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Which dual labour market model should we choose?

By

Morten Skak

Department of Economics

University of Southern Denmark

Campusvej 55, DK-5230 Odense M

Phone +45 6550 2111. Fax. +45 6615 8790

mos@sam.sdu.dk

Abstract

One way to improve our understanding of the complex labour market is to use dual models. Among various variants, the trade union high wage/perfect competition low wage model seems to be the favourite. The paper questions this choice and proposes the efficiency high wage/trade union low wage model as a better one. A presentation of the trade union high wage/perfect competition low wage, and the efficiency high wage/trade union low wage model, reveals two disaccords. One is about the implications for an economy's wage dispersion of variations in the bargaining ability of trade unions and the other concerns the effect on employment in the high wage sector of an increased wage in the low wage sector. A confrontation with some stylised facts of the labour market supports the proposed variant as the best dual model of the market.

Key Words: Labour market, dual model, trade union, efficiency wage.

JEL: J30, J31, J38

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1. Introduction

Although sparsely used, dual or two sector models contribute to our understanding of the complex labour market. With today's theories of wage formation rudely consisting of three types, namely perfect competition wages, trade union (monopoly or bargained) wages, and efficiency wages, three combinations are available for dual models, or six if separated in terms of high versus low wage sectors. From this wide menu economic literature seems to have picked a dual model with a trade union high wage sector and a perfect competitive low wage sector as the favourite, see Hall (1975), McDonald and Solow (1985), Burda (1988), Layard, Nickell and Jackman (1991) p. 43, and Roberts, Stæhr and Tranæs (2000). Next on the list seems to be the efficiency high wage/perfect competitive low wage model, see Akerlof and Yellen (1986) p. 3, Bulow and Summers (1986). However, neither the high wage trade union sector model, nor the high wage efficiency model, both with a competitive low wage sector, seems well supported by stylised facts of the labour market of OECD countries. Thus it seems worthwhile to consider which dual model that is best supported by the facts, rather than settle with the unsatisfactory statement that many dual models are possible and no one better than the other.

In doing so, a first observation would be that hardly any model builder who tries to picture the European continental labour markets would deny that trade unions play a crucial role for the wage formation. Thus, it seems obvious that to comply with stylised facts a dual model of OECD labour markets must include a sector where trade unions play a dominant role. Yet, as will be shown, a model with a trade union high wage sector and a competitive wage low sector is not well supported by observations of the bargaining ability of trade unions and income dispersion across OECD countries. The stylised fact is that various measures of the bargaining ability of trade unions on the one hand, and wage dispersion on the other is negatively correlated, and this points towards a dual model with an efficiency high wage sector and a trade union low wage sector as the better variant. Moreover, the evidence, although vague, on employment effects of (compulsory) raising low sector wages is contradictory to the trade unions high wage/perfect competitive low wage model and more in line with the efficiency high wage/trade union low wage model.

The aim of the present paper is to twofold; firstly, to compare the two mentioned variants in order to clarify their (opposite) conclusions, and secondly, to expose them to some stylised facts. For expositional convenience the paper starts out in section 2 with a two-sector model with trade union wage in the high wage sector and competitive wage in the low wage sector. Section 3 then presents a model with trade union wage in the low wage sector and efficiency wage in the high wage sector. In section 4 the propositions from the models are evaluated by their support in empirical evidence. Concluding remarks follow in section 5.

2. A trade union high wage sector and a competitive low wage sector model

The supply of labour is assumed to be inelastic and equal to N homogenous labour units. Moreover, the labour market is dual with respect to wage setting, having a high wage sector characterized by trade union wage setting and a low wage sector characterised by competitive wage setting. Finally, keeping in mind that the model should hold across the very open European countries, the output prices of the two sectors are assumed to be fixed outside the model as competitive world market prices.

