$$

A social planner maximises aggregate welfare per unit of time in equilibrium,

$$W = N[\pi + rV_e l^* + rV_u(n - l^*)],$$

where $N\pi$ is the total profit of the firms, $NrV_e l^*$ the total welfare of employed workers, and $NrV_u(n - l^*)$ the total welfare of unemployed workers. This equation can be rewritten as

[16] This mechanism is not unique to the efficiency wage model. Any "insider-outsider" model that, due to some friction, creates rents for insiders delivers similar conclusions. See Saint-Paul (2000) for a summary of these models.

[17] It may seem strange that for the firms, the discount rate r does not play a role. But if we write the flow equation for firms in discrete time, we have $\pi = (p - w)x - \frac{b}{1+r}\pi x + \frac{a}{1+r}\pi(n - x)$. Since $a = \frac{bx}{n-x}$, it is easy to see that the profit per unit of time is $\pi = (p - w)x$. The same reasoning holds for continuous time.

$W = Nl^*(p^* - e)$. The total welfare is thus total output multiplied by the social profit of production $(p^* - e)$. It can then be easily checked that product and labour market deregulation lead to a higher total welfare in our setup, $\frac{\partial W}{\partial m} \geq 0$ and $\frac{\partial W}{\partial s} \geq 0$ (see Appendix).

We now turn to how each interest group reacts towards types of deregulation in equilibrium. We first assess approval for a labour market deregulation, given the degree of integration in the product market. Remember that we consider here the case where the consumer price index $\tilde{p} = \bar{p}$ is not affected by the intended reforms, $\frac{\delta \tilde{p}}{\delta s} = \frac{\delta \tilde{p}}{\delta m} = 0$ (see section IV for the case where $\frac{\delta \tilde{p}}{\delta s} \neq 0, \frac{\delta \tilde{p}}{\delta m} \neq 0$). Our findings are expressed in the following Lemma.[18]

Lemma 2 ***(i)*** *Firms always favour a more flexible labour market,* $\frac{\partial \pi}{\partial s} \geq 0$.

(ii) *Employed workers never favour a more flexible labour market,* $\frac{\partial (rV_e)}{\partial s} \leq 0$. *The losses to employed workers of a labour market deregulation are decreasing in the labour market's initial flexibility,* s, *and in the product market's initial level of market integration,* m.

(iii) *The lower the initial labour market flexibility,* s, *the higher the influence of the product market,* m, *on labour market reforms.*

Firms always favour a reform that increases the labour market flexibility, s, since this decreases efficiency wages (Part (i) of Lemma 2). A decrease in wages leads firms to hire more labour l^* and therefore to an increase in their profits, π, as can be seen from equation (9). On the other hand, an increase in labour market flexibility, s, hurts employed workers directly through enjoying less insider power, as can be seen from equation (8). However, a more flexible labour market also indirectly benefits workers by increasing the probability of finding a job, a, if loosing their job in the future. Still, as shown in the Appendix, this indirect positive effect is never able to offset the negative direct effect. Therefore, employed workers never favour a labour market deregulation (Part (ii) of Lemma 2). Moreover, it is evident that employed workers enjoy greater initial rents $\frac{re}{sq}$ when the labour market is initially less flexible (see equation 8). This means that a labour market deregulation will increase losses for employed workers when the labour market is initially less flexible, thereby possibly increasing their opposition for a labour market reform.

[18] We only analyse cross-steady states. Although a discrete jump from one steady state to another is only one possible equilibrium path, Saint-Paul (1998) finds that transitional dynamics only account for a small fraction of the variation of each groups welfare, suggesting that the cross steady state comparison may be a good approximation.

This is the known "European Sclerosis" effect. European interest groups enjoy high rents and therefore oppose changes more (Saint-Paul, 2000). Furthermore, a higher initial product market integration leads to a more elastic labour demand. Therefore, an increase in labour market flexibility has a higher positive effect on the probability of obtaining a job per unit of time, a, and will therefore hurt employed workers less.[19] This is somewhat in line with the empirical findings of Estevão (2005, p3) who shows that: "Because product markets are more regulated in the Euro area than in other industrial countries, wage moderation affects production and unemployment less strongly." Finally, the influence of the product market on labour market reforms becomes higher when the labour market is less flexible (Part (iii) of Lemma 2). In other words, the more sclerotic the labour market, the more important product market conditions become.

We now assess approval for a product market deregulation, given the degree of flexibility in the labour market. Our findings are expressed in the following Lemma.

LEMMA 3 ***(i)*** *Employed workers always favour a more integrated product market,* $\frac{\partial(rV_e)}{\partial m} \geq 0$.

(ii) *Firms always oppose a more integrated product market,* $\frac{\partial \pi}{\partial m} \leq 0$. *The losses to firms of a product market deregulation are generally increasing in the product market's initial level of market integration,* m.[20]

(iii) *The lower the product market's initial level of market integration,* m*, the higher the influence of the labour market,* s*, on product market reforms.*

Employed workers favour a product market deregulation, since firms' labour demand elasticity and hence equilibrium employment increase (Part (i) of Lemma 3). This benefits workers by increasing the probability of finding a job, a, thereby leading to a higher efficiency wage in equilibrium. This result is in contrast to bargaining models as e.g. Blanchard and Giavazzi's (2003), where a reduction in firms' rents leads to a smaller pie and hence a smaller piece for workers to bargain over. The main difference between that reasoning and ours is that in our model the market parameters effectively influence the division of surplus between workers and

[19] Saint-Paul (1998) also finds that an adverse labour market policy selection is more likely when the elasticity of labour demand is low.

[20] In the case where equilibrium wages do not change for changes in labour demand (i.e. when the labour supply is horizontal), the maximum loss of a product market reform is not encountered for the smallest m ($m = 1$), but for $m \in [1, 1 + \sqrt{2}]$, as is shown in the Appendix. We do not discuss this case any further in the text.

employers. Note also that in our efficiency wage setup, workers' welfare always increases through product market deregulation, even when these reforms do not impact the consumer price index, i.e. when reforms take only place in some – but not all – sectors in the economy. This is not the case in a standard firm-workers bargaining setup; for employed workers to gain from a product market deregulation consumer prices must lower to such an extent that they can compensate for the lower rents from wage bargaining.[21] An increase in m leads to a universal reduction in market power and reduces firms' equilibrium profits (Part (ii) of Lemma 3). When the initial market integration is low, then a firm's market power is high and firms have generally more to lose from a product market reform. This is the product market side of the so-called sclerosis effect, as found for example in Duso (2002) and Kroszner and Strahan (1999). On cross-effects, the influence of the labour market on product market reforms is higher when there is less competition in the product market (Part (iii) of Lemma 3).

