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Does price stability exacerbate labour market rigidities in the EMU?

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Does price stability exacerbate labour market rigidities in the EMU?

by

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Abstract

How will the commitment to price stability affect labour market rigidities in the European Monetary Union? I explore a model where firms choose between fixed wage contracts (where the employer cannot lay off the worker, and the wage can only be changed by mutual consent), or contracts where employment is at will, so that either party may terminate employment (with strong similarities to temporary jobs). A fixed wage contract provides better incentives for investment and training, while employment at will facilitates efficient mobility. Inflation erodes the real value of a fixed contract wage over time, and badly matched workers are more likely to quit for other jobs. Disinflation has opposing effects on labour market rigidity: fixed wage contracts become more rigid in real terms, but fewer firms will choose fixed wage contracts.

Previous versions of the paper have circulated under the title ”Labour market rigidities and inflation”. I have benefitted from comments by Karl Ove Moene, Asbjørn Rødseth, Lucy White, and participants at presentations at the University of Oslo, CODE University of Barcelona, and the Norwegian School of Management, and from a discussion with Larry Katz. I am grateful for the hospitality of NBER, where part of this paper was written.

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1 Introduction

To what extent will the introduction of the European Monetary Union EMU affect the extent of rigidities in European labour markets? Given the importance attached to labour market rigidities in explaining persistent European unemployment, this seems to be a key consequence of the EMU. Recent research has looked at different parts of this issue. One strand of literature has explored the effect on the incentives for governments to reform labour market institutions, see overview in Calmfors (2001a). Another strand of research has focused more directly on the effect on the wage setting, cf eg Soskice and Iversen (1998), Cukierman and Lippi (2001) and Holden (2001a) (see surveys in Calmfors, 2001b and Franzese, 2001).

In the present paper, I explore to what extent EMU may affect the type of employment relationship chosen by labour market participants. The main focus will be on the possible implications of the strict commitment to price stability, defined by the European Central Bank as an annual increase in consumer prices of less than two percent.[1] However, I will also more briefly discuss how EMU may affect employment contracts via the effect on economic volatility.

The key effect of price stability is related to the argument raised by Tobin (1972) and Akerlof, Dickens and Perry (1996), that wages are rigid in nominal terms, and because of this, some inflation is necessary to "grease the wheels of the labour market". Against this view, among others Gordon (1996) and Mankiw (1996) point at the possibility that the labour market may adapt to a low rate of inflation. In other words, rigidities that might exist under positive rates of inflation, may be mitigated or disappear when society adapts to inflation being close to zero.

[1] In Holden (2001b), I analyse the macroeconomic implications of the commitment to low inflation, and argue that this may lead to higher unemployment also in the long run.

So far, there has been little research on the issue of how and to what extent the labour market will adapt to a situation with inflation at or close to zero. In the literature on monetary policy issues, labour market rigidities are usually unequivocally bad, being an important source of distortions. This is in contrast to the contract literature (e.g. Malcomson, 1997), where an important finding is that contracts that involve rigidities often serve a useful purpose by protecting the return of relation-specific investments, thus providing appropriate incentives for possible investors.

The present paper aims at contributing to the understanding of the effect of inflation on labour markets by exploiting fairly standard mechanisms from the contract literature. I analyse a model with two types of employment contracts:

- fixed wage employment contracts, where the firm cannot lay off the worker, and the wage can only be renegotiated by mutual consent, and
- employment at will contracts, where either party may unilaterally terminate the employment.

There are several possible interpretations of the two types of employment contracts. In labour markets with few regulations, as in the US, the employer can largely choose the type of employment contract. Employers can offer fixed wage contracts, like tenure for university professors, via legal contracts or by building up a credible reputation for this type of employment relationship. Without a specific contract, the general presumption is that employment is at will (see Malcomson, 1997). In most other countries, including the members of the EMU, labour market regulations put stronger restrictions on firms' possibilities. A fixed wage contract can then be thought of as a permanent job in a country where the firing costs are so large as to be

prohibitive.[2] In such countries, employment at will has many similarities with temporary labour contracts, which clearly provide more flexibility and less incentive for relation-specific investment than permanent jobs. Temporary jobs have become more widely used in Europe over the last decades (employees with contract of limited duration as percent of the total employees in European Community 12 countries have increased from 7.3 percent in 1985 (excluding East-Germany) to 13.2 percent in 1999, cf. Eurostat Labour Force Survey). Temporary jobs have recently also been subject to a large amount of research, cf. eg. Cahuc and Postel-Vinay (1999) and the references therein.

A key feature of the fixed wage contract that distinguishes it from employment at will, is that the employer cannot lawfully unilaterally cut the nominal wage. The wage remains constant until there is mutual agreement on a new wage. This corresponds to the legal situation in European labour markets. Even if the wage is given in a collective agreement, and the agreement has expired, the employer cannot lawfully unilaterally cut the nominal wage, see eg the country chapters in Blanpain (1994), Holden (1994) and Malcomson (1997). Thus, this institutional feature provides a possible reason for why nominal wages are rigid downwards.[3] If a negative shock takes place so that the employer wants to cut nominal wages, the employer cannot do so if this is resisted by the employee. However, the effect on real wages depend on the rate of inflation; under positive inflation, real wages will fall in spite of nominal wages being rigid.