The trade union wage sector

In this sector, given the output price, the demand for labour, N_t, is a function only of the sector wage W_t, which may thus be considered a real wage.

$$N_t(W_t). \qquad \text{Where } \frac{\partial N_t}{\partial W_t} = -\eta_t \frac{N_t}{W_t} < 0. \tag{1}$$

η_t, the absolute value of the demand elasticity, is assumed to be constant. The sectors (many identical) trade unions either bargain with employers about the wage or, as a limiting case, decides the wage unilaterally. Starting with the general case of a bargained wage the trade unions are assumed to maximize the "monopoly profit", i.e. the product $(W_t - W_c)N_t$, where W_c is the alternative wage that workers obtain outside the trade union sector, and with zero "profit" as the threat-point. W_c will later be defined as the wage of the competitive sector of the economy. It is further assumed that the bargain is only over the wage and that both sides have full information about the demand curve. The (federation of identical) employers want to

maximum profit, π, also with zero profit as the threat-point. With $0 < \beta$ indicating the bargaining ability of the trade union side, the agreed wage is found by maximizing *H*:

$$H = (W_t - W_c)^{\beta} N_t^{\beta} \pi \Rightarrow \tag{2}$$

$$\log H = \beta \log(W_t - W_c) + \beta \log N_t + \log \pi.$$

Maximizing log *H* with respect to W_t and use of the envelope theorem gives

$$\frac{W_t - W_c}{W_t} = \frac{1}{\eta_t + \gamma/\beta}. \tag{3}$$

Where γ is equal to $W_t N_t/\pi$. Relation (3) gives the mark up of the trade union wage over the alternative wage. The mark up grows with falling demand elasticity η_t and a falling wage share γ, or labour intensity in production. γ is insensitive to changes in W_t if the production function is Cobb-Douglas. It also follows that an increase of the relative bargaining ability of the trade union β will raise the mark up, with $\beta = \infty$ being the limiting case of a unilateral decision by a monopoly trade union. In order to have an internal solution, let $1 < \eta_t$.

(3) can be changed to express W_t as a function of W_c

$$W_t = \frac{-\left(\eta_t + \gamma/\beta\right)}{1-\left(\eta_t + \gamma/\beta\right)} W_c, \tag{4}$$

where $1 < (\eta_t + \gamma/\beta)$ and so $W_c < W_t$. For constant η_t the derivative of W_t with respect to W_c is

$$\frac{\partial W_t}{\partial W_c} = \frac{-\left(\eta_t + \gamma/\beta\right)}{1-\left(\eta_t + \gamma/\beta\right)} > 1. \tag{5}$$

Finally, the change in employment when W_c change is

$$\frac{\partial N_t}{\partial W_c} = \frac{\eta_t\left(\eta_t + \gamma/\beta\right)}{1-\left(\eta_t + \gamma/\beta\right)} \frac{N_t}{W_t} < 0. \qquad (6)$$

To underline the difference between this model and the later model with a trade union low wage sector (6) is stated as a proposition.

Proposition 1: An increase of the competitive low wage leads to a reduction of employment in the trade union high wage sector.

The competitive wage sector

With a perfect competitive labour market in the other sector of the economy the wage of this sector W_c is the alternative wage for workers in the trade union wage sector. On the competitive market the demand for labour, N_c, is a function of the sector wage W_c only:

$$N_c(W_c). \qquad \text{Where } \frac{\partial N_c}{\partial W_c} = -\eta_c \frac{N_c}{W_c} < 0. \qquad (7)$$

η_c, the absolute value of the demand elasticity, is assumed to be constant.

Equilibrium

As stated above, labour is assumed to be inelastically supplied at the level N. The competitive market secures full employment and so

$$N = N_t + N_c. \qquad (8)$$

The model thus has four relations (1), (4), (7) and (8) that simultaneously fixes the four endogenous variables W_t, W_c, N_t *and* N_c. The equilibrium values may be found by substitution: Relations (4) and (1) gives N_t as a function of W_c. Together with (8) and (7) this gives (9) that reveals the equilibrium value of the endogenous variable W_c.

$$N = N_t(W_t(W_c)) + N_c(W_c). \tag{9}$$

Knowing W_c, the corresponding equilibrium value of W_t is found from (4), and equilibrium values of N_t and N_c from (1) and (7), respectively. A change of the parameters η_t, γ and β will change the equilibrium values. However, (4) - or (3) - holds so that a second proposition can be stated.