Lemmas 2 and 3 confirm that deregulation in product and labour markets is opposed by firms and employed workers respectively, a fact that by now is widely known by academics and policy makers. More interestingly, reforms create positive externalities in our setup. Deregulating the product market generates benefits for workers. Deregulating the labour market generates benefits for firms. Therefore, a synchronisation of reforms – i.e. reforms that are agreed upon at the same time – may potentially open the way for approval for each type of deregulation, as is stated in the following Proposition, which makes the main point of the paper.

PROPOSITION 1 *Support for synchronised reforms is always higher than support for a single reform, since* ***(i)*** *Support from employed workers for synchronised reforms is higher than for only a labour market reform,* $\frac{\partial(rV_e)}{\partial s} + \frac{\partial(rV_e)}{\partial m} \geq \frac{\partial(rV_e)}{\partial s}$.

(ii) *Support from firms for synchronised reforms is higher than for only product market reforms,* $\frac{\partial\pi}{\partial m} + \frac{\partial\pi}{\partial s} \geq \frac{\partial\pi}{\partial m}$.

[21] See also Amable and Gatti (2002) for an efficiency wage model where an increased market integration — although increasing total labour demand – also leads some firms to shed relatively more workers, which is an often heard argument against a higher market integration or "globalisation". However, based on their reasoning, it can be shown that an increased market integration does not necessarily lead to a lower welfare for these workers. Indeed, given that total labour demand goes up and firms must additionally compensate those workers that face a higher exposure, all employed workers still favour a more integrated product market. Of course, this reasoning hinges strongly on the assumption that laid off workers find with the same probability another job in a new firm, which may not be the case in reality.

Both employed workers and firms favour thus synchronised reforms more than just a deregulation in their own market. The obvious reason is that the positive externalities of each reform, $\frac{\partial(rV_e)}{\partial m}$ and $\frac{\partial\pi}{\partial s}$, are now effectively used to compensate for the negative effects of the other reform, $\frac{\partial(rV_e)}{\partial s}$ and $\frac{\partial\pi}{\partial m}$, whereas in separate reforms these externalities are "thrown away". We further tentatively explore under which market conditions a synchronisation of reforms potentially works best. First, employed workers lose more from a labour market reform when the initial flexibility of the labour market is low (Lemma 2). A product market reform, on the other hand, brings the least increase in their welfare when initial integration is already high, since additional wage gains are lower (Lemma 1). Thus, high frictions in the labour market and low frictions in the product market leads employed workers to gain less from a synchronised deregulation. The opposite holds for firms. When their initial market power is high (product markets are not integrated), then inducing more competition hurts firms most (Lemma 3). A labour market reform, on the other hand, brings the least increase in optimal production and therefore profits when the initial labour market flexibility is already high (Lemma 1). Thus, high frictions in the product market and low frictions in the labour market leads firms to gain less from a synchronised deregulation. In conclusion, the higher the negative correlation between the frictions in the markets, the more one of the two interest groups will suffer from a synchronised deregulation. Otherwise said, support from both interest groups ("overall support") for a synchronised deregulation is most likely to be obtained when initial conditions are similar in both markets, as is pointed out in the following claim. A sketch of proof is given in the Appendix.

Claim 1 *A higher positive correlation between labour market flexibility, s, and product market integration, m, increases the overall support for synchronised reforms.*

This claim has a potentially interesting implication. When markets suffer from sclerosis, i.e. when frictions are at their highest, it has been traditionally found that it is harder to find support for deregulation. But our analysis may suggest that this is not necessarily the case when reforms can be synchronised across markets. This result also gives a possible explanation for the high positive correlation between product and labour market frictions in most OECD countries (see Table 1); markets may be most easily deregulated when done in synchronisation.

IV. EXTENSIONS

REFORMS TARGETED IN SOME SECTORS VERSUS ECONOMY-WIDE REFORMS

Until now we have considered the case where the consumer price index was not affected by reforms, $\tilde{p} = \bar{p}$ such that $\frac{\delta \tilde{p}}{\delta s} = \frac{\delta \tilde{p}}{\delta m} = 0$, which is the case when the reforms are targeted in particular sectors. This may be the case for product market reforms that seek to reduce legal barriers to entry that are still obstacles towards an internal European integration; in this dimension, there are a number of specific sectors – such as services, transport, energy and water – that remain highly regulated (see Nicoletti et al., 2000). In this extension, we consider the other extreme where the consumer price index is equal to the product market price of the reformed market, $\tilde{p} = p$, which implies that the reforms take place in the whole economy (real-world cases should normally fall in between the two extremes presented in the paper). As it turns out, letting reforms have a full impact on consumer prices does not change the explained mechanisms in a qualitative way; however, there are some quantitative differences that are worth pointing out. The fact that now consumer prices also change with reforms has direct repercussions on the labour supply, and therefore also on the market equilibrium and welfare measures of the interest groups.

In particular, given that a labour market reform (a higher s) now leads to a lower product market price p, workers benefit indirectly though their real wages $w_r = \frac{w}{p}$. This means that they are willing to take relatively larger cuts in nominal wages, while still supplying effort on the job; equilibrium employment/production, therefore, rises relatively more. A similar effect occurs for economy-wide product market reforms. After a product market reform (a higher m), given its downward effect on equilibrium prices, nominal wages have to go up by a smaller amount to induce the same amount of effort by the employed workers. This leads a product market reform to have a larger effect on equilibrium employment and production.

Therefore, the fact that workers now also care about the induced product market price changes clearly benefits firms; the required nominal pay changes – and therefore production changes – go more in their favour than was the case with partial reforms. This can be seen from the welfare measure for firms, equation (9), which shows that firms' welfare is higher when equilibrium production is higher. The employed workers also gain relatively more (lose less) when reforms take place economy-wide, although more indirectly. The fact that more employment results in equilibrium means that workers will find a job more easily, if eventually fired (see the welfare measure for employed workers, equation 8). Therefore, economy-wide reforms are easier to implement than targeted reforms. However, as shown in the Appendix, although both firms and employed workers benefit more (lose less) from economy-wide reforms than from targeted reforms, it is never the case that reforming more widely would change an opposition into an approval. In other words, when an interest group blocks a particular targeted reform, it would still block this reform if it were applied economy-wide. These findings are stated in the following Proposition.

