economics discussion Papers
The Open-Access, Open-Assessment E-Journal

Discussion Paper 2007-42
September 7, 2007

The Impact of Tax, Product and Labour Market Distortions on the Phillips Curve and the Natural Rate of Unemployment

Nikola Bokan

University of St. Andrews

Andrew Hughes Hallett

George Mason University and CEPR

Please cite the corresponding journal article:
http://www.economics-ejournal.org/economics/journalarticles/2008-27

Abstract:

Most people accept that structural and labour market reforms are needed in Europe. However few have been undertaken. The usual conjecture is that reforms are costly in economic performance and costly to finance. Blanchard and Giavazzi (2003) and Spector (2004) develop a general equilibrium model with imperfect competition to show the impact of labour *or* product market deregulation. We extend that model to combine both reforms, and include the costs of financing them, the conflict between long run gains and short run costs, and to allow for reforms of distortionary taxation. We also extend the model to explain the natural rate of unemployment and non-wage employment costs, to show the impact of reform on the short and long run Phillips curve parameters. We find that structural reforms imply short run costs but long run gains (unemployment rises and then falls, while wages move in the opposite way); that the long run gains outweigh the short run costs; and that the financing of such reforms is the main stumbling block. We also find that the implications for welfare improvements and employment generation are quite different: tax reforms are more effective for welfare, but market liberalisation for employment.

JEL: J58, H23, E24

Keywords: Structural reform, wage bargains, short vs. long run substitutability, endogenous entry of firms

Correspondence:
University of St Andrews, Centre for Dynamic Macroeconomic Analysis, School of Economics and Finance, St Andrews, Fife KY16 9AL, UK. Tel: +44-1334 462445. E-mail: nb85@st-andrews.ac.uk . *George Mason University, School of Public Policy, MS 3C6, 4400 University Drive, Fairfax, VA22030, USA. Tel: +1-703-993-2280. E-mail: ahughesh@gmu.edu*

We thank Charles Nolan, Alan Sutherland, Dirk Krueger, Helge Berger, Peter McAdam, participants at the Royal Economic Society, and seminars at Frankfurt, Berlin, Marburg and Tubingen Universities, for helpful comments on the theoretical model used in this paper. Financial support from CEBR at the Copenhagen Business School is gratefully acknowledged. The usual disclaimer applies.

1. Introduction

Tax reform, market liberalisation and deregulation in the labour markets are widely seen as the key to improved economic performance – particularly in Europe. As a result, structural reform has become a, if not the, leading policy issue in Europe. Yet the academic literature has seen very little formal analysis of the reform process, or of how far structural reforms could be expected to improve economic performance in practice. Similarly many countries have proved reluctant to actually embrace such reforms, despite being happy enough to extol their virtues in public debate. These inconsistencies need explanation.

Arguments for market or institutional reforms have been made, and supported, both by policy makers and analysts at the political level under the heading of the Lisbon agenda [Sapir, 2004]. Nevertheless, despite these reforms having been discussed and advocated so widely, they seldom seem to be carried out [Dellas and Tavlas 2005, Hughes Hallett et al 2005]. And where they have been attempted, it has often been as a piecemeal effort, partial in its scope and quickly abandoned in the face of opposition. The Hartz IV programme in Germany, labour market reforms and the liberalization of services in France, and the reconstruction of social security in Italy, are three obvious and specific examples. The usual conjecture is that such reforms are costly in economic performance and costly to finance; a conjecture that we examine in detail here to show that the problem is one of short run costs vs. long run gains.

Much of this debate has come to focus on reforms in the labour market. That, it seems, is based on the analytic and empirical evidence of a negative link between economic performance and wage rigidities in many countries [Bruno, 1986]. That link has certainly been observed in the labour and product markets of Europe [Koedijk and Kremers, 1996] when performance is measured in rates of growth and employment; and deregulation is measured in competition policy, merger codes and the liberalization of employment practices. The result has been high production costs; persistent unemployment; and sluggish growth without falling inflation. In addition, there is significant evidence that institutional and market distortions go a long way to explaining the persistence of unemployment in Europe.[1]

In this paper we develop a theoretical model of wage bargaining, together with imperfect competition in the product markets and different forms of distortionary taxation, in order to understand the likely incentives for, and eventual outcomes of structural reform. We use the results to explain policy makers' behaviour and derive certain conclusions about the appropriate design and sequencing of reform packages.

We start from a model proposed by Blanchard and Giavazzi (2003), and elaborated in Spector (2004), to show the conflict between the long run gains from market reforms and their short run costs – including the costs of financing those reforms. We extend that model to allow for distortionary taxation, and to show the implications for short and long term unemployment. We are then able to confirm the existence of short run costs as the main stumbling block to reform, and the existence of long run gains that will eventually outweigh those short run costs. We can similarly trace out how the implicit inflation-unemployment trade-offs, or sacrifice ratios, have been affected by

[1] Blanchard and Wolfers (2000), Nickell et al (2005).

this lack of reform and how far they might be eased by the different reform measures available.

Lastly, we are able to show how these different tax and market distortions affect the natural rate of unemployment, and hence which structural reform measures would be the most important to undertake from a welfare or employment perspective.

Apart from the Blanchard and Giavazzi and the Spector papers, there are three recent papers in the literature that examine this problem [Bayoumi et al 2004, Coenen et al 2006, Everaert and Schule 2006]. But they operate by numerical simulation. The advantage of our model is that we can stay in the realm of analytic solutions, and that we are able to extend previous work by combining market distortions with tax distortions. In addition, our model is able to show how the composition of the price mark-up that results from these distortions is generated, and how it depends on the different reform parameters in the model. We are also able to solve the endogenous entry problem (so that the degree of competition does not remain constant), and show that to be the key to the long run gains to be made out of structural reform.

2. The Model

In order to consider the impact of the tax system on wage bargaining behaviour, and hence identify the likely consequences for reform, we extend the Blanchard and Giavazzi [2003] framework by introducing distortionary taxation into the economy. Together with distortionary taxes, we consider two further deviations from the perfect competition in order to generate the need for both product and labour market reforms. The first one arises from the assumption of the imperfectly competitive product markets. In this case, we assume the presence of certain number of the monopolistically competitive firms each of them producing a differentiated good. Then, on the labour market side, we introduce an imperfection by assuming a formal wage bargaining process between firms and their workers.

The presence of monopolistically competitive firms leads to the creation of rents in the economy, the size of which is determined by the degree of monopolistic competition. At the same time, the existence of a wage bargaining process leads to a certain distribution of those rents between firms and workers. However, distortionary taxation is necessary to complete the story since any reform programme that is going to be undertaken needs to be financed. And if fiscal expenditures are therefore potentially endogenous, then taxes must ultimately be endogenous too.

We do not model the dynamics of adjustment explicitly in this paper. But in order to allow for differences in the effects over time we will follow Blanchard and Giavazzi by imposing a clear cut distinction between the short term and the long term. This is achieved by fixing the number of producers in the market exogenously in the short run, whereas we allow that number to be determined by a market entry condition in the long run. One can think of this entry condition as a *per unit* entry cost, c, representing certain regulatory or administrative entry barriers present in the product markets. Although there would be no difference to the equilibrium outcomes if this cost were treated as a shadow cost, it is perhaps better to think of it as real cost which is proportional to output. If this cost were to be a shadow cost, firms present in the

market would be able to earn pure profits in the long run; whereas if it is a real cost, firms can earn "excess" profits only in the short run since any excess would eventually be dissipated in the entry cost. Moreover, in order to perform any numerical analysis, the entry costs would need to be treated as real and could be thought as the cost of the time needed to satisfy all of the regulatory requirements plus the cost of setting the firm up and licensing it as a legal entity.

2.1 The Consumer's Problem

To model consumption, we assume that the economy contains a fixed number of workers-consumers L, indexed by j, who can choose to either work, or not to work. If the worker decides to work he must supply one unit of labour. If he does not work he is unemployed. Labour is therefore indivisible.

The utility function for worker j is given by following expression

$$U_j = [m^{1-\delta} \sum_{i=1}^{m} C_{i,j}^{\frac{\delta-1}{\delta}}]^{\frac{\delta}{\delta-1}} \tag{1}$$

where $C_{i,j}$ represents individual j's consumption of the i-th product; m represents the number of firms or products present in the market; and δ stands for the elasticity of (gross) substitution between products which is defined as $\delta = \overline{\delta} f(m)$, .We assume this elasticity to be an increasing function of number of products with $f'(m) > o$, and that $\overline{\delta}$ may be fixed by policy. This specification of δ is crucial for disentangling the difference between the short and the long run since, by imposing an exogenous number of firms present in the market, we assume that the elasticity of substitution is constant and exogenous in the short term. But in the long run, it will be endogenous and determined by the number of products that emerge in the final equilibrium.