Proposition 2: The wage dispersion measured by W_t/W_c increases, the lower is
- The demand elasticity in the trade union wage sector
- The relative wage share in the trade union wage sector

And the higher is
- The bargaining ability of the trade union

As described, trade unions are assumed only to consider the wage in the trade union sector, but, as shown, the model is simultaneous so that the wage of the trade union sector influences the competitive low wage with repercussions for the trade union wage. The model may be criticised for omitting this element in the behaviour of the trade unions. However, if the wage of the trade union sector is settled by the interaction of many, and so small, identical trade unions, each union will be without influence on the wage in the competitive sector and only care (directly) about the wage in the trade union sector.

3. An efficiency high wage sector and a trade union low wage sector model

As in the preceding model, the labour market is dual, but now with the high wage sector characterized by efficiency wage setting and the low wage sector characterised by trade union wage setting. The homogenous labour supply is still exogenously given at the level N, and the two output prices of the two sectors are fixed outside the model (as competitive world market prices). Each of the individual employers, which, within the model, are assumed identical, makes efficiency wage considerations based on the type of work to be done, the possibilities for monitoring the work, etc. Thus, efficiency wages are negotiated and fixed at a decentralised level. Alternatively, one may assume that the efficiency wage of the model is the average of a fine lattice of efficiency wages, which may change continuously, influenced

not only by the trade union wage but also by the business cycle, the composition of demand, and the technical development. The (average) efficiency wage is assumed to be higher than the trade union wage.

It is a well-known fact that higher paid workers often negotiate their salary with the employer, and this should somehow be reconciled with the models assumption of an efficiency high wage sector. As a first observation note that if workers are sure employers will pay the efficient wage they must perceive this wage as the alternative wage in case of a break down of negotiations with no agreement reached. Hence, the efficient wage becomes the threat point of the trade union, and the Nash bargaining equilibrium wage is; see (4)

$$W_{th} = \frac{-\left(\eta_t + \gamma/\beta\right)}{1-\left(\eta_t + \gamma/\beta\right)} W_e.$$

Where W_{th} is the trade union wage of the high wage sector and W_e is the efficient wage of this sector. This formulation opens for both efficiency wage considerations and trade union monopoly rent as factors explaining the wage in the high wage sector. But note also, that $\beta \rightarrow 0 \Rightarrow W_{th} \rightarrow W_e$, i.e. the agreed and paid wage will be the efficiency wage in case the bargaining ability of the trade union is exhausted. A crucial element of negotiations between employers and workers is that they serve to reveal to the parties the wage elasticity of labour demand (employers try to clarify or convince workers on this) and the effort function of workers (workers try to clarify or convince employers on this). When employers know the effort function, they feel sure that workers will behave according to this function when paid the efficiency wage, and that this eliminates the threat of strikes and other inefficient behaviour, in short, $\beta = 0$. Because of this, wage formation in the high wage sector may best be described by efficiency wage setting, implemented through negotiations.

The annex of the paper gives a numerical example of an efficiency high wage/trade union low wage model with only one output *Y* produced by workers of the two sectors. This technical relation between the sectors implies that labour demand of both sectors is strongly influenced by the wage paid in the other sector.

The efficiency wage sector

In this sector, the demand for labour, N_e, is a function of the sector wage W_e only:

$$N_e(W_e). \qquad \text{Where } \frac{\partial N_e}{\partial W_e} = -\eta_e \frac{N_e}{W_e} < 0. \tag{10}$$

η_e, the absolute value of the demand elasticity, is assumed to be constant. The effort function is borrowed from Layard, Nickell and Jackman (1991) with effort *e* equal to $e(W_e/W_t,u)$, e_1, $e_2 > 0$, and e_{11}, $e_{12} < 0$. W_t is the alternative wage that influences workers effort (later to be defined as the trade union low sector wage) and *u* is the rate of unemployment. Employers' minimization of wage per effort unit gives the Solow condition $\frac{e_1}{e}\frac{W_e}{W_t} = 1$. This locks the relation $\frac{W_e}{W_t}$ for any given level of *u*, and the wage-wage elasticity at each level of *u* is thus

$$\varepsilon_{W_t} = \frac{\partial W_e}{\partial W_t}\frac{W_t}{W_e} = 1. \tag{11}$$