A limit to the nominal wage rigidity lies in the fact that in some situations, the employer can circumvent the problem by terminating the employment contract with due notice, and then

[2] This assumption is clearly extreme; however, there is strict employment protection legislation in many European countries, in particular in Southern Europe (see OECD, 1999, for information about employment protection legislation in OECD countries.)

[3] The more common justification for downward nominal wage rigidity is that agents find nominal wage cuts to be unfair, see eg Akerlof, Dickens and Perry (1996).

offer a new contract with a lower pay. This approach may be feasible in countries where the employment protection legislation is weak, but much more difficult in countries with stricter employment protection legislation. In the model, I consider the two extreme alternatives; complete employment protection (fixed wage contract), and no employment protection (employment at will).

The different types of employment contracts have different strengths and weaknesses. A fixed wage contract provides better incentives for investment and training, while employment at will facilitates efficient labour mobility. It turns out that inflation affects the workings of a fixed wage contract. Under zero inflation, a fixed wage contract may involve a real wage that is above the productivity of workers that are badly matched. Positive inflation erodes the real value of the contract wage (which is set in nominal terms), and badly matched workers are more likely to quit for other jobs. In essence, some inflation makes fixed wage contracts less rigid, and thus a more attractive type of employment contract. Reducing inflation to zero will have opposing effects on labour market rigidities. Fixed wage contracts will become more rigid, but more firms will choose to let employment be at will, as fixed wage contracts become less attractive.

The analysis of the efficiency of investments under fixed pay contracts draws upon MacLeod and Malcomson (1993). The main innovation of the paper lies in the application of ideas from the contract literature on an important macroeconomic issue, namely real effects of the rate of inflation. Compared to the labour economics literature, the paper involves a slight novel twist to the arguments of Acemoglu and Pischke (1999) by showing that a fixed wage contract may provide the employer with appropriate incentives to offer general training to the employees. Larsen (1999) considers the same type of employment contracts as is done here, within a dynamic general equilibrium framework, but with no discussion of the effect of the rate of inflation.

In the model, competition among firms ensures that workers always reap the full return of their labour, irrespective of type of employment contract. This neglects that the type of employment relationship in practice may have important effects on the bargaining position of the worker, as argued eg by Lindbeck and Snower (1988) and Bertola (1999). Thus, the model does not reflect that firms may want a flexible employment relationship to capture a larger share of the value added, at the expense of the worker.

The remaining of the paper is organised as follows. The formal model is presented in section 2, and analysed in section 3. In section 4, I consider firms' choice of type of employment contracts. In section 5, I discuss the effect of changes in economic volatility. Section 6 concludes.

2 The model

To analyse the choice of type of employment contract, the model has the following features. First, players may undertake investments that affect their payoff from this and possibly other employment relationship. For simplicity, I consider only one type of investment, that firms provide on-the-job training, as this is sufficient to generate a motivation for the fixed wage contract. Secondly, when the initial contract is written, and investments are undertaken, there is uncertainty associated with the payoff of both the existing and alternative partnerships.

The economy under consideration consists of N sectors, each with a different product. Output is produced under constant returns to scale, with labour as the only input. The sectors differ with respect to the return from training, but are otherwise symmetric. In each sector, there is a large number L workers (who are identical ex ante), and $K > 1$ identical firms (where L is much larger than K). To sharpen the results, I disregard any mobility of workers between sectors. To save notation, subscript indicating sector is suppressed whenever possible.

There are two production periods. (The sequence of events is illustrated in Figure 1.) In period 1, workers are identical, and output per worker is $y > 0$. In period 2, the output of worker i is a stochastic variable. If worker i stays in the initial firm, his productivity Y^i can take the values y^H and y^L. If he takes a job in a different firm, his productivity R^i can take the values r^H and r^L. Let $\text{Prob}(Y^i = y^H) = \theta$ and $\text{Prob}(R^i = r^H) = \gamma$, where $0 < \gamma, \theta < 1$. For simplicity, Y^i and R^i are assumed to be independent. I assume that

(A1) $$y^H > r^H > y^L > r^L.$$

Thus, productivity is in most cases higher within the initial firm than elsewhere. However, workers with r^H and y^L have higher productivity in other firms; these are referred to as bad matches.

Y^i and R^i are unknown in period 1, but observable to all agents in period 2, with one important exception. If a firm observes y^H or r^H, it knows that this is correct, but observing y^L or r^L may be a deliberate signal from the worker. That is, a clever worker may pretend he/she is less clever, whereas a low productive worker cannot pretend that he/she is high productive.[4]

At the beginning of period 1, firms offer employment contracts to the workers, which may be of two different kinds. A fixed wage contract specifies a fixed nominal wage w per period, to be paid if the worker works in the firm. The contract prevents the firm from laying off the worker

[4] In the model, the reason for making this assumption is to ensure that it is not profitable for the firm to pay low productive workers to quit, because that might tempt high productive workers to pretend they are low productive so as to obtain the same offer. As is well known, the existence of a contract does not prevent efficient separations under perfect information (see e.g. Malcomson, 1997).

in period 2, but it does not affect the possibility the worker has of leaving the firm for another job, reflecting legal restrictions on the length of time a contract may bind a worker. The specified wage can be renegotiated in period 2, but only by mutual consent. Alternatively, firms may offer workers a job where employment is at will, that is, either party may unilaterally terminate the employment relationship. This job would specify a fixed wage in period 1, with no binding provisions for period 2.