This specification has three important features. First, assuming that all workers are identical, the utility of the workers will not depend directly on the number of products, but on the level of aggregate consumption instead. Second, an increase in the number of products increases the elasticity of substitution between them and thereby reduces monopoly power of the individual producer. This may have indirect consequences for the utility of the individual worker. Third, with a fixed labour supply, employment generation and reducing unemployment are synonymous.

When making consumption or labour market decisions, each worker maximises (1) subject to the following budget constraint:

$$\sum_{i=1}^{m} P_i C_{i,j} = (1 - t_w) w_j N_j + P w_r(u)[1 - N_j] \tag{2}$$

where N_j takes the value of one if worker j chooses to work, or zero if he or she is unemployed. $w_r(u)$ may therefore be interpreted as the real value of the unemployment benefits (or support) received from government in the case of unemployment; or equivalently as the worker's reservation wage.

2.2 Unemployment

We now assume that the implied level of social support (or unemployment benefits and the reservation wage) increases with government expenditures and decreases with the rate of unemployment in the economy as a whole: that is, $w_r^{'}(u) < 0$.

There are several ways to justify this assumption. First $w_r(u)$ may represent the labour market institutions that affect wage bargains: minimum wage levels, hiring and firing costs, the size and duration of unemployment benefits, employment subsidies, or the level of social support itself. Increases in any one of those factors would, if set too high, increase the reservation wage when unemployment is low or social support generous [Blanchard and Wolfers, 2000]. Or it may be that market reforms create temporary unemployment, but lower the reservation wage since workers know that the old jobs may not be preserved. But higher employment would, in either case, lead to higher wages and higher reservation wages.[2]

Alternatively, it could be that the higher is the unemployment rate, the higher is the political pressure on governments to finance new social benefits or provide job protection. Or conversely, the higher the unemployment rate in a fixed benefit system, the more the workers will be willing to accept lower wages, and hence a lower reservation wage, in order to keep themselves in work. But higher employment would again lead to higher wages and a higher reservation wage.

This last explanation follows from a standard search model which allows for layoff risk, wage changes once in a job, different wage offers to insiders vs. outsiders, and for random matching and wage bargaining – see Rogerson et al (2005) for a survey. In those models, the equilibrium (natural) rate of unemployment is given by

$$u_N = \lambda / [\lambda + \alpha_w] \tag{3}$$

where $\alpha_w = \alpha_0[1 - F(w_r)]$ describes the probability of receiving an acceptable job offer in the current period, and F(w) represents the probability distribution of wage offers made in that period. Hence $[1 - F(w_r)]$ will be the probability distribution of the arrival of *acceptable* job offers if the probability of an offer declines with increasing wage offers for $w \geq w_r$ (a reasonable assumption). Finally α_0 is the contact rate, reflecting the probability of contact between employers and employees. Hence α_w describes the arrival rate of offers that actually lead to employment. Lastly λ reflects the layoff risk, being the separation rate implied by the probability that a job will be terminated in the current period. Both probability distributions (for contacts and for layoffs) will remain unspecified here, but are usually taken to be independent Poisson distributions; in which case α_0, α_w, and λ become constants that describe the *average* rates of contact, employment or separation per period.[3]

Given this set up, the expected short run movements in the rate of unemployment will be given by the difference between current separations and new hires:

$$\partial u / \partial t = \lambda(1 - u) - \alpha_0[1 - F(w_r)]u \tag{4}$$

[2] This is the argument used by Spector (2004), where reservation wages rise with employment.
[3] We assume the probability distributions governing contacts and wage offers to be independent.

which converges over time to u_N. Alternatively, since $\alpha_w = \alpha_0[1 - F(w_r)]$, we can insert α_w into (4) and interpret $\alpha_w = m(u,v)/u$ as the arrival rate of job matches, where m(u,v) is the usual matching function of this literature and v the vacancy rate.

With these results, it is easy to check that

$$(5) \qquad \frac{\partial u_N}{\partial \alpha_w} = -\frac{\lambda}{(\lambda + \alpha_w)^2} < 0, \quad \text{and that } \frac{\partial \alpha_w}{\partial w_r} = -\alpha_0 \frac{\partial F(w_r)}{\partial w_r} > 0$$

since $\frac{\partial F(w_r)}{\partial w_r} < 0$ follows from the definition of $F(w)$ as a probability density function.

As a result we have: $\frac{\partial u_N}{\partial w_r} = \frac{\partial u_N}{\partial \alpha_w} . \frac{\partial \alpha_w}{\partial w_r} < 0$ and $\frac{\partial(\partial u / \partial t)}{\partial w_r} = -u \frac{\partial \alpha_w}{\partial w_r} < 0$

Consequently a higher reservation wage (degree of social support) will accompany lower unemployment, and vice versa (higher unemployment with lower reservation wages), in both the long and the short run – as claimed.

2.3 Welfare Indicators

Finally P stands for the price aggregator obtained after solving consumer's optimization problem. It is given by:

$$(6) \qquad P = [\frac{1}{m} \sum_{i=1}^{m} P_i^{1-\delta}]^{\frac{1}{1-\delta}}$$

This expression is slightly different from the standard Dixit-Stiglitz aggregator as a consequence of the assumed form of the utility function at (1). Solving the consumer's optimization problem, and using the fact that the problem is symmetric across all consumers, we can obtain an expression for the consumption that would maximise utility for the individual consumer. It is given by

$$(7) \qquad [(1 - t_w)\frac{w_j}{P} - w_r(u)]N_j + w_r(u)$$

This expression is also proportional to the period maximum utility level, and may be used to make welfare comparisons in what follows. All welfare comparisons will be measured in consumption equivalents therefore.

2.4 The Firms' Problem

We assume that each firm produces a differentiated product indexed by *i* using the same production technology which is linear in labour. Output is therefore given by[4]

[4] Alternatively one can think of (8) as a production technology in which capital is fixed and normalized to one. Interestingly, Spector (2004) claims that capital plays a key role in the outcomes of deregulation in the product and labour markets because unions and employers bargain over the rents created by the irreversibility of capital investment, as well as over the rents derived from imperfect competition; and he gives the labour-capital conflict a central position in his analysis. However, in a discussion paper version of this paper (Bokan and Hughes Hallett, 2006), we show that the introduction of capital per se (via a Cobb-Douglas production function) complicates the analysis but does not change any of the results. Hence it makes no difference, for our purposes, if we ignore capital or treat it as fixed.

(8) $$Y_i = N_i$$

Since both individual and aggregate demands are determined by the consumer's optimization problem, the firms' problem consists of determining prices taking costs and demand as given. This allows us to obtain the partial equilibrium demand function for each product market. It is given by:

(9) $$Y_i = \frac{Y}{m}\left(\frac{P_i}{P}\right)^{-\delta}$$

2.5 Wage Bargaining and the Government

Before describing wage bargaining problem, we need to introduce the tax system. We assume first that both workers and producers are obliged to pay certain taxes. Workers need to pay a tax on the wages they earn. In our model, it is assumed that a common average tax rate will be imposed on every working worker's wage. We also assume that unemployment benefits are not taxed.

Next, producers need to pay payroll taxes[5] defined as a certain fixed percentage of the workers gross wage. Both of these taxes are assumed to be flat taxes. Extensions to a progressive tax system are possible, but lead to extremely complicated expressions which effectively deny any insight into the scope for reform. Our flat tax specification meanwhile implies the following government budget constraint, over and above any fixed or lump sum elements in taxation or expenditures:

(10) $$B = (t_w + t_p)w_j - Pw_r(u)[1 - N_j]$$

We treat *B* as being constrained by a ceiling on government debt. That means any increases in expenditures, or reductions in tax rates, must be matched by increases in tax revenues elsewhere in the system. This is just an artificial device which allows us to focus on the cost of financing any reforms. However, deficits do have to be financed by interest payments or tax revenues. So B will always be limited in practice.

Meanwhile each firm bargains with *L/m* workers over wages and employment in that industry, in both the short and the long run. Intuitively, a fraction *L/m* of the workers forms a union. That union then bargains with the firm over wages and the level of employment. Indivisibility of labour implies that workers can either be employed in the firm or be unemployed.

In what follows, we consider a world of Nash bargaining solutions. There are three reasons for this. First, the efficient bargaining concept allows wages to be bargained off the labour demand curve, which implies that an increase in wages could be achieved without an immediate decrease in employment. Second, empirical studies [Dobbelaere, 2004] have rejected *The Right to Manage Model* in favour of an efficient bargaining model as the appropriate explanation of wage bargaining in many European countries. Since the case for structural reform is particularly strong in Europe, it is important to have a model that captures that feature. Third, this assumption ensures incentive compatibility on both sides of the labour market.