PROPOSITION 2 ***(i)*** *Economy-wide reforms ($\tilde{p} = p$) that lead to a higher market integration (more flexible labour market) result in an employment/production increase. This increase is relatively larger than for targeted reforms ($\tilde{p} = \bar{p}$).*

(ii) *Employed workers and firms benefit more (lose less) from economy-wide reforms than from targeted reforms. However, applying economy-wide reforms instead of targeted reforms cannot change an opposition into an approval.*

Of course, given that results do not change qualitatively when considering economy-wide reforms, the main result of the paper still holds; reforms are easier implemented when synchronising them across markets.

A MORE GENERAL MODEL WHERE WORKERS MAY SHIRK IN EQUILIBRIUM

The main aim of the presented efficiency-wage setup was to show how market imperfections (through EPL) increase employed workers' rents stemming from asymmetric info. Therefore, since EPL plays a role in the economy through its effect on employed workers' rents, it creates inefficiencies in employment, production and prices. Nevertheless, it behooves us to display a more general setup, where workers may shirk in equilibrium, and to show that the explained mechanisms stay basically the same. Suppose – unlike the standard efficiency wage model of Shapiro and Stiglitz (1984) – a model where there is some shirking in equilibrium.[22] Workers' cost of effort is then $e(f)$, where $f < 1$ is the fraction of time a worker does not shirk. The flow equation of a worker can therefore be written as

$$rV_e = w - fe(p) + p_f(V_u - V_e), \tag{10}$$

[22] See also Galdón-Sanchez and Güell (2003) for such a model.

where $p_f = b+(1-p)qs$ is the probability of being fired for a redundancy, b, or for a disciplinary case $((1-f)qs)$. Optimising with respect to f and rearranging, one can then obtain the *individual condition* – the equivalent of the no-shirking condition of the basic model – where a worker optimally provides effort for a fraction $f^*$of time,

$$w_r \geq rV_u + f^*e(f^*) + \frac{e(f^*) + f^*e'(f^*)}{sq}[r + b + (1 - f^*)qs] \equiv w^{n'}. \tag{11}$$

It is easy to see that this equation is the interior solution variant of the standard Shapiro-Stiglitz's (1984) no-shirking condition. Indeed, when workers do not shirk in the optimum, then $f^* = 1$ and $e'(f^*) = 0$ in the equation (11) above, and we are back in our basic no-shirking equation (3).

There are a few noteworthy features related to this more general wage equation. First, the fact that there is now a real possibility of being fired when shirking means that the punishment of shirking for workers is relatively higher. This reality means that the offered wage must be a term $T \equiv [e(f^*) + f^*e'(f^*)](1 - f^*)$ higher in order to induce workers to make an effort.[23] Second, however, changes in the labour market flexibility, s, have a *neutral* direct impact on how shirking in $(1 - f^*)$ amount of time affects the incentives, i.e. T does not change with s.[24]

Given the above individual condition, the aggregate labour supply, labour demand and market equilibrium can be easily characterised, as shown in the Appendix. Then, based on the derived market equilibrium, one can analyse how a change in labour market flexibility, s, changes equilibrium employment/production, wages and welfare for firms and workers. All results are qualitatively the same as for the case of no-shirking in equilibrium. Given that the no-shirking condition in equilibrium (equation 3) is the corner solution of the more general problem where a worker chooses optimally the fraction of time f to work (equation 11), this should come as no surprise.

EQUIVALENCE BETWEEN PROBABILITY OF FIRING AND COST OF FIRING

We modelled EPL as a probability of a firm being able to fire a worker when caught shirking; this was done to reflect the multiple dimensions of an EPL. However, one can make the link between

[23] Note that it is not clear how this wage relates to the wage where $f^* = 1$ without specifying a particular function $e(f)$. This function determines the exact values of p^*, $e(f^*)$ and $e'(f^*)$ in equilibrium. But that is also not the aim of this exercise.

[24] See also Galdón-Sanchez and Guëll (2003) for a detailed explanation of a similar neutral direct effect of EPL.

a probability of firing and a cost of firing, to provide a true micro-economic foundation for our firing probability. In accordance with Galdón-Sánchez and Güell (2000, 2003), one could think of firms having to pay a higher severance payment when dismissals are considered to be unfair by courts. The link between higher firing costs and a stricter EPL can then be made by equalising a stricter EPL regulation to a higher severance pay level for cases taken to court and found to be unfair (these outcomes would also determine the upper bound of private settlements). Then, given the difficulty in observing workers' effort, in the case of any disciplinary dismissal workers have an incentive to contest the case, even if they have been fairly dismissed. Courts' decisions are based on whatever evidence is presented by the agents, which is not perfectly correlated with reality, given the information problem. In that sense, the decisions by the court will tend to be imperfect. Therefore, one can think of some probability, say g, that true disciplinary decisions are ruled unfair by the courts.[25] If the decision is ruled as unfair, a cost equivalent to a proportion c of the lost utility due to being unemployed, $c(V_u - V_e)$, has to be paid to the fired worker, with $c \geq 0$.[26] Therefore, modifying the equilibrium flow equation (10) for a worker, which we use instead of the main flow equations in the paper given its ease for optimising, one can write the new flow equation as

$$rV_e = w_r - fe(f) + b(V_u - V_e) + (1-f)q(1-g)(V_u - V_e) + (1-f)qg[c(V_e - V_u)].$$

Taking first order conditions with respect to the optimal time of effort f, and putting $f^* = 1$ and $e'(f^*) = 0$, the incentive compatible wage is

$$w_r \geq rV_u + e + \frac{e(r+b)}{q[(1-g) - gc]} \equiv w^N. \tag{12}$$

In this setup, deregulating the labour market can be implemented through a proportional decrease in the severance payment c, i.e. an increase in $(-c)$, and $\frac{\partial w^N}{\partial(-c)} = -\frac{ge(r+b)}{q[(1-g)-gc]^2} \leq 0$. Therefore, if probability g and cost c are such that $[(1-g) - gc] = s$, then

$$\frac{\partial w^n}{\partial s} = \frac{1}{g}\frac{\partial w^N}{\partial(-c)},$$

[25] There is some evidence that disciplinary dismissals are very often used in some European countries, and that they are often declared unfair in court. In France, for instance, for the period 1982-1998, as much as 74% of all labour conflicts that arrived in court were declared unfair and as much as 80% of cases that arrived in court involved disciplinary disputes (See Galdón-Sanchez and Güell, 2000, for more details).