In period 1, firms may provide on-the-job training for the worker, at a cost $z^i = 0$ (no training) or $z^i = z > 0$. Such training may be firm specific or general. I focus on training for which any firm-specific return is too small to warrant provision of training (cf discussion below). To simplify notation I assume that the training is completely general, increasing the productivity of the worker by v in all jobs, so productivity is $Y^i + v$ is the same firm, and $R^i + v$ in other firms.

At the beginning of period 2, firms decide their wage and hiring policy. This involves a choice of strategy according to which the firm offers each worker a wage that depends on his/her observed productivity within the firm and in other firms. The firm is assumed to be able to commit to following this policy, not allowing counteroffers by the worker. This assumption simplifies the exposition by providing the firm with the entire bargaining power, but without affecting the qualitative differences between fixed wage contracts and employment at will. (A more general analysis of renegotiation with an existing contract is provided in MacLeod and Malcomson, 1993, and Holden, 1999.) A possible justification of the assumption (outside this model) is that each firm has many workers, so if one worker tries to improve the wage, the firm gains from following a tough line to set an example for other workers.

Subsequently, the productivity level of each worker, in the initial firm as well as in other firms, is realised. The productivity levels are $y^i = Y^i + v$ and $r^i = R^i + v$ (for $z^i = z$), or $y^i = Y^i$ and $r^i = R^i$ (for $z^i = 0$).

Then, renegotiation of the wage contract may take place: the firm may offer of a new wage in period 2, w_2, which the worker may accept or reject. If the worker accepts, employment takes place under the new wage in period 2. If the worker rejects, the consequences depend on the type of contract. Under a fixed wage contract, the worker may quit, but the firm is not allowed to lay off the worker. When employment is at will, the offer by the firm is a take-it-or-leave-it offer, so that a rejection by the worker implies that he is laid off. As a convention, workers choose to work where their productivity is higher. If a separation takes place, competition among the firms for the available workers will ensure that workers are offered a wage equal to their outside productivity r^i.

According to standard theory on training, an efficient level of on-the-job training would be ensured if the worker could pay for the general part of the training, as the worker in this case captures the revenue from the general skills (cf. Becker, 1964). This is the main idea behind apprentice systems, which are prevalent in many countries. However, as argued by among others Acemoglu and Pischke (1999), in many cases it may be difficult to contract on the amount of on-the-job training that is provided by the firm. For example, it may be difficult to verify for a court whether an apprentice has really learned the trade, or whether he has only been assigned to tasks where there is little to learn. Following Acemoglu and Pischke (1999), I assume that the provision of training is observable to all agents, but not verifiable at court.

Regarding the return of on-the-job training, I assume that

(A2) $v(1-\gamma) - z > 0$

(A2) ensures that the expected profitability of training is positive even in the case where the firm only captures the return if the outside productivity of the worker is low.

Finally, I assume that

(A3) $[y + \theta y^H + (1-\theta)y^L + v - z] /2 > r^H + v.$

The left hand side of (A3) is the wage in a fixed wage contract under zero inflation. As will become apparent below, (A3) ensures that to attract workers in period 1 under zero inflation, the wage must be set so high that workers will not quit voluntarily in period 2, even if they are badly matched.

3 Analysis

At the beginning of period 1, workers will accept the offer of contract that gives them the highest expected payoff. Under complete information in period 2, it would not be difficult to ensure a first-best outcome if the contract could be made dependent on the productivity levels and the amount of on-the-job training. However, as it is assumed that neither the productivity levels nor the amount of on-the-job training is verifiable to outsiders, the contract cannot specify remuneration in period 2 that is contingent on these variables. Furthermore, I neglect that firms may build up reputation for letting remuneration depend on the same variables. Firms employ many workers, and it is assumed not to be possible to verify the productivity of individual workers. As there is constant returns to scale, and as firms will always take on more workers as

long as the expected profits from doing so are positive, it follows that in equilibrium the expected profits of hiring one worker in period 1 must be zero.[5]

Under both types of contracts, workers with high outside or inside productivity will choose to reveal this truthfully, as in equilibrium there is nothing to gain by deliberately pretending that either of the productivities are low.

To simplify the exposition, I first analyse the two types of employment relationships separately, for afterwards to explore firms' choice between these types of contract.

Employment at will

In period 2, the firm benefits from always offering the minimum value of the worker's inside and outside productivities, that is $w_2 = \min[y^i, r^i]$. Workers who have higher outside than inside productivity will then quit to take a new job, while other workers accept a renegotiation of the contract to the value of their outside productivity. This implies that all workers, irrespective of whether they stay or leave, will obtain the payoff associated with their outside option.