[5] Or training costs, firing costs; or any profit or corporate taxes that vary in line with production costs.

Assuming risk neutrality for the unions, the wage bargaining problem can be written:

$$\max_{w_i, N_i} \{\beta \log[(1-t_w)w_i - Pw_r(u)]N_i + (1-\beta)\log[P_i - (1+t_p)w_i]N_i\} \tag{11}$$

where β represents an exogenously determined index of union bargaining power; and where t_w and t_p represent the average tax rates paid by employees and employers respectively ($0 \leq t_w, t_p < 1$). This formulation implies that unions want to maximize the *net* wage surplus from employment, the first term within the brackets, while firms want to maximize their net profit represented by the second term.

Several important consequences of market regulation now follow. On the product market side we have c and $\delta = \bar{\delta} f(m)$. Reductions in the entry cost, *c*, can be thought as the removal of administrative restrictions; or the replacement of some state owned monopolies by market firms. The degree of product substitutability in the markets is broken into two parts. First, a policy component ($\bar{\delta}$) whose increase could represent some market liberalisation measure, or a reduction in some domestic/external trade barrier which has the effect of increasing product substitutability. These are matters which lie under government control. The second element, *f(m),* is an index of market competition which increases with the number of firms. If we change δ by policy, we change $\bar{\delta}$. But *m* may then change. So, in practice we speak of a *net* change to δ.

Finally, in the labour markets, we have β representing bargaining power whose increase can be interpreted as the increase in the degree of the workers' power over wage and employment decisions ranging from rights to strike, employment protection legislation, severance conditions, firing costs, or other collective matters. In addition both types of taxes represent regulatory instruments under direct government control.

3. Solving for equilibrium outcomes

In order to proceed, we solve the model in three steps. First we solve for short run partial equilibrium values for relative prices and real wages. These will be used to obtain the short run general equilibrium prices and wages. After obtaining those values, we can solve for the corresponding long run equilibrium values.

3.1 Short run partial equilibrium relationships

Equilibrium demand for each product, and hence employment, will be determined by (9). Since workers and firms bargain over both wages and employment, and since employment is already determined as a function of output, our bargaining problem can be resolved by substituting (9) into (11) and then allowing workers and firms to bargain over wages and prices. The solution to that problem is given by:

$$\frac{P_i}{P} = \frac{\delta(1+t_p)w_r(u)}{(\delta-1)(1-t_w)} \tag{12}$$

which follows from the first order conditions for relative prices and real wages:

(13) $$\frac{\mathrm{P_i}}{\mathrm{P}} = \left(\frac{\delta + \beta - 1}{\delta(1+\mathrm{t_p})}\right)\frac{\mathrm{w_i}}{\mathrm{P}} \qquad \text{and}$$

(14) $$\frac{w_i}{P} = \left(\frac{\beta}{1+t_p}\right)\frac{P_i}{P} + \left(\frac{1-\beta}{1-t_w}\right)w_r(u)$$

Using the expressions above, we can solve for short run partial equilibrium real wages and relative prices as functions of the regulatory parameters in the model. In fact:

(15) $$\frac{P_i}{P} = [1+\mu]w_r(u) \qquad \text{and}$$

(16) $$\frac{w_i}{P} = \left[\frac{1+\beta\mu(1-t_w)-\beta(t_w+t_p)+t_p}{(1+t_p)(1-t_w)}\right]w_r(u)$$

where μ represents a relative price mark-up in a broad sense, defined as

(17) $$\mu = \frac{\delta(t_w+t_p)}{(\delta-1)(1-t_w)} + \frac{1}{\delta-1}.$$

It is easy to see that this mark-up is an increasing function of both taxes on wages paid by employees, and the payroll tax paid by employers. That is,

(18) $$\frac{\partial\mu}{\partial t_p} = \frac{\delta}{(\delta-1)(1-t_w)} > 0 \qquad \frac{\partial\mu}{\partial t_w} = \frac{\delta(1+t_p)}{(\delta-1)(1-t_w)^2} > 0 \qquad \text{and} \quad \frac{\partial\mu}{\partial \mathrm{t_w}} > \frac{\partial\mu}{\partial \mathrm{t_p}} > 1$$

when $\delta > 1$. This result is to be expected since, in the case of increases in payroll taxes, it is optimal for producers to bargain for higher prices; whereas in the case of an increase in the taxes paid by employees, the latter will demand higher wages. However, the latter would lead producers to require an even higher mark-up in order to prevent profits from changing too much – their ability to do so being limited only by the degree of inter-product substitutability.

These results also show that μ represents a mark-up in *relative* prices, reflecting the combined rents to the firm and the derived rents to the work force. Hence μ could be negative if relative prices fell below average for good *i*. However $\mu > (t_w+t_p)/(1-t_w)$ holds for all $\delta \geq 1$; and μ is a decreasing function of δ which reaches its minimum value at $\theta = (t_w+t_p)/(1-t_w)$ when $\delta \to \infty$; a minimum which increases with $\mathrm{t_p}$ and $\mathrm{t_w}$. Hence we can think of $\mu - (\mathrm{t_w}+\mathrm{t_p})/(1-\mathrm{t_w})$ as the degree of market distortion due to imperfect competition; and $(t_w+t_p)/(1-t_w)$ as the degree of distortion due to the tax regime. There will always be some distortions therefore, even under perfect competition, so long as there are taxes. Moreover, by (12), $\delta \geq 1$ is required since otherwise prices will turn negative.

3.2 Short run general equilibrium

Since in a symmetric equilibrium all producers need to charge the same price, and since not all of them can have relative prices larger than one in a general equilibrium, all relative prices must be equal to one in the general equilibrium setting. Substituting that into (15) provides us with the following condition for the reservation wage:

$$w_r(u) = \frac{1}{1+\mu} \tag{19}$$

Taking tax rates as temporarily fixed, this expression implicitly determines the short run unemployment rate which is a consequence of the assumed fixed short run coefficient of the elasticity of substitution. Substituting (19) into (16) we obtain an expression for the short run general equilibrium real wage in terms of μ:

$$\frac{w_i}{P} = \frac{1+\beta\mu(1-t_w)-\beta(t_w+t_p)+t_p}{(1+t_p)(1-t_w)(1+\mu)} \tag{20}$$

3.3 Comparative Statics in the Short Run

Proposition 1: *Short run real wages are an increasing function of labour's bargaining power if and only if the mark-up, broadly defined, is greater than the share of the total tax burden on the per unit net wage received by employees: or, equivalently, if the following condition (market distortions exist) is satisfied:*

$$\mu > \frac{t_w + t_p}{1-t_w} \tag{21}$$

Proof: The first derivative of short run equilibrium real wage is positive if (21) holds, since then $\frac{\partial \frac{w_i}{P}}{\partial \beta} = \frac{\mu(1-t_w)-t_p-t_w}{(1-t_w)(1+t_p)(1+\mu)} > 0$ holds, given that $\delta \geq 1$ implies $\mu \geq 0$. ■

Notice that, whatever the tax system, (21) will hold as long as $\delta < \infty$. But if $\delta \to \infty$ and product market competition increases, then (21) will become an equality and labour's bargaining power will have no impact on real wages. This conclusion is new and shows that the composition of the mark-up matters; and it conflicts with Spector's (2004) analysis which finds the effects of increasing competition to be ambiguous for reasons discussed in section 3.5 below.

Next we consider the consequences of a change in the two types of taxes on wages.
Proposition 2: *The short run equilibrium real wage is always a strictly decreasing function of payroll taxes, whereas it is unaffected by changes in wage taxes.*

Proof: Substitute the broad mark-up, (17), into the solution for short run equilibrium real wages, and take first order derivatives with respect to t_p and t_w. ■

The intuition behind this conclusion comes from the effect of tax changes on the mark-up. Evidently the mark-up is *less* responsive to changes in the payroll tax than it

is to changes in taxes paid on wages (see (18); t_w<1). Thus, in the case of an increase in payroll taxes, real wages must fall because firms can always increase their mark-up by more than enough to compensate for the increase in the payroll tax: see again (18). The burden is therefore partly transferred to the workers. But if there is an increase in wage taxes, workers will demand higher wages. Nevertheless, firms are able to compensate for this increase by raising their mark-up by more than they could have done in the payroll tax case. That results in an increase in the general price level such that real wages remain unaffected.