Moreover, total differentiation of the Solow condition gives $d(W_e/W_t)/du < 0$, so that higher unemployment reduces the optimal W_e for unchanged W_t. In accordance with this the (identical companies of the) sector pays an efficient wage to workers, which follows the relation

$$W_e(W_t, \frac{N_e}{N_n}). \quad \text{Where } \frac{\partial W_e}{\partial W_t} = \varepsilon_{W_t}\frac{W_e}{W_t} > 0, \text{ and } \frac{\partial W_e}{\partial(\frac{N_e}{N_n})} = \varepsilon_{N_e/N_n}\frac{W_e N_n}{N_e} > 0. \tag{12}$$

W_t is the alternative wage to be fixed outside the sector, N_e is employment in the efficient wage sector, and N_n is the total number of workers, who are not employed in the other sector of the economy. The other sector will later be introduced as the trade union wage sector. N_e/N_n is thus the employment rate of the non-trade union wage sector of the economy. Until the trade union wage sector is introduced, N_n will be considered exogenous. ε_{N_e/N_n} is the elasticity of the efficient wage with respect to the employment rate, N_e/N_n.

To find the equilibrium employment in the efficient wage sector, substitute (12) into (10) to get:

$$N_e = N_e(W_e(W_t, \frac{N_e}{N_n})). \tag{13}$$

Total differentiation gives

$$dN_e = -k\frac{N_e}{W_e}\left[\frac{W_e}{W_t}dW_t - \varepsilon_{N_e/N_n}\frac{W_e}{N_n}dN_n\right]. \tag{14}$$

Where

$$k = \frac{\eta_e}{1+\eta_e\varepsilon_{N_e/N_n}} > 0.$$

$k \to 0$ for $\varepsilon_{N_e/N_n} \to \infty$ and/or $\eta_e \to 0$.

The change of employment in the efficiency wage sector due to a change of the alternative wage can now be stated as

$$\frac{\partial N_e}{\partial W_t} = -k\frac{N_e}{W_n} < 0. \tag{15}$$

This means that an increase of the alternative (trade union) wage will reduce employment in the efficiency wage sector. The reduction may, however, be damped by a low demand elasticity and/or a high efficiency wage elasticity with respect to the employment rate.

The size of the labour force not employed in the other (trade union) sector of the economy, i.e. N_n, also influences the employment in the efficiency wage sector. The influence follows from the partial derivative

$$\frac{\partial N_e}{\partial N_n} = k\varepsilon_{N_e/N_n}\frac{N_e}{N_n} = \frac{\eta_e\varepsilon_{N_e/N_n}}{1+\eta_e\varepsilon_{N_e/N_n}} > 0. \tag{16}$$

Thus, because an increase of N_n reduces the employment rate N_e/N_n, it also brings down the need for a high wage in the efficiency wage sector. The falling efficiency wage gives more employment in the sector. The induced employment increase is, however, low if ε_{N_e/N_n} is small, and the increase in employment may also be reduced by low demand elasticity.

For later use, it is convenient to reduce the relation for employment in the efficiency wage sector, cf. equation (14), to

$$N_e = N_e(W_t, N_n). \tag{17}$$

The trade union wage sector

The wage of the trade union wage sector, W_t is set by unilateral decision of a monopoly trade union, or contained in a negotiated collective agreement. In case of unemployment, employees of this sector get an outside income A, which becomes the threat value of trade unions in negotiations. W_t is thus set as described by relation (4) with A substituted for W_c:

$$W_t = \frac{-\left(\eta_t + \gamma/\beta\right)}{1-\left(\eta_t + \gamma/\beta\right)}A. \tag{18}$$

The exogenous outside income *A* is not specified, but may be thought of as a weighted average of unemployment and social benefits plus the value of idleness. It is not influenced by the efficiency wage because it is presumed that employment in the efficiency wage sector is, if not impossible, of negligible importance to workers employed in the low wage trade union sector. Thus, as specified, the model is recursive with no feedback from the efficiency wage to the trade union wage. This may look like a limitation of the model, because the trade union wage setting should include possible repercussions from the efficiency wage, which by itself is influenced by the trade union wage. However, with demand elasticity η_t assumed constant, only a change in γ could change W_t. If the production function is CES γ may change, but if it is Cobb-Douglas γ is insensitive to changing wages. This, and the fact that collective agreements typically are made only once a year, or every second year, and in some cases with even longer intervals, while high level (efficiency) wages are set more often, and are influenced by factors such as the actual state of the business cycle, the internal development of demand among industries, the changing production techniques, and a mixed functional interdependence between workers of the two sectors, makes it less likely that repercussions through this sector are taken into account by trade union under collective bargaining. Moreover, in case there are many small trade unions, each collective agreement will have no influence on the efficiency wage level.