It follows that firms will only capture any firm-specific return from on-the-job training, because the general element of the training is captured by the worker due to an increase in the

[5] It turns out that in the fixed wage case, profits may be discontinuous in the initial wage at the wage level where a badly matched worker is indifferent between quitting for another job (which strictly increases profits) or staying in the same job. It may thus happen that expected profits is strictly positive for $w \leq w'$, and negative for $w > w'$. To avoid non-existence, I introduce the possibility that firms may spend money to recruit workers (eg. on job ads), assuming that workers prefer employers using more money (per job) on job ads if and only if the pay is the same. Under this assumption, the equilibrium would be $w = w'$ and firms spending the residual revenues (above wage costs) on job ads, so that expected profits be zero.

outside productivity. Here all return is general, and the firm will not provide any on-the-job training. There is an efficiency loss, as analysed by Williamson (1985).

The expected profits to the firm, per worker, is

$$(1) \qquad \pi^A = y - w^A + \theta[y^H - \gamma r^H - (1-\gamma) r^L] + (1-\theta)(1-\gamma)(y^L - r^L).$$

The explanation of (1) is as follows. In period 1, output is y and the wage offered in period 1 is w^A. In period 2, productivity is y^H with probability θ; the worker stays in the firm but the wage is pushed down to the reservation wage r^H or r^L. With probability $(1-\theta)$, productivity is y^L, in this case a worker with high outside productivity quits, while a worker with low outside productivity r^L will stay in the firm at low wage $(= r^L)$. To simplify notation, there is no discounting between the periods.

As noted above, competition for workers will ensure that expected profits per worker are zero. Setting $\pi^A = 0$ in (1), and solving for w^A, I obtain

$$(2) \qquad w^A = y + \theta y^H + (1-\theta)(1-\gamma)y^L - \theta\gamma r^H - (1-\gamma) r^L.$$

Using (2), the expected total remuneration of the worker, in money terms, is thus

$$(3) \qquad V^A = w^A + \gamma r^H + (1-\gamma) r^L = y + \theta y^H + (1-\theta)[(1-\gamma)y^L + \gamma r^H].$$

Thus, even if the worker is pushed down to his reservation wage in period 2, competition among firms in period 1 will ensure that the worker receives the entire product of his labour, in expected

terms. This feature will hold under a fixed wage contract also. The results are summarised in Proposition 1:

Proposition 1: Under employment at will, the second period wage is equal to the outside option of the worker. Thus, the firm will not provide any general training, as the worker would capture all the return from the training.

Fixed wage contracts

A fixed wage contract specifies a fixed wage w per period, which can be renegotiated by mutual consent in period 2. However, as w is specified in nominal terms, an increase in the general price level at a rate s-1 > 0 would imply that the real wage in period 2 under the initial contract is w/s (the price level in period 1 is normalised to unity, so s is the price level in period 2).

Again, the optimal strategy of the firm in period 2 involves a wage offer equal to the minimum of the worker's inside and outside productivities, that is $w_2 = \min[y^i, r^i]$. Under a fixed wage contract, firms are not allowed to lay off a worker even if the real wage is above the productivity level of the worker. The worker now has three options, accept a new offer, reject and stay under the initial contract, or quit for a new job.

Proposition 2

There exists critical values for the rate of inflation s - 1, where $1 < s' < s'' < s'''$, given by

$$s' = \frac{y + \theta(y^H + v) + (1-\theta)(y^L + v) - z}{r^H + v} - 1$$

$$s'' = \frac{y + \theta(y^H + v) + (1-\theta)(1-\gamma)(y^L + v) - \theta\gamma(r^H + v) - z}{r^H + v} - 1 + \gamma$$

$$s''' = \frac{y + \theta(y^H + v) + (1-\theta)(1-\gamma)(y^L + v) - \theta\gamma(r^H + v) - z}{r^L + v} - 1 + \gamma$$

such that

(a) The firm will provide training if the rate of inflation is not too high, that is, if $s - 1 < s''' - 1$.

(b) (i) if $s < s'$, the contract wage is $w^F = (y + \theta y^H + (1-\theta)y^L + v - z)/(1+1/s)$, no worker will quit, the wage will not be renegotiated, and total expected remuneration of workers is $V^F = w^F + w^F/s = y + \theta y^H + (1-\theta)y^L + v - z$.

(ii) if $s' \leq s < s''$, the contract wage is $w' = (r^H + v)s$, badly matched workers will quit, workers with high outside productivity will get the pay of their outside productivity, and the total expected remuneration of workers, V, satisfies $V^F \leq V \leq V^S$.

(iii) if $s''' > s \geq s''$, the contract wage is $w^S = [y - z + \theta y^H + (1-\theta-\gamma)y^L + (1-\gamma)v - \theta\gamma(r^H - y^L)]/(1+(1-\gamma)/s)$, badly matched workers will quit, workers with high outside productivity will get the pay of their outside productivity, and the total expected remuneration of workers is $V^S = y + \theta y^H + (1-\theta)y^L + v - z + (1-\theta)\gamma(r^H - y^L)$.

(Proof in appendix)

The intuition for these results is first that (unless inflation is too high) the firm provides training because training in most cases does not affect the wage, so that the firm captures most of the return. Inflation shifts the real wage profile over the duration of the contract by eroding the real value of the contract wage in period 2. If inflation is too high, the initial contract is irrelevant because all workers will prefer outside offers to the initial contract, so we are essentially back to employment at will where no training is provided. This case is neglected in the sequel, where I

restrict attention to the case where $s < s'''$. If inflation is lower, but still sufficiently high that the real value of the contract wage in period 2 is lower than the outside offer of workers with high outside productivity, badly matched workers will quit.