Proposition 3: *The short run equilibrium reservation wage is always a strictly decreasing function of both types of taxes.*

Proof: (18) and (19) together imply the result. ■

This result is also intuitive since the equilibrium reservation wage is inversely related to the mark-up, and the mark-up is increasing in both types of taxes. Proposition 3 therefore implies that the equilibrium unemployment rate will increase with increases in both types of taxes, in contrast to the competition effect which causes unemployment to fall (Spector, 2004). But the size of the effect on reservation wages, and hence on the unemployment rate, will differ depending on which tax rate has been changed since (18) implies $\partial\mu / \partial t_w > \partial\mu / \partial t_p$ in (19).

3.4 The Long Run: Entry and Exit

In the long run, firms can restructure or enter new markets. We assume that firms need to pay a fixed entry cost which is a fraction of the price per unit of output. This means that firms will enter the market so long as rents cover those entry costs.

Since firms get a share $(1-\beta)$ of the total rents from which taxes need to be paid, we can define the share of *net* rents available to cover per unit entry costs as follows:[6]

$$(1-\beta)[1-(1+t_p)w_r(u)] \tag{22}$$

Substituting (19) for $w_r(u)$, we can now express the maximum acceptable entry cost as a function of the mark-up, bargaining power and taxes. It is given by

$$c = (1-\beta)\left(\frac{\mu - t_p}{1+\mu}\right) \tag{23}$$

However the mark-up itself is no longer exogenous since the elasticity of substitution coefficient will change because the number of firms, and hence the number and varieties of goods, changes when firms enter and exit the market. In fact, the number

[6] This expression defines the net rents going to firms from *all* sources: from price setting, wage setting and tax distortions, over and above what would happen with perfect competition in all markets and no distortions. In the latter case, real wages would equal $w_r(u)$ as can be seen from (27) and (28) below. Hence (22) represents net rents per unit, in excess of "normal profits", and the scale factor (Y) plays no role once excess profits per unit of output are determined since the production function is monotonic.

of firms and the degree of substitution between goods will adjust through entry and exit until the rents, (22), are fully consumed by the entry costs (23). In other words the number of firms, and thereby the degree of competition, must be such as to totally dissipate any excess profits/rents over entry cost. Recall that we require $\delta \geq 1$. Hence:

Proposition 4: *The number of firms, goods and employment will eventually rise if tax rates of either type are increased; or if market regulations lower the degree of substitutability (the degree of competition) between goods and producers.*

Proof: The first derivative of the maximum acceptable entry cost is positive:

$$\frac{\partial c}{\partial \mu} = (1-\beta)\frac{(1+t_p)}{(1+\mu)^2} \tag{24}$$

Combining (24) with (18), or with $\partial\mu/\partial\delta < 0$ from (17), gives the result. ■

Non-monotonicity: It is important to see what is going on here. Increasing tax rates of either type increases the mark-up that firms can impose, and hence the costs (and rents) they are prepared to pay in order to enter the market. Moreover, that mark-up will have increased by *more* than the original increase in tax rates: that follows from (18). Hence, the number of firms and degree of competition has to fall in the short term, although profits and rents will rise as (24) implies. But if rents have risen, then new firms will enter the market and, in the longer term, the number of firms, goods and employment will rise again. In other words, there is a non-monotonic response. First output and the number of firms fall; but in the longer run they will both rise, and by more than they fell in the short term.

Corollary 2: *More firms (goods, employment) enter the market in the long term than leave in the short term*.

Proof: The changes in the short term mark-ups, μ_j, are given by (18); and the subsequent (long term) adjustments by the partial derivatives from (24), (26) below, and (17), once the new degree of substitutability has been established. Putting these together, the total change is

$$d\mu = \left[1 + \frac{\partial\mu}{\partial\delta}.\frac{\partial\delta}{\partial c}.\frac{\partial c}{\partial\mu}\right]\mu_j dj \qquad \text{for } j = t_w, t_p, \delta \tag{25}$$

where the second term on the right represents long run changes. But, using (24), (26) and (17), the square bracket is negative if $-2t_w t_p < 0$. That always holds, irrespective of δ, so long as both taxes are present. Given (18), that result confirms proposition 4.■

Corollary 3: *In the long run, a policy of reducing wage taxes will be more effective than reducing payroll taxes for increasing the number of firms, goods or employment. However, a policy of market liberalisation that raises the level of competition between producers will be more effective than either at low levels of competition (defined by* $\delta(\delta-1) < 1 - t_w$*); but less effective if competition or taxation are already high.*

Proof: Competition, and the number of goods and firms all increase if the allowable level of entry costs increases. By (24), that requires the mark-up μ to rise. The result

now follows by comparing the partial derivatives in (18) with each other, and with $\partial\mu/\partial\delta$ <0 from (17). Note that (24) implies that the number of firms increases with the entry costs they are prepared to pay in order to enter a new market, and with the ease with which their goods can be substituted for others (δ). And employment increases because $\partial w_r(u)/\partial c$ <0 follows from (27) below. ■

Finally, by substituting (14) into (20) and rearranging, we can solve for the long run elasticity of substitution as a function of the regulatory parameters. That solution is:

$$\delta = \frac{(1-\beta)(1-t_w)}{c-(1-\beta)t_w} \tag{26}$$

Using (23) and (14) in (16) and (17), we can now solve for the long run reservation wage and the long run real wage. Their equilibrium values are given by:

$$w_r(u) = \frac{1-c-\beta}{(1-\beta)(1+t_p)} \text{ and} \tag{27}$$

$$\frac{w_i}{P} = \frac{1-c-\beta t_w}{(1+t_p)(1-t_w)} \tag{28}$$

The introduction of taxation in this model has therefore increased the complexity of the solution, but it is straightforward to see the effects of the regulatory parameters on the equilibrium reservation wage, real wages and employment.

3.5 Comparative Statics in the Long Run

Proposition 5: *Long run equilibrium reservation wage (unemployment rate) is always a decreasing (increasing) function of labour's bargaining power.*

Proof: The first derivative of $w_r(u)$ with respect to labour's bargaining power is always negative:

$$-\frac{c}{(1-\beta)(1+t_p)} < 0. \ \blacksquare \tag{29}$$

Proposition 6: *Long run equilibrium real wage are always a decreasing function of bargaining power.*

Proof: Taking first order derivatives in (28), we obtain $-t_w/[(1+t_p)(1-t_w)]$ which is also negative. ■

To explain propositions 5 and 6, consider a permanent increase in labour's bargaining power. In the short run, this leads to a rise in real wages since the share of the profits (rents) going to the workers will have increased. But that means the profits available to firms will be reduced and it will be harder to satisfy the requirement imposed by the entry condition – the more so, the greater is β. Therefore the number of the firms present in the market will decrease. A decrease in the number of firms implies a decrease in the elasticity of substitution faced by the remaining firms. That means that firms will charge higher prices. Workers will demand higher wages to compensate.

But, because firms have market power [and because taxation increases the mark-up that this implies; *and* because the tax wedge increases the nominal wage claim workers have to make in order to preserve their take home pay], these wage increases will be passed on in price increases. That leads to reduction in the real wage finally received by the workers. If taxation were to go to zero, this effect would vanish as (28) would be independent of β. It would also vanish even if markets were to become fully competitive since $\delta \to \infty$ implies $c \approx (1-\beta)\, t_w$ in (26), which makes w_i / P independent of β in (28). Hence, either distortionary taxes or imperfect competition, or both, is responsible for the decreasing value of bargaining power.

Finally we consider the effects of a change in the taxes on reservation and real wages.

Proposition 7: *The long run reservation wage is not affected by changes in the taxes paid by employees, but is a decreasing function of the taxes paid by employers. By contrast, the long run equilibrium wage is an increasing function of the taxes paid by employees and a decreasing function of the taxes paid by employers.*

Proof: The first derivative of $w_r(u)$ with respect to t_w is zero, and with respect to t_p is

$$-\frac{1-c-\beta}{(1-\beta)(1+t_p)^2} \tag{30}$$

which is negative so long as $c+\beta<1$. Similarly the first derivative of the long run real wage with respect to t_w is

$$\frac{1-c-\beta}{(1+t_p)(1-t_w)^2} \tag{31}$$

whereas the first derivative with respect to t_p is given by

$$-\frac{1-c-\beta t_w}{(1+t_p)^2(1-t_w)} \tag{32}$$

.