[26] We model the to be paid severance pay as a proportion c of the lost utility $(V_e - V_u)$ in order to be as close as possible to the main model we present. Modelling the severance pay as a fixed amount would lead to qualitatively similar results, but not to the exact same functional form.

as can be easily seen from comparing the no-shirking wages (3) and (12). In sum, if one models firing costs as the payment that firms have to incur when courts consider a disciplinary dismissal as unfair, then a decrease in firing costs c has an equivalent effect on wages – and hence on the market equilibria and welfare measures – as an increase in firing probability s. Therefore, modelling a reform in EPL as a decrease in the firing cost or an increase in the firing probability is equivalent in this setup.

IV. CONCLUSIONS

European product and labour markets often suffer inefficiently high frictions. Since reforms in these markets typically come with a redistribution of rents, they are often met with opposition from the losing interest groups. Frictions in labour markets lead employed workers to enjoy higher rents, which makes them likely to oppose a removal of these rigidities. Similarly, frictions in product markets may result in a low competition, thereby benefitting firms that will therefore try to steer the political decision process towards a status quo.

In this paper, we demonstrated that by exploiting complementarities, synchronising deregulation across markets may make this opposition lower. As being relevant for European economies, we focussed on product market (de)regulation that determines the degree of market integration and labour market (de)regulation that determines the degree of employment protection. In this context, each deregulatory reform creates – apart from the expected negative effect on the directly affected interest group – positive externalities on the other interest group. A synchronised deregulation across markets can use these externalities to compensate for the direct negative impact of reforms on interest groups, whereas in separate deregulatory reforms these externalities are "thrown away". Deregulation complementarities may therefore offer a further tool in reforming some sclerotic European markets.

The aim of this work is to add to the growing body of research on reforms across markets, and builds in particular on the important work of Blanchard and Giavazzi (2003), which shows that there exist interactions between reforms in product and labour markets. We suggest two new insights. First, the main result of this paper is that in our setup reforms always create positive externalities, which may be used to more easily obtain approval from interest groups; therefore, synchronising reforms across markets reduces opposition. This finding contrasts to bargaining models such as Blanchard and Giavazzi's (2003), which advocate sequential reforms or find sometimes reforms not to create the positive cross-effects in the first place – e.g. when reforms are only attempted in targeted sectors. Second, in the light of these differences, it should be clear that there exist different types of markets and regulatory instruments; each particular market and deregulation may call for a different optimal scope and timing.

The right timing and scope of reforms is important from a policy point of view, given the political difficulties that exist to implement deregulation. But, although there is recent empirical work that tries to measure how the effects of deregulation in one market are influenced by frictions in other markets (Estevão, 2005; Griffith et al., 2007; Kugler and Pica, 2006), little work on interactions between reforms exists. There is some recent empirical evidence on reform complementarities by Bassani and Duval (2006), who find through calibration exercises that reform complementarities would amplify the employment effects of separate reforms by between 12% and 19%. They further point out that this is an average effect and argue that certain interactions may be more important than others, which is consistent with our findings that particular sectors and types of deregulation may call for a different optimal timing and scope. Further detailed theoretical and empirical work is needed in order to asses industries in the dimensions of wage formation, product market competition and type of (de)regulation to have clearer predictions on this issue.

APPENDIX

Proof of Lemma 1

(i) Assuming that all firms are identical, $l_i = l$, the equilibrium equation (7) can be rewritten as $(d - \frac{(m+1)Nl}{mN}) = e + (r + \frac{bNl}{Nn-Nl})\frac{e}{sq}$, and N cancels out.[27] Therefore, the equilibrium can be characterised by

$$(d - \frac{(m+1)l^*}{m}) - e - (r + \frac{bl^*}{n - l^*})\frac{e}{sq} = 0, \text{ or} \tag{13}$$

[27] It is worth pointing out that the equlibirum is independent of the number of firms N. Since we use replica economies, no matter how many firms present, it is as if each firm faces an individual total labour supply with n workers. This does not imply that there is immobility of workers across firms or sectors. The total labour force of workers Nn is free to move and supply labour to any firm. But since firms and workers are symmetric, in equilibrium each firm will hire the same number of workers and the equilibrium wage will be the same. This allows us as well to let $N \to \infty$, which justifies our assumption that firms take the aggregate job acquisition rate a as given.

$$\begin{cases} w^* - d + \frac{m+1}{m} l^* = 0 \\ w^* - e - \frac{re}{sq} - \frac{be}{sq}\frac{l^*}{n-l^*} = 0 \end{cases} \tag{14}$$

Solving for equilibrium l^*, the equation gives us a unique equilibrium $l^* \leq n$.

(ii) The derivative of equilibrium labour l^* w.r.t. direct competition m in equation (13) is $\frac{\partial l^*}{\partial m} = \frac{\frac{l^*}{m^2}}{F} \geq 0$, with $F \equiv \frac{m+1}{m} + \frac{Bn}{(n-l^*)^2} \geq 0$ and $B \equiv \frac{be}{sq}$. To have the same base for comparison, we assume the same equilibrium employment l^* for different degrees of competition, as in Saint-Paul (1998). We do this for all the second order -and third order- derivatives in this paper. The second derivative is then $\left.\frac{\partial^2 l^*}{\partial m^2}\right|_{l^*=\bar{l}^*} = \frac{-\frac{l^*}{m^3}(\frac{1}{2m}+1+\frac{Bn}{(n-l^*)^2})}{F^2} \leq 0$. The derivative of equilibrium labour w^* w.r.t. direct competition m in equation (14) is $\frac{\partial w^*}{\partial m} = \frac{Bn}{(n-l^*)^2}\frac{\partial l^*}{\partial m} \geq 0$ and $\left.\frac{\partial^2 w^*}{\partial m^2}\right|_{l^*=\bar{l}^*} = \frac{Bn}{(n-l^*)^2}\frac{\partial^2 l^*}{\partial m^2} \leq 0$.