Comparing V^F and V^S, we see that inflation improves the efficiency of fixed wage contracts, by facilitating efficient labour mobility.

(4) $$V^S = V^F + (1-\theta)\gamma\,(r^H - y^L) > V^F$$

This provides a possible explanation for why real-world wage contracts are not fully indexed. Nominal wage contracts involve less real wage rigidity if inflation is positive, inducing efficient labour mobility.

An overview over worker's payoff in period 2 under alternative contract forms is shown in figure 2.

4 Firms' choice of type of employment contracts

We now consider a situation where firms may choose what type of employment contracts to offer. Consider first the case with low inflation, $s < s'$, where case (i) in Proposition 2 applies and we know that badly matched workers do not quit. Comparing V^A and V^F yields

(5) $$V^F = V^A - (1-\theta)\gamma(r^H - y^L) + (v - z).$$

Inspection of (5) reveals the two opposing efficiency effects of a fixed wage employment relationship. A fixed wage contract keeps wages high for badly matched workers, thus preventing mobility of labour to more productive jobs (the second term in (5)). On the other hand, a fixed wage prevents the firm from exploiting the weak ex post bargaining position of the worker; thus it ensures an efficient level of investment (the last term in (5)).

It is immediate that in a sector where $V^F > V^A$, all workers will be hired under at fixed wage contracts. Here no workers will accept employment at will, as this yields lower expected utility. In contrast, employment at will prevails in sectors where $V^F < V^A$. To show the implications of the model, it is sufficient to have two types of sectors, differing with respect to the return from training, v. v takes the value v^H in sectors where training is important, and v^L in sectors where training is less important, where

(A4) (i) $v^H - z > (1-\theta)\gamma(r^H - y^L)$; (ii) $v^L - z < (1-\theta)\gamma(r^H - y^L)$.

Comparing (5) and (A4), we see that firms offer fixed wage contracts in the sectors where training is important, and not in the industries where training is of minor importance.

Then consider the medium inflation cases (ii) and (iii), ie $s''' > s \geq s'$. We know from Proposition 2 that when inflation is sufficiently high so that the outside option is binding for workers with high outside productivity, badly matched workers will quit. Comparing V^A and V^S shows that

(6) $V^S = V^A + v - z$.

Using (A2), V^S is unambiguously greater than V^A. Because inflation erodes the real value of the contract wage in period 2, the fixed wage does not prevent mobility of badly matched workers. Yet the fixed wage involves sufficient rigidity of period 2 wages to induce the firm to provide on-the-job training. It follows that firms in all sectors will offer fixed wage contracts. (This extreme corner solution is clearly the result of a simplistic modelling with only two types of sectors, and should not be taken as a serious empirical prediction.) The results are summarised in

Proposition 3

(i) If $s < s'$, firms in sectors with high return to training will choose fixed wage contracts, and firms in sectors with low return to training will choose employment at will contracts.

(ii) If $s''' > s \geq s'$, all firms will choose fixed wage contracts.

(iii) Overall welfare is higher in case (ii), when inflation $s - 1 \geq s'-1$, than in case (i).

As briefly mentioned in the introduction, labour laws pose restrictions on firms' choices of employment contracts. In a country with strong employment protection legislation, Proposition 2 suggests that in some parts of the economy, firms will respond to low inflation by offering temporary jobs and more generally look for ways of making employment and wages more flexible. Moreover, the costs associated with strong employment protection legislation will be higher under very low inflation.

In a country with weak employment protection legislation, Proposition 3 suggests that some firms will voluntarily offer higher employment security than they are legally required to, but that this tendency will be less widespread under low inflation.

5 EMU and economic volatility

The standard argument concerning EMU and economic volatility is that membership in a monetary union implies increased economic volatility, because monetary policy can no longer be used to stabilise the economy (eg Bean, 1998). According to this view, membership in EMU should increase the incentives to choose flexible solutions in the labour market. In the present setting this would mean less strict employment protection legislation, and more widespread use of temporary contracts and employment at will. However, concerning EMU members, one could also argue that monetary policy over the last decades only to a limited extent has been used to stabilise the economy. In some situations, having an independent currency has even worked in a destabilising way (eg in the early 1990s, when positive interest rate differentials relative to D-mark further increased the already too high interest rates in many European countries). For these and other reasons it is not clear whether one can expect more or less economic volatility after EMU than before.

The present model suggests that the effect of economic volatility depends on which variables are becoming more volatile. More volatility in the value of outside productivity, r^L and r^H, would increase the uncertainty in the payoffs of both firms and workers under employment at will, but have less or no effect on payoffs under fixed wage contracts. Risk averse agents would thus find fixed wage contracts more attractive. [6]One possible interpretation of volatility in outside productivity would be fluctuations in labour market tightness, where r^L and r^H then would be interpreted to incorporate search costs and difficulties in finding a new job. If labour market

[6] In sections 2-4, agents are for simplicity assumed risk neutral, as risk aversion would not affect the qualitative results, only involve obvious modifications. However, in this section risk aversion is crucial for the results.

tightness is more volatile in EMU, because of the absence of a country-specific monetary policy, firms could respond by choosing fixed wage contracts, which are less responsive to labour market fluctuations.