Of these two expressions, the first is always positive and the second always negative so long as $c+\beta<1$. However, it is easy to check that $c+\beta<1$ always holds if $\delta \geq 1$ (implying $\mu \geq 0$) since $t_p \geq 0$.[7] ■

3.6 Business Tax Reform: An Example

A much discussed area of economic reform is to reduce fiscal distortions. Consider a scenario in which government plans to reduce the taxes faced by employers. Let us also assume that the government is either required to keep the budget balanced, or needs to keep the deficit within some strict upper bound such as demanded by the

[7] From proposition 7, and its short run counterpart (propositions 2 and 3), we can now see that the ambiguous effect of increasing competition on wages noted by Spector [2004] is in fact a temporal effect; not a capital-labour conflict since capital is not needed to obtain the result. In the short run wages fall due to myopia in the wage bargains struck by workers. In the long run wages rise because competition in the product markets reduces mark-ups and therefore increases consumption and employment.

Stability and Growth Pact. Wage taxes would have to rise to compensate. What are the short and long run effects of this policy?

According to Proposition 2, the short run increase in the wage taxes needed to keep the budget in balance will not affect real wages, whereas the planned reduction in payroll taxes would lead to an increase in the real wage through its favourable (lower) effect on the mark-up. But the extra taxes paid by employees have the opposite effect, increasing the mark-up while the lower payroll taxes reduce it. This combination of tax changes would therefore lead to a short run decrease in employment since the negative wage tax effect will be larger than the positive payroll tax effect on $w_r(u)$ [corollary 1]. Thus the short term impact of this type of policy would be to increase unemployment. It might have been better to have just reduced wage taxes; or to have removed the short term requirement to keep the budget balanced. In either case, these are disincentives which may block this kind of structural reform programme. It entails a short run loss in economic performance, political loss of face, and a counter-productive outcome if budget balance is enforced – although abandoning fiscal restraint might have risked destabilising the budget.

But in the long term, the sequence of events is quite different. Indeed, the direction of impact is reversed. By proposition 7, the *net* long run effect of an increase in the wage taxes needed to compensate for our reduction in payroll taxes, would lead to a reinforcing increase in long run real wages; and to a decrease in the unemployment rate (since the reservation wage, which also increases, is negatively related to un-employment). This outcome follows because a rise in wage taxes will not affect the reservation wage (proposition 7). But the compensating fall in payroll taxes will in-crease the reservation wage, reflecting a fall in unemployment, even if t_w has had no effect.

The final outcome of this example is therefore summarised in table 1. It reflects the non-monotonic property highlighted above, which arises here because the increase in wage taxes has had a larger effect in increasing the mark-up, and hence real wages and the reservation wage, than the decrease in payroll taxes has had in decreasing it.

Table 1: The Short and Long Term Implications of Lowering Business Taxes

a) In the short run (by propositions 2 and 3)

$$\frac{\partial w_i / P}{\partial t_w} = 0, \quad \frac{\partial w_i / P}{\partial t_p} < 0 \quad \text{and} \quad \frac{\partial w_r(u)}{\partial t_w} < 0, \quad \frac{\partial w_r(u)}{\partial t_p} < 0$$

So $t_p \downarrow$ implies $w_i / P \uparrow$, but also $w_r(u) \uparrow$ so $u \downarrow$. But $t_w \uparrow$ implies no changes in w_i / P, while $w_r(u) \downarrow$ so $u \uparrow$. And of the two, t_w has the stronger effect. Hence u rises overall.

b) In the long run (by proposition 7)

$$\frac{\partial w_i / P}{\partial t_w} > 0, \quad \frac{\partial w_i / P}{\partial t_p} < 0 \quad \text{and} \quad \frac{\partial w_r(u)}{\partial t_w} = 0, \quad \frac{\partial w_r(u)}{\partial t_p} < 0$$

So $t_p \downarrow$ implies $w_i / P \uparrow$, and $w_r(u) \uparrow$ so $u \downarrow$ as before. But $t_w \uparrow$ now implies $w_i / P \uparrow$ and no change in $w_r(u)$, which leaves u unchanged. And, as before, t_w has the stronger effect. So this time, u falls overall. ■

In other words, there is a demand side effect despite the neutral budget changes; and the distribution of the burden of taxation matters a great deal.

This example demonstrates a widely accepted premise that structural reforms (an easing of business taxes in this case) would be beneficial in the long run; but would induce short run costs, both in terms of economic performance (indicated here by the increase in the short run unemployment rate) and in its political implications. This short run-long run conflict has been made much sharper by the presence of the budget restraint, and that in itself might be enough to block the reform efforts altogether. But the long term effects are entirely positive, as indicated by the falling unemployment. The question therefore is whether the discounted long run benefits will outweigh the short run costs. To make that determination, we need a model with explicit dynamics. That is a topic for further research; at this point we have only a comparative statics answer to that question.

4. Unemployment, the Natural Rate and the Phillips Curve

We now combine these results with the unemployment model in section 2.2, to show how structural reforms will affect unemployment – both in the short and long term.

In the short term: Proposition 1 does not extend to reservation wages or unemployment since μ is invariant to β in the short term: $\partial w_r / \partial \beta = 0$ in (19). But w_r and u do change with both tax rates, so those are the reforms that will affect unemployment in the short run. In fact, proposition 3 implies that short term unemployment will rise with both kinds of taxes, but more so with wage taxes than business taxes. These are the reforms which could be used to improve the short run Phillips curve trade-ff.

In the long term: The short term results show that w_r changes with δ when the latter starts to change with the entry of new firms. So taxes, competition policy and labour market deregulation will all affect unemployment in the long run. Proposition 7 shows that u_N is unaffected by wage taxes t_w, but increases with business taxes t_p; and Proposition 5 shows that u_N will also increase with union bargaining power β. These are the structural reforms that influence the natural rate of unemployment, in effect by shifting the long run Phillips curve left to a lower u_N position.

Product market liberalisation: For a full set of results we also need to note that:

$$\frac{\partial \mu}{\partial \delta} = \frac{-(1+t_p)}{(\delta-1)^2(1-t_w)} < 0 \text{ from (17); and } \frac{\partial w_r}{\partial \delta} = \frac{1}{\delta^2(1+t_p)} > 0 \text{ using (27), (24), (17).}$$

Thus, to summarise, unemployment will fall in the short run if either tax rate (t_p or t_w) is reduced; but it will fall further per unit reduction with wage taxes. It also falls if competition policy, $\bar{\delta}$, is applied more vigorously (recall that the government cannot affect the *f(m)* component of δ in the short run). In the longer run, unemployment will fall with deregulation in the labour markets, β; with business taxes t_p, but not wage taxes; and with increasing values of $\bar{\delta}$ -- that is with market liberalisation.

Institutional reform: We can extend our results to include the impact of institutional reforms on the natural rate of unemployment. From section 2.2, an increase in hiring costs would imply a fall in α_w since F(w) would decline. Higher firing costs, on the other hand, would be reflected in a fall in both α_0 and λ. And an increase in union density, an increase in insiders vs. outsiders, would mean a lower contact probability between employers and the unemployed and hence a lower value of α_0. Lastly, we can incorporate increases in unemployment benefits or the minimum wage as an exogenous increase in the reservation wage, w_r. Although not the subject of this paper, each of these changes in institutional arrangements can easily be included in our list of potential structural reforms and their effects on unemployment inferred from (5) for changes in α_w (for hiring costs); or from

$$(33) \qquad \frac{\partial u_N}{\partial \alpha_0} = \frac{-\lambda[1-F(w_r)]}{(\lambda+\alpha_w)^2} < 0 \quad \text{and} \quad \frac{\partial u_N}{\partial \lambda} = \frac{\alpha_w}{(\lambda+\alpha_w)^2} > 0$$

or $du_N = [\alpha/(\lambda+\alpha_w)^2](d\lambda - \lambda d\alpha_0)$, positive if $d\lambda/\lambda > d\alpha_0$ but negative otherwise, for all the others.

Sensitivity results: From (30) we can infer that u_N will improve via lower business taxes by more in those countries where t_p is low, c is low or δ large; i.e. in countries that already have low business taxes, low entry costs and competitive product markets. So it is the deregulated economies which have most to lose from a lack of reform; and who would have most to gain, at least in employment, from business tax reforms. Trade union bargaining power of plays no role in that comparison. Similarly, starting from (29), deregulating the labour market will reduce u_N by more in those countries where there is strong wage bargaining power but competitive markets: entry costs do not play a role in this comparison. Lastly, liberalising the product markets will have a greater effect in reducing u_N in those economies where competition or taxes of either kind are low.