(iii) Using equation (13), $\frac{\partial l^*}{\partial s} = \frac{(r+\frac{bl^*}{(n-l^*)})\frac{e}{qs^2}}{F} \geq 0$ and $\left.\frac{\partial^2 l^*}{\partial s^2}\right|_{l^*=\bar{l}^*} = \frac{-(r+\frac{bl^*}{(n-l^*)^2})(\frac{e}{qs^3})}{F^2} \leq 0$. Similarly, using equation (14), we find $\frac{\partial w^*}{\partial s} = -\frac{m+1}{m}\frac{\partial l^*}{\partial s} \leq 0$ and $\left.\frac{\partial^2 w^*}{\partial s^2}\right|_{l^*=\bar{l}^*} = -\frac{m+1}{m}\frac{\partial^2 l^*}{\partial s^2} \geq 0$.

(iv) The inverse demand in the product markets is $p = d - \frac{\sum^m l_i}{m}$. Since firms are symmetric, in equilibrium $p^* = d - \frac{\sum^m l_i^*}{m} = d - \frac{\sum^m l^*}{m} = d - \frac{ml^*}{m} = d - l^*$. Therefore, $\frac{\partial p^*}{\partial m} = \frac{\partial p^*}{\partial l^*}\frac{\partial l^*}{\partial m} = -\frac{\partial l^*}{\partial m} \leq 0$ and $\frac{\partial p^*}{\partial s} = \frac{\partial p^*}{\partial l^*}\frac{\partial l^*}{\partial s} = -\frac{\partial l^*}{\partial s} \leq 0$.

Proof of $\frac{\partial W}{\partial s} \geq 0$ and $\frac{\partial W}{\partial m} \geq 0$

If the output price were constant, the social planner would always be concerned about more employment and more production. Since in this model the output price is not taken as given, we need to check whether this still holds. When taking derivatives of total welfare $W = Nl^*(p^* - e)$ w.r.t. equilibrium employment, $\frac{\partial W}{\partial l^*} = N[(p^* - e) + l^*(\frac{\partial p^*}{\partial l^*})]$. From Part (iv) of Lemma 1, we know that $p^* = d - l^*$, and $\frac{\partial W}{\partial l^*} = N(d - 2l^* - e)$. If the competition structure is such that $m = 1$, the equilibrium wage will be $w^* = d - 2l^*$, and $\frac{\partial W}{\partial l^*} = w^* - e$. Since $w^* > e$, $\frac{\partial W}{\partial l^*} > 0$. If $m > 1$, the wage is higher than $d - 2l^*$ (see Lemma 1), so the inequality holds for all degrees of competition.

Proof of Lemma 2

(i) The welfare per unit of time for firms in equilibrium is $\pi = \frac{(l^*)^2}{m}$ and thus $\frac{\partial(\pi)}{\partial s} = \frac{2l^*}{m}\frac{\partial l^*}{\partial s} \geq 0$.

(ii) The welfare per unit of time for employed workers in equilibrium is $rV_e = (r + a^*)\frac{e}{sq}$ and thus $\frac{\partial(rV_e)}{\partial s} = \frac{e}{sq}[\frac{\partial a^*}{\partial l^*}\frac{\partial l^*}{\partial s} - (r + a^*)\frac{1}{s}] = \frac{e}{q}[\frac{bn}{(n-l^*)^2}\frac{(r+\frac{bl^*}{(n-l^*)})\frac{e}{qs}}{F} - (r + \frac{bl}{(n-l^*)})\frac{1}{s^2}]$. Then, $\frac{\partial(rV_e)}{\partial s} \geq 0$ iff $\frac{e}{q}\frac{bn}{(n-l^*)^2}[s - \frac{1}{s}] \geq \frac{m+1}{m}$. Given that $\frac{m+1}{m} > 0$, a necessary condition therefore is that $s > \frac{1}{s}$.

But this never holds, since $s \in [0,1]$. Therefore, $\frac{\partial(rV_e)}{\partial s} < 0$. Then, for a given equilibrium employment level $l^* = \bar{l}^*$, $\frac{\partial^2(rV_e)^*}{\partial s^2}\Big|_{l^*=\bar{l}^*} \geq 0$. Further, using the results of Lemma 1, we find $\frac{\partial^2 l^*}{\partial s \partial m}\Big|_{l^*=\bar{l}^*} = \frac{\frac{1}{m^2}(r+\frac{bl^*}{(n-l^*)})(\frac{e}{qs^2})}{F^2} \geq 0$ and therefore $\frac{\partial^2(rV_e)^*}{\partial s \partial m}\Big|_{l^*=\bar{l}^*} \geq 0$, because $\frac{\partial a^*}{\partial l^*} = \frac{bn}{(n-l^*)^2} \geq 0$.

(iii) Given the equilibrium employment $l^* = \bar{l}^*$, the influence of the product market on a labour market reform is $\frac{\partial^3(rV_e)^*}{\partial s \partial m \partial s}\Big|_{l^*=\bar{l}^*} = \frac{e}{sq}\frac{\partial a^*}{\partial l^*}\frac{\partial^3 l^*}{\partial s \partial m \partial s} \leq 0$, since $\frac{\partial^3 l^*}{\partial s \partial m \partial s}\Big|_{l^*=\bar{l}^*} \leq 0$ (this follows from the derivation of $\frac{\partial^2 l^*}{\partial s \partial m}\Big|_{l^*=\bar{l}^*}$ in part (ii)).

Proof of Lemma 3

(i) The welfare per unit of time for employed workers in equilibrium is $rV_e = (r + a^*)\frac{e}{sq}$ and thus $\frac{\partial(rV_e)}{\partial m} = \frac{e}{sq}\frac{\partial a^*}{\partial l^*}\frac{\partial l^*}{\partial m} \geq 0$, because $\frac{\partial a^*}{\partial l^*} = \frac{bn}{(n-l^*)^2} \geq 0$ and $\frac{\partial l^*}{\partial m} \geq 0$.