Increased volatility in the inside productivity y^L and y^H, which could be interpreted as arising from larger fluctuations in product prices, would, on the other hand, make firms more inclined to choose contracts where employment is at will, thus eliminating the risk of being stuck with unprofitable workers. If exchange rate fluctuations are an important reason for fluctuations in product prices, membership in EMU could reduce volatility in inside productivity, and again make firms more inclined to choose fixed wage contracts.

6 Concluding remarks

How will the commitment to price stability affect labour market rigidities in the EMU? To analyse this issue I explore a model where firms may offer fixed wage contracts (where firms cannot lay off workers), or jobs where employment is at will, so that either party may terminate employment. Employment being at will facilitates efficient mobility. On the other hand, a fixed wage contract provides good incentives for investment and training, as agents reap the return from their investment. Inflation makes fixed wage contracts more flexible in real terms, because the real value of the contract wage is eroded over time, so that badly matched workers are more likely to quit for other jobs. Under zero inflation, fixed wage contracts become more rigid in real terms, but more firms will offer jobs where employment is at will, as fixed wage contracts become less attractive.

The paper also suggests a possible explanation for the prevalence of nominal contracts, as opposed to fully indexed real wage contracts. With some inflation, nominal wage contracts

involve real wage flexibility that facilitates efficient labour market mobility, a feature that would be lost under real wage contracts regardless of the rate of inflation.

In the model, the real wage flexibility of a fixed wage hinges on the rate of inflation. This neglects that the wage could be made more flexible by reducing the base pay, and introducing more flexible components. However, the choice between bonus schemes or fixed pay also depends on other issues that are not related to inflation (cf eg MacLeod and Malcomson, 1998). Furthermore, labour regulations may limit the flexibility associated with other types of remuneration than fixed pay. Lebow et al (1999) show that US firms are able to circumvent some, but not all the wage rigidity by varying benefits.

Throughout the paper, wages are assumed to be set at the individual level. For workers covered by collective agreements, additional complexities will arise. However, in today's Europe, collective agreements to an increasing degree allow for local and individual flexibility, and the issues analysed in the present paper may still be relevant. The results of the paper can be extended to the union sector if there is less room for local and individual wage flexibility if inflation is low, also for employees covered in collective agreements. In Holden (1994, 2001b), I argue that unions may have a stronger bargaining position if inflation is very low, which may imply that some inflation increases the scope for individual wage setting.

In the model, fixed wage contracts have the extreme property that they in most cases involve constant nominal wages throughout the employment relationship. More realistically, workers would have some bargaining power and there would be renegotiation and higher wages arising from inflation and increased productivity. Renegotiation would imply that the returns from investment were shared between employer and employees, thus reducing players' incentive to invest. The qualitative results in the paper could still be derived if, as is plausible, (i) wages are

less responsive to outside opportunities under fixed wage contracts than under employment at will (so that firms have stronger incentives for providing training), and (ii) the fixed contract wage is given in nominal terms, so that inflation makes the real wage more flexible if a negative shock occurs.

An alternative interpretation of the model is that fixed wage contracts correspond to jobs in countries with strong employment protection legislation, where labour market laws and regulations constitute important barriers to firms' possibility of unilaterally cutting nominal wages. Employment at will resembles jobs in countries with weak employment legislation, like the UK and the US, or (more relevant in the EMU) it can be thought of as temporary jobs. This interpretation is consistent with recent empirical studies showing strong nominal rigidity in Sweden and Italy (Agell and Lundborg, 1999, Dessy, 1999) and much less nominal rigidity in the UK and the US (Smith, 2000, Lebow, Saks and Wilson, 1999). Under this interpretation, the paper predicts that nominal wages are likely to be more rigid in countries with strong employment protection legislation. A reduction in the rate of inflation will exacerbate the real wage rigidity imposed by employment protection legislation. On the other hand, firms are likely to try to opt of the rigidity by choosing more temporary labour contracts, consistent with evidence presented by Agell and Lundborg (1999) that the increased use of temporary labour contracts in Sweden in the low-inflation period in the 1990s according to managers were related to high job security for permanent workers. In addition, the political pressure towards a weakening of the employment protection legislation is likely to increase.

Under this interpretation, employment protection legislation may give firms stronger incentive to provide on-the-job training, by preventing the firm from pushing workers down to their outside options. This is consistent with the finding of a positive correlation between long

term employment relationships, supported by employment protection legislation, and on-the-job training, provided by Acemoglu and Pischke (1999). For instance, the extent of formal company training seems to be much higher in Germany than in the US, consistent with employment protection legislation being much stronger in Germany. Arulampalam and Booth (1998) provide evidence from the UK that workers on short-term employment contracts are less likely to be involved in work-related training. On the other hand, strict employment protection legislation may reduce labour mobility, as indicated by evidence in Burgess (1994).