Phillips curve trade-offs: One disadvantage of working with a standard model of structural reform, even if extended to determine the short term and natural rates of unemployment, is that there is no nominal sector to explain the level and evolution of prices as a result of monetary policy or external influences. This would be an important extension, and we are working on it. But we can still use the Phillips curves implicit in the model to demonstrate the potential impact of different structural reforms on the Phillips curve trade-off, or *sacrifice ratio* defined in terms of real wages vs. unemployment, as we did at the start of this section. Thus:

a) equations (19) and (20) show how structural reforms will change the implicit short run Phillips curve trade-off by looking at how real wages, and hence consumption and utility levels, can be increased – while keeping unemployment fixed – by increasing wage bargaining power or decreasing business taxes (but not wage taxes). These are outcomes that would have to come from an improvement in the short run Phillips curve. But it comes at a cost since to get the same effect in the long run requires wage bargaining power to be reduced. In fact, the effect on the long run trade-off will be more favourable because a rise in long run real wages/consumption/utility of a given size will now be accompanied by a *fall* in the natural rate of unemployment. Likewise,

reducing business taxes will increase real wages and welfare in the long run as well as short run (as will higher wage taxes in the long run – which is to mimic the Scandinavian flexicurity approach of the past few years). This is to judge changes to the Phillips curve by its real wage and welfare outcomes, and shows that it could well be counter-productive to tinker with reforms that change the short run trade-off.

b) alternatively we can ask what structural reforms would reduce unemployment for a given level of inflation, assuming constant or unchanged monetary policies. This is to judge changes to the Phillips curve by potential outcomes along the unemployment axis. Reforms that would improve the Phillips curve in this way were given earlier: reducing business or wage taxes, or strengthening competition policy in the short run; but to deregulate labour markets, reduce business taxes or to liberalise the product markets in the long term.

5. Which Reforms will be most effective?

a) **From a welfare perspective**. It is natural to ask which reform strategy would be the most effective in terms of increasing the number of products and employment in an economy. That means being effective in getting the mark-up or acceptable cost of entry to fall as taxes, or labour and product market regulation falls. But if a measure is effective in that sense, then it will raise real wages and the reservation wage at the same time: by (27) and (28). That implies an increase in welfare and a decrease in unemployment. Hence one way to determine which reforms are most effective is to determine which instrument has the largest impact on real wages and welfare.

From corollary 3, we already know that a reform of wage taxes, t_w, will be the more effective of the two tax instruments. We also know that deregulation of the product markets will be better than tax reform if $\delta(\delta-1) < 1-t_w$; from which we can calculate the maximum value of δ, δ_{max}, such that market liberalisation would be the preferred option, given the tax rate on wages. Following a similar approach, we can compare the size of the partial derivatives of w_i/P with respect to β, δ and t_w and determine thresholds for the most efficient instrument. After some algebra, this yields:

Corollary 4: *a) Product market liberalisation is more effective (welfare enhancing) as a reform programme than deregulating the labour market if*

(34) $$\delta < 1+\sqrt{(1-\beta)(1-t_w)-t_w} \le 2,$$

or if ***δ > 1+1/θ*** *where θ is the measure of tax distortion defined in section 3.*
b) Labour market deregulation is more effective than tax reform if

(35) $$t_w < (1-\beta)(\delta-1)/\delta$$

Proof: Compare $\partial(w_i/P)/\partial\delta$, $\partial(w_i/P)/\partial\beta$ and $\partial(w_i/P)/\partial t_w$ in absolute size.■

Corollaries 3 and 4 therefore provide a set of simple sufficient conditions to assess the relative efficiency of each type of reform programme, each condition being expressed

as the maximum δ value that can hold if the given instrument is to be more effective.

Thus, for the existing OECD and EU members discussed in Table 3, we find:

i) Product market liberalisation is more effective than tax reform if $\delta \leq 1.5$.
ii) Product market liberalisation is more effective than labour market deregulation if $\delta \leq 2$ (if $\beta \approx 0$), or if $\delta \leq 1.5$ (if $\beta \approx 0.25$).
iii) Tax reform is better than labour market deregulation unless $\delta \leq 1.3$ ($\beta \approx 0$); or unless $\delta \leq 1.5$ (when $\beta \approx 0.25$), and for δ values above 4 or 5 if $\beta = 0.5$.

Hence tax reform is almost always the more effective reform instrument for the range of parameter values that are likely to hold in the OECD economies. An exception would be in an economy with severe labour market distortions ($\beta \geq 0.5$). In that case, labour market deregulation is likely to be a more effective instrument.

b) From the employment perspective: The corresponding results for which reform strategy is most effective in reducing unemployment are rather different. Because the structural and institutional reforms that affect employment take some time, we will only consider the long run consequences of the different measures on u_N. We also consider only the case in which the relationship between w_r and *u* is not changed: so the source of reform does not alter the relationship between reservation wages and the rate of unemployment. That may not always be true, but the results easily generalise.

From Proposition 7, business taxes t_p are clearly a more effective reform instrument than wage taxes t_w as far as employment generation is concerned. Given that, we have:

Corollary 5: *a) Business tax reform is **less** effective as an instrument for generating employment than product market liberalisation if*

$$\delta < \left\{1 + \sqrt{1 + 4\psi}\right\}/2 \quad \text{where} \quad \psi = (1 + t_p)/(1 - t_w)^2 \tag{36}$$

*b) but **more** important for generating employment than labour market deregulation if*

$$\delta < (2 + t_p)/(1 + t_p) \tag{37}$$

c) Liberalising product markets is more effective than deregulating labour markets if

$$\delta < (1 - \beta)\sqrt{(1 - t_w)/c} \tag{38}$$

Proof: Compare $\partial w_r / \partial t_p, \partial w_r / \partial \delta$ and $\partial w_r / \partial \beta$ in absolute size, using the results of sections 3.4, 3.5 and 2.2 with the parameters in (5) fixed. Note that (36) and (37) are sufficient conditions. ■

Unlike for the welfare comparisons, there is a clear ranking of effectiveness here if δ is small**.** In the long run, unemployment is best reduced (and employment generated) by product market liberalisation; then by reducing business taxes; and then by deregulating the labour markets. This will be the case for economies with many imperfectly competitive markets. Reducing wages taxes would have no effect, either positive or negative, except as a short term measure. But in economies with more competitive markets, the ranking will be reversed: deregulating the labour markets will be most

effective, then reforming business taxes, then product market liberalisation.

Evidently the inequalities in (36), (37) and (38) are crucial for determining which ranking applies in practice. It seems likely that the second ranking will apply to most developed economies since, even with tax rates as high as $t_w = 0.5$ and $t_p = 0.5$, and entry costs as low as c = 0.1, the upper bounds on δ remain below 2 or 3. And that is broadly what the data in our sample of OECD and EU economies shows (table 4).

Thus, in core Europe and in contrast to the welfare comparisons, the effective reforms will lie in deregulating the labour markets; then reducing business taxes; and then in market liberalisation. Could Mrs Thatcher have been right after all?

6. A Starter Empirical Analysis

To evaluate the practical significance of our results, we have used the OECD's *Tax Data Base* and unemployment figures from the OECD's *Main Economic Indicators.* The former supplies t_w and t_p defined as "all in" average tax rates on manufacturing wages and corporate incomes, inclusive of social security contributions; the latter, unemployment rates on a standard definition.[8] For the remaining parameters, we set β (the wage bargaining parameter) at 0.25, being the mid-range estimate from the Layard, Nickell and Jackman (1991) study, and then consider β = 0 and β = 0.5 (decentralised and centralised bargaining respectively) as alternatives. Finally, and perhaps controversially, we set δ at 3.5 for the short run substitutability between products[9], and δ = 10 for the long run. These figures are based on the few within-period product substitutability studies in the literature and may be compared to δ = ∞ for perfectly competitive markets.[10] All data are for 2005.
As a benchmark, Table 2 records the tax and price distortions, as they stood in 2005, for the 24 OECD economies and the EU as a whole. There is considerable variation, but three features stand out.

First, all of Europe suffers greater tax and price distortions than the US. Ireland is an exception. But outside Europe, only Canada does. Similarly, core Europe (Belgium, France, Italy, Germany, and Sweden in this instance) are noticeably more distorted than the EU as a whole; and the Netherlands, Czech Republic, Hungary, Poland and Finland come close. In most cases European tax distortions and price distortions are equally serious. But in the Netherlands, Poland, Finland and Denmark, it is the price distortions which are more serious (implied by the high values of c, reflecting above average mark-ups), while tax distortions are more serious in France and Italy. There is therefore a small vs. large economy distinction in terms of competitive markets.