(ii) The welfare per unit of time for firms in equilibrium is $\pi = \frac{(l^*)^2}{m}$. Thus, $\frac{\partial(\pi)}{\partial m} = \frac{2l^*}{m}\frac{\partial l^*}{\partial m} - \frac{(l^*)^2}{m^2}$ and $\frac{\partial(\pi)}{\partial m} \geq 0$ when $\frac{2l^*}{m}(\frac{\partial l^*}{\partial m} - \frac{l^*}{m^2}) \geq 0$. From Lemma 1, we know that $\frac{\partial l^*}{\partial m} = \frac{\frac{l^*}{m^2}}{F}$, so $\frac{\partial l^*}{\partial m} \leq \frac{l^*}{m^2}$ and $\frac{\partial(\pi)}{\partial m} \leq 0$ for every m. The minimum of $\frac{\partial(\pi)}{\partial m}$ is reached for $m = m'$, where $m\prime = \frac{(1+\sqrt{2})}{(1+\frac{Bn}{(n-l)^2})}$. Hence, $\frac{\partial(\pi)}{\partial m}$ does not behave monotonously. But $m' \in [1, 1+\sqrt{2}]$ and for $s \to 0$, $m' \to 1$. For $m \geq m'$, $\frac{\partial^2(\pi)}{\partial m^2}\Big|_{l^*=\bar{l}^*} \geq 0$ and thus for $m \geq m'$, a higher m increases $\frac{\partial(\pi)}{\partial m}$ and thus increases the loss for firms.

(iii) Given the equilibrium employment $l^* = \bar{l}^*$, the influence of the labour market on a product market reform is $\frac{\partial^2(\pi)}{\partial m \partial s}\Big|_{l^*=\bar{l}^*} = \frac{2l^*}{m}\frac{\partial^2 l^*}{\partial m \partial s}$. We can derive that $\frac{\partial^3(\pi)^*}{\partial m \partial s \partial s}\Big|_{l^*=\bar{l}^*} = \frac{e}{sq}\frac{\partial a^*}{\partial l^*}\frac{\partial^3 l^*}{\partial s \partial m \partial s} \leq 0$, since $\frac{\partial^3 l^*}{\partial s \partial m \partial s} \leq 0$. Thus, the lower s, the higher the influence of m on $\frac{\partial(\pi)}{\partial s}$.

Proof of Proposition 1

(i) $\frac{\partial(rV_e)}{\partial m} \geq 0$ from Part (i) of Lemma 3. From here logically follows $\frac{\partial(rV_e)}{\partial s} + \frac{\partial(rV_e)}{\partial m} \geq \frac{\partial(rV_e)}{\partial s}$.

(ii) $\frac{\partial(\pi)}{\partial s} \geq 0$ from Part (i) of Lemma 2. From here logically follows $\frac{\partial(\pi)}{\partial s} + \frac{\partial(\pi)}{\partial m} \geq \frac{\partial(\pi)}{\partial m}$.

Sketch of Proof of Claim 1

We first check the effects of s and m on both $\frac{\partial(\pi)}{\partial s}$ and $\frac{\partial(\pi)}{\partial m}$. From point (ii) of Lemma 3, we know that $\frac{\partial^2(\pi)}{\partial m^2}\Big|_{l^*=\bar{l}^*} \geq 0$ for $m \geq m'$ where $m' \in [1, 1+\sqrt{2}]$. Thus, a lower m generates a more negative $\frac{\partial(\pi)}{\partial m}$. Also, we know from point (iii) of Lemma 1 that $\frac{\partial^2 l^*}{\partial s^2}\Big|_{l^*=\bar{l}^*} \leq 0$ and therefore $\frac{\partial^2(\pi)}{\partial s^2}\Big|_{l^*=\bar{l}^*} = \frac{2l^*}{m}\frac{\partial^2 l^*}{\partial s^2} \leq 0$, higher s thus generates a lower $\frac{\partial(\pi)}{\partial s}$. Hence, the direct effects of a high s and low m are clearly negative. We now check the cross-effects. The ratio $\frac{\frac{\partial^2(\pi)^*}{\partial s \partial m}\big|_{l^*=\bar{l}^*}}{\frac{\partial^2(\pi)^*}{\partial m^2}\big|_{l^*=\bar{l}^*}} = \frac{(r+\frac{bl}{(n-l^*)^2})(\frac{e}{s^2 q})}{-l^{*2}(\frac{1}{2m}+l^*+\frac{Bn}{(n-l^*)^2})}$ and is lower for a lower m. This indicates that the negative effect of a lower m on $\frac{\partial(\pi)}{\partial m}$ dominates the positive effect of a lower m on $\frac{\partial(\pi)}{\partial s}$. Also, the ratio $\frac{\frac{\partial^2(\pi)^*}{\partial s^2}\Big|_{l^*=\bar{l}^*}}{\frac{\partial^2(\pi)^*}{\partial s \partial m}\Big|_{l^*=\bar{l}^*}} = -\frac{em}{s}$ is lower for a higher s. This indicates that the negative effect of a higher s on $\frac{\partial(\pi)}{\partial s}$ dominates its positive effect on $\frac{\partial(\pi)}{\partial m}$.

We check the effects of s and m on both $\frac{\partial(rV_e)}{\partial s}$ and $\frac{\partial(rV_e)}{\partial m}$. From point (i) of Lemma 2, we know that $\frac{\partial(rV_e)}{\partial s}$ is smaller for a lower s. Also, we know from point (ii) of Lemma 1 that $\frac{\partial^2 l^*}{\partial m^2}\Big|_{l^*=\bar{l}^*} \leq 0$ and therefore $\frac{\partial^2(rV_e)^*}{\partial m^2}\Big|_{l^*=\bar{l}^*} = \frac{e}{sq}\frac{\partial a^*}{\partial l^*}\frac{\partial^2 l^*}{\partial m^2} \leq 0$. Hence, the direct effects of a lower s and higher m are clearly negative. We now check the cross-effects. The derivative $\frac{\partial(rV_e)}{\partial m}$ also diminishes for a lower s, as we can see when substituting $\frac{\partial l^*}{\partial m}$, and a lower s is thus worse for both reforms. But, we know from point (ii) of Lemma 2 that the higher m, the higher $\frac{\partial(rV_e)}{\partial s}$. However, the ratio $\frac{\frac{\partial^2(rV_e)^*}{\partial m^2}\Big|_{l^*=\bar{l}^*}}{\frac{\partial^2(rV_e)^*}{\partial s \partial m}\Big|_{l^*=\bar{l}^*}} = \frac{\frac{l}{m}[\frac{1}{m}-2(r+\frac{Bn}{(n-l)^2})]}{\frac{e}{s^2 q}(r+b+a)}$, and a higher m leads to a lower ratio with $\lim_{m\to\infty}(\frac{\frac{\partial^2(rV_e)^*}{\partial m^2}\Big|_{l^*=\bar{l}^*}}{\frac{\partial^2(rV_e)^*}{\partial s \partial m}\Big|_{l^*=\bar{l}^*}}) = 0$. This indicates that $\frac{\partial(rV_e)}{\partial m}$ lowers faster than $\frac{\partial(rV_e)}{\partial s}$ rises for m larger.