EMU may also affect employment contracts via the effect on economic volatility. This effect depends on which variables are becoming more volatile. Increased volatility of workers' outside opportunities, eg due to larger fluctuations in labour market tightness, may make both workers and firms more inclined to choose fixed wage contracts to reduce the impact of labour market volatility. In contrast, increased volatility in the inside productivity (eg due to product price fluctuations) may make firms prefer employment at will. Somewhat speculatively, one may argue that membership in EMU may lead to larger fluctuations in labour market tightness (no stabilising effect from country-specific monetary policy) and smaller fluctuations in product prices (no exchange rate fluctuations), and thus make fixed wage contracts more attractive. If this is the case, it would mitigate or possibly reverse the effect of lower inflation inducing more widespread use of temporary contracts/employment-at will.

Appendix Proof of Proposition 2:

(a) Straightforward algebra shows that $r^L + v < w^S/s$ for all $s < s'''$, which ensures that a worker with low outside productivity being paid w^S will not quit as long as $s < s'''$. Thus these workers will stay in the firm under their contract wage, so that the firm captures the full return of the training for these workers. From (A2), we know that this is sufficient for the firm to provide the training in period 1.

(b) Consider first case (i), where the worker stays under the initial contract. The firm captures the full return of training for all workers. The expected profits to the firm, per worker, is

$$\pi^F = y - w^F - z + \theta(y^H + v - w^F/s) + (1-\theta)(y^L + v - w^F/s). \quad (7)$$

(7) reflects that the worker always stay at the initial firm, to the contract wage w^F. Setting $\pi^F = 0$ in (7), solving for w^F to obtain

$$w^F = (y + \theta y^H + (1-\theta)y^L + v - z)/(1+1/s). \quad (8)$$

The expected total remuneration of the worker in money terms is

$$V^F = w^F + w^F/s = y + \theta y^H + (1-\theta)y^L + v - z. \quad (9)$$

It remains to show that no worker will quit in this situation. Straightforward algebra shows that $r^H + v < w^F/s$ for all $s < s'$, which ensures that no worker being paid w^F will quit as long as $s < s'$.

Then consider case (iii), where a worker obtains the payoff of his outside option if this is high, and the payoff specified in the contract if the outside option is low. Although the firm will only capture the firm-specific element of any training if both inside and outside productivity is high (here all training is general), and nothing if only the outside productivity is high (in this latter case the worker quits), (A2) ensures (as noted above) that this is sufficient for the firm to profit from providing training in period 1.

The expected profits to the firm, per worker, is

$$\pi^S = y - w^S - z + \theta[y^H + v - \gamma(r^H+v) - (1-\gamma)w^S/s\ ] + (1-\theta)(1-\gamma)(y^L + v - w^S/s). \quad (10)$$

The last term in (10) relates to the case with low inside and outside productivity, where the worker works under the initial contract. The second last term relates to the case where inside productivity is high; if outside productivity is low, the initial contract applies, if outside productivity is high the firm must bid up the wage to $r^H + v$, so as to match the outside alternative. A worker with high outside and low inside productivity quits. Setting $\pi^S = 0$ in (10), solving for w^S,

(11) $w^S = [y - z + \theta y^H + (1-\theta-\gamma)y^L + (1-\gamma)v - \theta\gamma (r^H - y^L)]/(1+(1-\gamma)/s)$.

Total expected remuneration to the worker in money terms is thus

(12) $V^S = w^S + \gamma (r^H + v) + (1-\gamma)(w^S/s) = y + \theta y^H + (1-\theta)(1-\gamma)y^L + v - z + (1-\theta)\gamma r^H$.

It remains to show that badly matched workers will indeed quit. Straightforward algebra shows that $r^H + v \geq w^S/s$ for all $s \geq s''$, which ensures that badly matched workers will quit, and workers with high inside and outside productivity will have their period 2 wage increased to $r^H + v$.

Finally, consider the intermediate case (ii), where $s' \leq s < s''$. Let me first show that $s' < s''$. Note that s'' can be rewritten as

$$s'' = s' + \gamma(1-\theta)\left(1 - \frac{y^L + v}{r^H + v}\right)$$

and the parenthesis is strictly positive as $y^L < r^H$ from (A1). In this situation $w^F/s < r^H + v < w^S/s$, so firms will earn a positive profit by hiring a worker on a wage $w'/s \leq r^H + v$, because then $w' < w^S$, and still badly matched workers quit. However, competition for workers cannot push wages up till w^S, because then badly matched workers will not quit, and the firm will obtain negative profits. In this situation the pay is given by the highest possible value consistent with badly matched workers quitting, ie $w'/s = r^H + v$, and firms spend the excess profits (above wage costs) on job ads. QED

References

Acemoglu, D. and J.-S. Pischke (1999). Beyond Becker: Training in imperfect labour markets. Economic Journal 109, F112-F142.

Agell, J. og P. Lundborg (1999). Survey evidence on wage rigidity and unemployment. IFAU WP 1999:2, Uppsala, Sverige.

Akerlof, G.A., W.T. Dickens and W.L. Perry. (1996). The macroeconomics of low inflation. Brookings Papers on Economic Activity 1, 1-75.

Arulampalam, W. and A. L. Booth (1998). Training and labour market flexibility: Is there a trade-off? British Journal of Industrial Relations 36, 521-536.