---

[8] The OECD figures agree with Eurostat's ESA95 data, except that the latter does not separate employer from employee social security contributions. As a result, we don't have consistent data for the smaller states of the EU (Estonia, Cyprus, Latvia, Lithuania, Malta, and Slovenia) who are not yet members of the OECD. Splitting those contributions 50-50 between employers and employees gives us rough estimates of the figures in tables 2 to 4 for those countries. Their figures are available on request.
[9] We impose δ=3.5 to give a 20% mark-up on average, following Rotemberg and Woodford (1992).
[10] Ogaki and Reinhart (1998a,b) suggest 2.9-3.9 for the US, while developing countries have lower figures which again suggests 2.9-3.9 would be about right for the OECD economies. Ravn et al (2004) prefer 2.0; Papadaki et al (2004) 3.0-5.0; and Gali et al (2003) calculate mark-ups which imply δ = 3.3 for the EU. Long run figures correspond to the midpoint US estimates in Duca and VanHoose (2000).

Second, countries can be grouped by the strength of their overall market distortions:

(i) Core Europe: Belgium, Germany, France, Italy Sweden and the EU-25 ($\mu > 1.5$).
(ii)The Hapsburgs: Czech Republic, Hungary, Poland, Slovakia, Finland, Netherlands ($1.5 > \mu > 1.4$)[11].
(iii) Periphery Europe: Austria, Denmark, Greece, Spain, Norway ($1.4 > \mu > 1.1$)
(iv) The Anglo-Saxons: the US, UK, Portugal, Switzerland, Canada, and Australia with $1.1 > \mu > 0.95$; and
(v) Recovery economies: Japan, Ireland ($\mu < 0.95$). The small transition economies (not shown here) also fit into this group.

This grouping, while arbitrary, remains unchanged for different values of δ and β.

Third, tax distortions are larger than price distortions in Belgium, the Czech Republic, Denmark, Germany, France, Italy, Netherlands Sweden, Austria, Finland, Poland, Hungary and Slovakia. But price distortions are more important in Spain, Greece, Ireland, Portugal, the UK and the non-EU economies. That may reflect the size of the domestic markets; but more likely a generally lower incidence of taxation.

Tables 3 and 4 then give the upper bounds on δ, or the degree of competition in the markets, to show which different reform measures would be the most effective for generating either welfare improvements or new employment opportunities. Table 3, as noted, makes it clear that tax reform is almost always the most effective instrument unless the labour market in very distorted. Table 4 meanwhile, implies that market liberalisation will be the most effective for generating new employment, followed by business tax reforms, and then labour market regulation – except in the case of core Europe (which, in this case, comprises France, Germany, Belgium, Netherlands, Italy, Austria, Finland, Denmark, Sweden, Czech Republic and Poland) where labour market reform may be more important than lowering business taxes.

7. Conclusions

We have taken a standard model of the labour market in an economy with imperfect competition in the product and labour markets and extended it to allow for the endogenous entry of firms, the implications for unemployment, distortionary taxation (to show the composition of the price mark-up), and for different parameters that affect the separation and hiring rates. Prices are set by the interaction of supply and demand, while wages are determined by bargaining. Both labour and firms derive rents from their market positions; and, in the long run, firms are free to enter or exit these markets.

From the general equilibrium outcomes of this model, we find:

a) There is a difference between the short run and long run consequences of reform. The short run involves significant costs or losses in unemployment and welfare, but the long run effects are almost uniformly favourable. Structural reform programmes are therefore likely to be avoided, or abandoned if undertaken, if policy makers

[11] With surprisingly little violence to history: the Netherlands was under Hapsburg rule for a limited time, Poland only partly, but Finland never was. Note that Austria is *approximately* a Hapsburg here.

become sensitive to their short run costs.

b) Fiscal restraints, such as those imposed by Europe's Stability and Growth Pact, exaggerate this effect and make it less likely that such reforms will be carried out.

c) The choice of reform instrument matters. Reducing wage taxes has a bigger impact on welfare than reducing payroll taxes, but the reverse holds for employment.

d) Reforms intended to reduce unemployment are very different from those designed to improve welfare. Pro-competitive market liberalisation is likely to be more effective than tax reform if the goal is employment generation; but the opposite is true if the goal is to improve the general level of welfare. Deregulating the labour market is only effective where wage bargaining distortions are very large ($\beta \geq 0.5$).

e) Institutional reforms that underlie the parameters λ, α_0 or α_w can also be effective for generating employment (ranked by whether $\lambda > \alpha_0$ or not). But these reforms have little effect on the general level of welfare as measured by consumption units.

f) Business and wage taxes do not have the same effects on wages, output or employment as is conventionally assumed in the public finance literature.[12]

g) Excessive union power ($\beta \rightarrow 1$) will mean no reforms are possible since the long term gains vanish ($c \rightarrow 0$) and we are left with the case where short run costs dominate. The next steps in this research will be to model the dynamics of the reform process explicitly, to give an idea when the short run costs are likely to appear to outweigh the (discounted) long run benefits, and whether fast or slow reform programmes would prove to be more effective.

References:

Bayoumi T, D Laxton, and P Pesenti (2004) "Benefits and Spillovers of Greater Competition in Europe: A Macroeconomic Assessment" Staff Report 182, Federal Reserve Bank of New York.

Blanchard O and F Giavazzi (2003), "Macroeconomic Effects of Regulation and Deregulation in Goods and Labour Markets", *Quarterly Journal of Economics*, 118, 897-907

Blanchard O, and J Wolfers (2000) "The Role of Shocks and Institutions in the Rise of European Unemployment: the Aggregate Evidence" *Economic Journal,* 110, C1-33

Bokan N and A Hughes Hallett (2006), "Labour and Product Market Reforms in an Economy with Distortionary Taxation", Discussion Paper 5431, Centre for Economic Policy Research, London.

[12]This result conflicts with Prescott (2004), who claims that payroll taxes are the prime cause of poor performance and unemployment. This is true only if business taxes are the only candidates for reform.

Bruno M (1986), "Aggregate Supply and Demand Factors in OECD Unemployment: an Update", *Economica*, 53, 35-52. Further Information in IDEAS/RePEc

Coenen G, P McAdam and R Straub (2006), "Tax Reform and Labour Market Performance in the Euro Area: A Simulation based Analysis Using the New Area Wide Model", *Journal of Economic Dynamics and Control* (forthcoming).
Further Information in IDEAS/RePEc

Dellas H and G Tavlas (2005) "Wage Rigidities and Monetary Union", *Economic Journal*, 115, 907-27. Further Information in IDEAS/RePEc

Dobbelaere S (2004), "Estimation of Cost-Price Margins and Union Bargaining Power for Belgian Manufacturing", *International Journal of Industrial Organisation*, 22, 1381-98. Further Information in IDEAS/RePEc

Duca J V and D VanHoose (2000), "Has Greater Competition Restrained US Inflation?" *Southern Economic Journal*, 66, 729-41. Further Information

Everaert L and W Schule (2006), "Structural Reforms in the Euro Area: Economic Impact and the Role of Synchronisation Across Markets and Countries", WP/06/137, International Monetary Fund, Washington, DC. Further Information in IDEAS/RePEc

Gali J, J Lopez-Salido and J Valles (2003), "Understanding the Effects of Government Spending on Consumption" Pompeu Fabra University and Bank of Spain.
Further Information in IDEAS/RePEc

Hughes Hallett A, S E H Jensen and C Richter (2005), "The European Economy at the Cross Roads: Structural Reforms, Fiscal Constraints and the Lisbon Agenda" *Research in International Business and Finance*, 19, 229-50. Further Information in IDEAS/RePEc

Koedijk K and J Kremers (1996), "Market Opening, Regulation and Growth in Europe", *Economic Policy*, 23, 445-67. Further Information

Layard R, S Nickell and R Jackman (1991), "Unemployment" Oxford University Press, Oxford. Further Information

Nickell S, Nunziata I and W Ochel (2005), "Unemployment in the OECD since the 1960s: What do we Know?" *Economic Journal*, 115, 1-28. Further Information in IDEAS/RePEc

Ogaki M and C Reinhart (1998a), "Intertemporal Substitution and Durable Goods: long run data" *Economics Letters*, 61, 85-90. Further Information in IDEAS/RePEc

Ogaki M and C Reinhart (1998b) "Measuring Intertemporal Substitutability: the Role of Durable Doods", *Journal of Political Economy*, 106, 1078-98.
Further Information in IDEAS/RePEc

Papadaki E, M Marette, Y Lau and J Hernandez (2004) "International Trade Model, Version 1" Department of Foreign Affairs and Trade, Government of Canada, Ottawa.