Proof of Proposition 2

(i) When $\tilde{p} = p$, given that in equilibrium $\tilde{p} = p^* = d - l^*$ (see part (iv) of the proof of Lemma 1) and using again that $l_i = l$, the equilibrium in the markets can be characterized by

$$(d - \frac{(m+1)l^*}{m}) - [e + (r + \frac{bl^*}{n-l^*})\frac{e}{sq}](d - l^*) = 0.$$

Solving for equilibrium l^*, the equation gives us a unique equilibrium $l^* \leq n$. The derivative of equilibrium labour l^* w.r.t. m is $\frac{\partial l^*}{\partial m}\Big|_{\tilde{p}=p} = \frac{\frac{l^*}{m^2}}{F'} \geq 0$, with $F' \equiv \frac{m+1}{m} + \frac{Bn}{(n-l^*)^2}p^* - \frac{w^*}{p^*} \geq 0$, since $p^* \geq w^*$. Likewise, the derivative of equilibrium labour l^* w.r.t. s is $\frac{\partial l^*}{\partial s}\Big|_{\tilde{p}=p} = \frac{p^*(r+\frac{bl}{(n-l^*)})\frac{e}{qs^2}}{F'} \geq 0$. Further, $F' \equiv \frac{m+1}{m} + \frac{Bn}{(n-l^*)^2}\tilde{p} - \frac{w^*}{\tilde{p}} \leq F \equiv \frac{m+1}{m} + \frac{Bn}{(n-l^*)^2}\tilde{p}$. See Lemma 1 for the derivation of F, where we now put $\tilde{p} = \bar{p}$ back in (before, we normalised for simplicity $\tilde{p} = \bar{p} = 1$). Therefore, $\frac{\partial l^*}{\partial m}\Big|_{\tilde{p}=p} \geq \frac{\partial l^*}{\partial m}\Big|_{\tilde{p}=\bar{p}}$ and $\frac{\partial l^*}{\partial s}\Big|_{\tilde{p}=p} \geq \frac{\partial l^*}{\partial s}\Big|_{\tilde{p}=\bar{p}}$.

(ii) From the derivations in Lemma 2 and 3, $\frac{\partial(rV_e)}{\partial s} = \frac{e}{sq}[\frac{\partial a^*}{\partial l^*}\frac{\partial l^*}{\partial s} - (r + a^*)\frac{1}{s}]$, $\frac{\partial(\pi)}{\partial s} = \frac{2l^*}{m}\frac{\partial l^*}{\partial s}$, $\frac{\partial(rV_e)}{\partial m} = \frac{e}{sq}\frac{\partial a^*}{\partial l^*}\frac{\partial l^*}{\partial m}$ and $\frac{\partial(\pi)}{\partial m} = \frac{2l^*}{m}\frac{\partial l^*}{\partial m} - \frac{l^{*2}}{m^2}$. One can then derive that $\frac{\partial(rV_e)}{\partial s}\Big|_{\tilde{p}=p} \geq 0$ iff $\frac{p^*bn}{(n-l^*)^2}\frac{e}{q}[1-\frac{1}{s^2}] > \frac{1}{s}[\frac{m+1}{m} - \frac{w^*}{p^*}]$, which can never occur since $\frac{m+1}{m} > \frac{w^*}{p^*}$ but $1 \leq \frac{1}{s^2}$. Therefore, $\frac{\partial(rV_e)}{\partial s}\Big|_{\tilde{p}=p} < 0$. It is further evident that $\frac{\partial(\pi)}{\partial s}\Big|_{\tilde{p}=p} \geq 0$ and $\frac{\partial(rV_e)}{\partial m}\Big|_{\tilde{p}=p} \geq 0$. Finally, $\frac{\partial l^*}{\partial m} = \frac{\frac{l^*}{m^2}}{F'}$, so $\frac{\partial l^*}{\partial m} \leq \frac{l^*}{m^2}$ and $\frac{\partial(\pi)}{\partial m}\Big|_{\tilde{p}=p} \leq 0$ for every m. Therefore, the qualitative effects of deregulation are the same for $\tilde{p} = p$ and $\tilde{p} = \bar{p}$ (see proofs of Lemma 2 and 3). Further, given that $\frac{\partial l^*}{\partial m}\Big|_{\tilde{p}=p} \geq \frac{\partial l^*}{\partial m}\Big|_{\tilde{p}=\bar{p}}$

and $\frac{\partial l^*}{\partial s}\Big|_{\tilde{p}=p} \geq \frac{\partial l^*}{\partial s}\Big|_{\tilde{p}=\bar{p}}$, it is therefore straightforward that $\frac{\partial(rV_e)}{\partial s}\Big|_{\tilde{p}=p} \geq \frac{\partial(rV_e)}{\partial s}\Big|_{\tilde{p}=\bar{p}}$, $\frac{\partial(\pi)}{\partial s}\Big|_{\tilde{p}=p} \geq \frac{\partial(\pi)}{\partial s}\Big|_{\tilde{p}=\bar{p}}$, $\frac{\partial(rV_e)}{\partial m}\Big|_{\tilde{p}=p} \geq \frac{\partial(rV_e)}{\partial m}\Big|_{\tilde{p}=\bar{p}}$, and $\frac{\partial(\pi)}{\partial m}\Big|_{\tilde{p}=p} \geq \frac{\partial(\pi)}{\partial m}\Big|_{\tilde{p}=\bar{p}}$.