Bean, C. (1998). The interaction between aggregate-demand policies and labour market reform. Swedish Economic Policy Review 5, 353-382.

Becker, G. (1964). Human Capital. Chicago: The University of Chicago Press.

Bertola, G. (1999). Microeconomic perspectives on aggregate labor markets. In Handbook of Labor Economics, Vol 3C, O.C. Ashenfelter and D. Card (eds). Elsevier.

Blanpain, R. (ed) (1994). International Encyclopaedia for Labour Law and Industrial Relations. Deventer: Kluwer Law and Taxation Publishers.

Burgess, S. (1994). The reallocation of employment and the role of employment protection legislation. Centre for Economic Performance DP 193, London.

Cahuc, P. and F Postel-Vinay (1999). Temporary jobs, employment protection and labor market performance. Mimeo, Universite Paris 1-Eurequa.

Calmfors, L. (2001a). Unemployment, labour-market reform and monetary union. Journal of Labor Economics 19, 265-289.

Calmfors, L. (2001b). Wages and wage-bargaining institutions in the EMU – a survey of the issues. Mimeo, Institute for International Economic Studies, Stockholm.

Cukierman, A. and F. Lippi (2001). Labor markets and monetary union. A strategic analysis. Forthcoming in Economic Journal.

Dessy, O. (1999). Wage rigidity in Italy. University of Southampton working paper.

Franzese, R.J. (2001). Credibly conservative monetary policy and wage/price bargaining organization: A review with implications for monetary policy in the European common currency area. Mimeo, The University of Michigan.

Gordon, R.J. (1996). Comment on Akerlof et al. (1996). The macroeconomics of low inflation. Brookings Papers on Economic Activity 1, 60-66.

Holden, S. (1994). Wage bargaining and nominal rigidities, European Economic Review 38, 1994, 1021-1039.

Holden, S. (1999). Renegotiation and the efficiency of investment. Rand Journal of Economics 30, 106-119.

Holden, S. (2001a). Monetary regimes and the co-ordination of wage setting. CESifo WP 429.

Holden, S. (2001b). Monetary policy and nominal rigidities under low inflation. Mimeo, University of Oslo.

Larsen, J.D.J (1999). The macroeconomic implications of turnover costs and wage contracts. Mimeo, Bank of England.

Lebow, D.E, R.E. Saks, and B.A. Wilson (1999). Downward nominal wage rigidity. Evidence from the employment cost index. WP, Board of Governors of the Federal Reserve System.

Lindbeck, A. and D. Snower (1988). The Insider-Outsider Theory of Employment and Unemployment. Cambridge, Mass.: MIT Press.

MacLeod, W.B. and J.M. Malcomson (1993). Investment, holdup, and the form of market contracts. American Economic Review 37, 343-354.

MacLeod, W.B. and J.M. Malcomson (1998). Motivation and markets. American Economic Review 88, 388-411.

Malcomson, J.M. (1997). Contracts, hold-up, and labor markets. Journal of Economic Literature 35 (4), 1916-1957.

Mankiw, N.G. (1996). Comment on Akerlof et al. (1996). The macroeconomics of low inflation. Brookings Papers on Economic Activity 1, 66-70.

OECD (1999). Employment Outlook, June. Paris.

Smith, J.C. (2000). Nominal wage rigidity in the UK. The Economic Journal 110, C176-C195.

Soskice, D. and T. Iversen (1998). Multiple wage-bargaining systems in the single European currency area. Oxford Review of Economic Policy 14, 110-124.

Tobin, J. (1972). Inflation and unemployment. American Economic Review 62, 1-18.

Williamson, O.E. (1985). The Economic Institutions of Capitalism. New York: Free Press.

Figure 1: The timing of events in the model

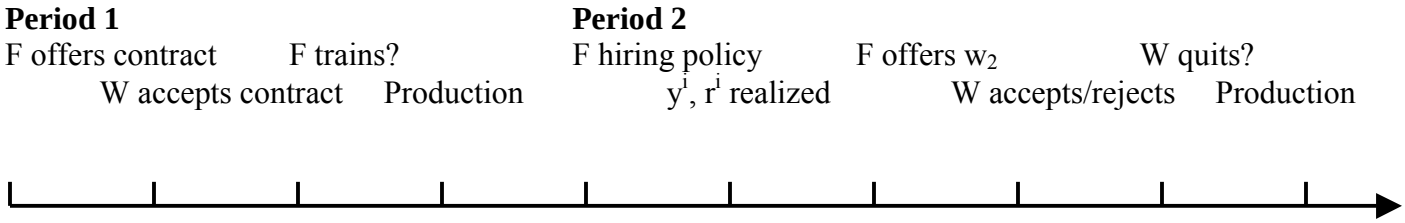

Figure 2: Workers' payoff under different situations

	At will	Fixed wage & low infla.	Fixed wage & medium infla.
y^H, r^H	r^H	w^F/s	$r^H + v$
y^H, r^L	r^L	w^F/s	w^S/s
y^L, r^H	r^H (quit)	w^F/s	$r^H + v$ (quit)
y^L, r^L	r^L	w^F/s	w^S/s