Prescott E, (2004) “Why Do Americans Work So Much More than Europeans?” Federal Reserve Bank of Minneapolis Quarterly Review, 28, 2-13.
Further Information in IDEAS/RePEc

Ravn M, S Schmit-Grohe and M Uribe (2004) “The Economics of Subsistence Points”, Working Paper 11012, NBER, Cambridge, MA. Further Information in IDEAS/RePEc

Rogerson R, R Shimer and R Wright (2005) “Search-Theoretic Models of the Labour Market: A Survey”, *Journal of Economic Literature*, 43, 959-88.
Further Information in IDEAS/RePEc

Rotemberg J, and M Woodford (1992) “Oligopolistic Pricing and the Effects of Aggregate Demand on Economic Activity” *Journal of Political Economy*, 100, 1153
Further Information in IDEAS/RePEc

Sapir A et al (2004) “*An Agenda for a Growing Europe*”, Oxford University Press, Oxford (The Sapir Report). Further Information

Spector, D. (2004) “Competition and the Capital-Labour Conflict” *European Economic Review*, 48, 25-32.

Table 2: Price and Tax Distortions, by country, with β = 0.25, δ =3.5 and variations.

Country	tax distortion: $\theta = \frac{t_w + t_p}{1 - t_w}$	β=0.25 δ=3.5 price distortion			β=0.25 δ=10.0 price distortion			β=0.25 δ=∞ price distortion		
		μ	**μ-θ**	**c**	**μ**	**μ-θ**	**c**	**μ**	**μ-θ**	**c**
Belgium	1.183	2.050	0.873	0.431	1.426	0.243	0.348	1.183	0	0.304
Germany	1.032	1.845	0.813	0.431	1.258	0.226	0.348	1.032	0	0.304
France	0.899	1.659	0.760	0.357	1.110	0.211	0.355	0.899	0	0.273
Italy	1.018	1.825	0.807	0.363	1.242	0.224	0.263	1.018	0	0.208
Netherlands	0.773	1.482	0.709	0.399	0.970	0.197	0.307	0.773	0	0.258
Austria	0.708	1.391	0.683	0.368	0.898	0.190	0.269	0.708	0	0.216
Spain	0.612	1.257	0.645	0.316	0.791	0.179	0.203	0.612	0	0.176
Ireland	0.314	0.840	0.526	0.298	0.460	0.146	0.181	0.314	0	0.119
Portugal	0.484	1.078	0.594	0.303	0.649	0.165	0.187	0.484	0	0.124
Finland	0.779	1.491	0.712	0.377	0.977	0.198	0.280	0.779	0	0.303
Greece	0.536	1.150	0.614	0.303	0.696	0.170	0.184	0.536	0	0.125
Denmark	0.709	1.393	0.684	0.435	0.899	0.190	0.353	0.709	0	0.309
Sweden	0.923	1.692	0.769	0.380	1.137	0.214	0.284	0.923	0	0.232
UK	0.453	1.035	0.582	0.344	0.610	0.160	0.240	0.453	0	0.191
Czech Rep	0.774	1.484	0.709	0.342	0.971	0.197	0.236	0.774	0	0.179
Hungary	0.781	1.494	0.713	0.353	0.979	0.198	0.250	0.781	0	0.194
Poland	0.757	1.461	0.704	0.383	0.953	0.195	0.288	0.757	0	0.236
Slovakia	0.723	1.412	0.689	0.382	0.914	0.191	0.219	0.723	0	0.160
EU-25	0.811	1.535	0.724	0.376	1.014	0.201	0.279	0.811	0	0.226
US	0.421	0.989	0.568	0.343	0.579	0.158	0.238	0.421	0	0.182
Japan	0.362	0.907	0.544	0.308	0.513	0.151	0.192	0.362	0	0.131
Canada	0.477	1.067	0.590	0.347	0.641	0.164	0.242	0.477	0	0.185
Australia	0.400	0.960	0.560	0.344	0.556	0.156	0.239	0.400	0	0.182
Switzerland	0.405	0.966	0.561	0.326	0.561	0.156	0.216	0.405	0	0.154
Norway	0.584	1.219	0.638	0.368	0.761	0.176	0.269	0.584	0	0.215

Notes:

a). δ = 3.25 represents a consensus estimate of the average short run inter-product substitutability in the advanced OECD economies, derived from the references given in the text. It corresponds to price mark-ups which range from about 5% in the US or UK, to 55% in the EU-25, and 60%-85% in France, Germany or Italy. δ =10 is a consensus estimate of the likely long run degree of within period substitutability, taken from estimates for the US economy (Duca and van Hoose 2000, 2006). Finally, δ = ∞ represents perfect competition.

b). Further results for β = 0 and β = 0.5, representing decentralised and centralised wage bargaining respectively, are available from the authors upon request. But those variations make little difference to our comparisons and are not reported here.

Table 3: Threshold Values for Policy Effectiveness for Improving Welfare,
δ_{max} values.

Country	Market liberalisation better than tax reform if $\delta < \delta_{max}$, for any β value:	Market liberalisation beats labour reform if $\delta < \delta_{max}$			Tax reform beats labour reform if $\delta < \delta_{max}$		
		a)	b)	c)	a)	b)	c)
Belgium	1.42	2.00	1.20	never	1.68	2.17	5.26
Germany	1.54	2.00	1.68	never	1.20	1.28	1.50
France	1.49	2.00	1.53	never	1.36	1.55	2.15
Italy	1.49	2.00	1.51	never	1.39	1.59	2.25
Netherlands	1.45	2.00	1.38	never	1.50	1.85	3.21
Austria	1.48	2.00	1.49	never	1.40	1.62	2.36
Spain	1.53	2.00	1.65	never	1.23	1.34	1.61
Ireland	1.55	2.00	1.69	never	1.19	1.26	1.46
Portugal	1.54	2.00	1.68	never	1.20	1.28	1.50
Finland	1.47	2.00	1.47	never	1.43	1.68	2.54
Greece	1.54	2.00	1.68	never	1.20	1.28	1.50
Denmark	1.42	2.00	1.17	never	1.70	2.22	5.68
Sweden	1.47	2.00	1.45	never	1.45	1.70	2.63
UK	1.50	2.00	1.57	never	1.32	1.48	1.95
Czech Rep	1.51	2.00	1.57	never	1.31	1.47	1.92
Hungary	1.50	2.00	1.54	never	1.35	1.53	2.07
Poland	1.47	2.00	1.45	never	1.46	1.72	2.70
Slovakia	1.52	2.00	1.61	never	1.27	1.40	1.74
EU-25	1.47	2.00	1.47	never	1.43	1.67	2.52
US	1.50	2.00	1.57	never	1.32	1.48	1.94
Japan	1.54	2.00	1.45	never	1.21	1.30	1.53
Canada	1.50	2.00	1.56	never	1.33	1.49	1.98
Australia	1.50	2.00	1.57	never	1.32	1.48	1.94
Switzerland	1.52	2.00	1.62	never	1.26	1.39	1.72
Norway	1.48	2.00	1.50	never	1.40	1.62	2.35

Notes: a) with β = 0; b) β = 0.25; and c) β = 0.5 ("never" means δ_{max} is complex).

Table 4: Threshold Values for Policy Effectiveness in Lowering Unemployment,
δ_{max} values.

Country	Tax reform is less effective than market liberalisation if $\delta < \delta_{max}$, for any β value:	Tax reform is more important than deregulating labour markets if $\delta < \delta_{max}$ for any β:	Market liberalisation beats deregulating labour: $\delta < \delta_{max}$		
			a)	b)	c)
Belgium	2.48	19.81	1.18	never	never
Germany	2.41	12.48	1.18	never	never
France	2.19	4.85	1.43	1.08	never
Italy	2.24	5.60	1.41	1.06	never
Netherlands	2.22	5.55	1.28	never	never
Austria	2.13	4.36	1.39	1.04	never
Spain	1.91	3.32	1.60	1.20	never
Ireland	1.84	2.65	1.68	1.26	never
Portugal	1.92	2.97	1.66	never	never
Finland	2.17	4.86	1.36	1.02	never
Greece	1.94	3.06	1.66	1.24	never
Denmark	2.28	6.77	1.16	never	never
Sweden	2.42	5.71	1.35	1.01	never
UK	1.97	3.25	1.48	1.11	never
Czech Rep	2.11	4.08	1.49	1.12	never
Hungary	2.13	3.13	1.45	1.14	never
Poland	1.92	4.93	1.34	never	never
Slovakia	2.06	3.72	1.55	1.16	never
EU-25	2.19	4.99	1.36	1.02	never
US	1.96	3.17	1.48	1.12	never
Japan	1.89	2.79	1.64	1.23	never
Canada	1.99	3.33	1.47	1.10	never
Australia	1.95	3.12	1.48	1.11	never
Switzerland	1.92	2.99	1.56	1.17	never
Norway	2.07	3.90	1.39	1.04	never

Notes: a) with β = 0; b) β = 0.25; and c) β = 0.5; where "never" implies $\delta_{max} < 1$.