Market Equilibrium and labour market reforms in a more general framework
Given the characterisation of a worker's individual condition in equation (11), the market equilibrium can be easily characterised. First, a firm's labour demand curve can be derived in the same way as in the basic model, with this difference: output per firm is now $p^* l_i$ instead of l_i. Second, the flow into unemployment is now $p_f^* \sum^N l_i$ instead of $b \sum^N l_i$, so that, assuming again for simplicity that $w_r = w$, one can write the aggregate condition for workers, the equivalent of equation (6) in the paper, as $w \geq f^* e(f^*) + [\frac{e(f^*)+f^* e'(f^*)}{sq}][r + \frac{p_f^* \sum^N l_i}{nN - \sum^N l_i}]$. Therefore, the equilibrium employment l_i^* in the labour market can be characterised by

$$(d - \frac{(m+1)\sum^N f^* l_i^*}{mN}) = f^* e(f^*) + [\frac{e(f^*) + f^* e'(f^*)}{sq}][r + \frac{p_f^* \sum^N l_i^*}{nN - \sum^N l_i^*}].$$

Assuming symmetry $l_i = l^*$, the effect of a more flexible labour market, s, on the equilibrium employment l^* is then $\frac{\partial l^*}{\partial s} = \frac{(\frac{e(f^*)+f^* e'(f^*)}{s^2 q})(r + \frac{bl^*}{n - l^*})}{f^* \frac{m+1}{m} + \frac{e(f^*)+f^* e'(f^*)}{sq} \frac{p_f^* n}{(n-l^*)^2}}$ This derivative is the "interior equivalent" to the solution found in Lemma 1 part (ii), where $f^* = 1$ and $e(f^*) = e$.Therefore, further results on wages and welfare measures are equivalent, since the main results in the paper are just the corner solution for the more general model.

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TABLE

Table 1: Indicators of Product Market regulation and Employment Protection Legislation,1998 (Min is 0, Max is 6).

	product market regulation	employment protection legislation
United States	1.0	0.2
United Kingdom	0.6	0.5
Canada	1.6	0.6
New Zealand	1.5	1.0
Ireland	1.5	1.0
Australia	2.0	1.1
Belgium	2.6	2.1
Finland	2.5	2.1
Sweden	1.8	2.4
Netherlands	1.8	2.4
Austria	2.1	2.4
Japan	1.5	2.6
Germany	2.0	2.8
France	2.5	3.1
Italy	2.6	3.3
Spain	2.1	3.2
Portugal	2.5	3.7
Greece	3.1	3.5

Source: Boeri et al. (2000) and Nicoletti et al. (2001).

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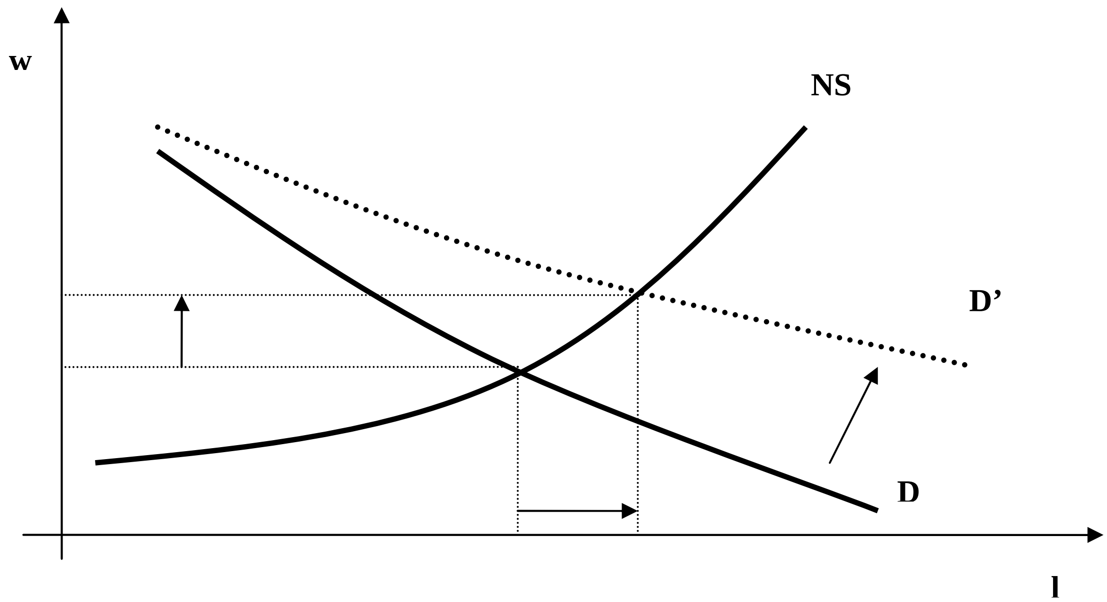

Figure 1: The effects of a product market deregulation through an increase in m
(NS = aggregate no-shirking condition, D = aggregate labour demand)

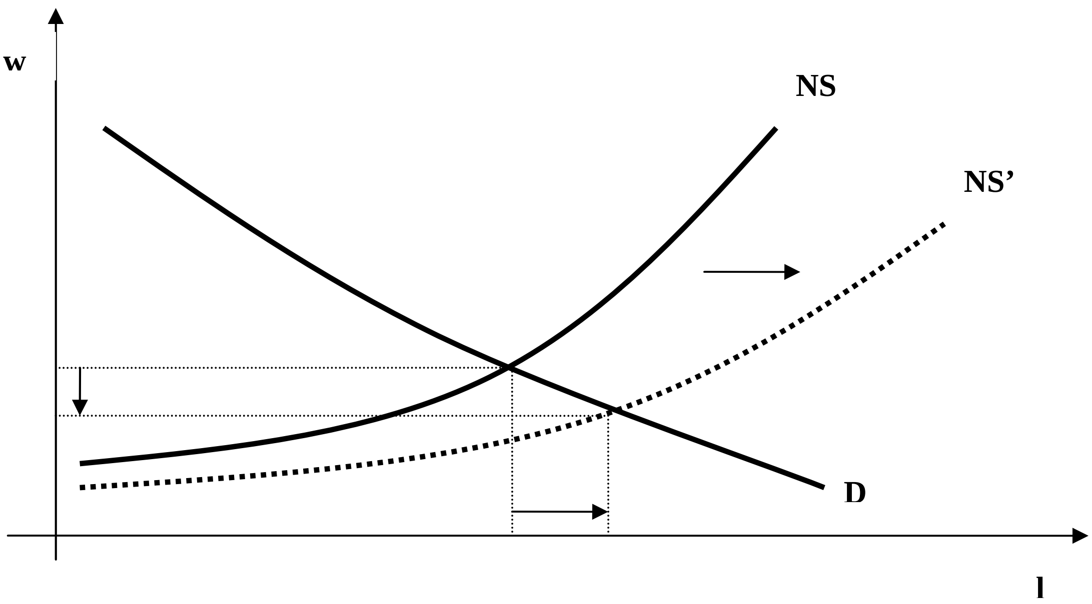

Figure 2: The effects of a labour market deregulation through an increase in s
(NS = aggregate no-shirking condition, D = aggregate labour demand)