The demand for labour in the trade union wage sector, N_t, follows the function

$$N_t(W_t). \qquad \text{Where } \frac{\partial N_t}{\partial W_t} = -\eta_t \frac{N_t}{W_t} < 0. \tag{19}$$

η_t is the constant absolute value of the demand elasticity. The (identical companies of the) sector pays the trade union wage, W_t, to workers.

Equilibrium

The labour market of the economy is composed of the two above-mentioned sectors and the pool of unemployed workers. As before, the inelastic total supply of labour is *N*, so that

$$N = N_t + N_n. \tag{20}$$

As said, the system is recursive so that W_t is first found from (18), N_t is then found from (19), and N_n from (20). Knowing W_t and N_n, W_e and N_e are found simultaneously from (10) and (12). The properties of the equilibrium can be studied by substituting (19) into (20), solve for N_n, and insert this in (17) to get

$$N_e = N_e(W_t, N - N_t(W_t)). \tag{21}$$

(21) may be expressed in differences using (15), (16) and (19):

$$dN_e = (-k\frac{N_e}{W_t} + k\varepsilon_{N_e/N_n}\frac{N_e}{N_n}\eta_t\frac{N_t}{W_t})dW_t. \tag{22}$$

(22) shows that the change of employment in the efficiency wage sector following a change in the trade union wage becomes

$$\frac{\partial N_e}{\partial W_t} = k\frac{N_e}{W_t}(\frac{N_t}{N_n}\varepsilon_{N_e/N_n}\eta_t - 1). \tag{23}$$

The sign of (23) may be negative, zero or positive implying that the change of employment in the efficiency wage sector cause by a rise of the wage of trade union wage sector W_t may go both ways if moving at all. Employment in the efficiency wage sector will increase if

$$1 < \frac{N_t}{N_n}\varepsilon_{N_e/N_n}\eta_t. \tag{24}$$

The explanation is as follows: High demand elasticity in the trade union wage sector, η_t, implies a big reduction of the employment in this sector in case of a rise of W_t. The reduced employment will reduce the required wage in the efficiency wage sector and this may lead to an increase of employment in this sector. Moreover, low employment rate elasticity in the efficiency wage sector increases the probability for an increase of employment in this sector. All in all, it can only be stated that

Proposition 3: An increase of the trade union low wage will have ambiguous effects on employment in the efficiency high wage sector.

Moreover, using (10) and (23), the change of W_e when W_t changes becomes

$$\frac{\partial W_e}{\partial W_t} = \frac{k}{\eta_e}\frac{W_e}{W_t}(1 - \frac{N_t}{N_n}\varepsilon_{N_e/N_n}\eta_t). \tag{25}$$

(25) is positive, i.e. an increase of the low trade union wage leads to an increase of the wage in the efficiency wage sector, if

$$\frac{N_t}{N_n}\varepsilon_{N_e/N_n}\eta_t < 1. \tag{26}$$

This may be the most likely case. However, even in this case a reduction of the wage dispersion between sectors will occur. To demonstrate this the following wage-wage elasticity can be derived from (25)

$$\frac{\partial W_e}{\partial W_t}\frac{W_t}{W_e} = \frac{k}{\eta_e}(1 - \frac{N_t}{N_n}\varepsilon_{N_e/N_n}\eta_t) < 1. \tag{27}$$

The wage-wage elasticity is less than one, because both the bracket and the outside fraction is less than one. This and knowledge about the parameters influencing the trade union wage can be used in a fourth proposition

Proposition 4: The wage dispersion measured by W_e/W_t decreases the lower is
- The demand elasticity in the trade union low wage sector
- The relative wage share in the trade union low wage sector, i. e. labour intensity in production

And the higher is
- The bargaining ability of the trade union

By (10) is clear that an increase of W_t will reduce employment in the trade union wage sector, but as demonstrated by (23) it may at the same time increase employment in the efficiency wage sector. What about the impact on total employment? Adding (23) and (19) gives

$$\frac{\partial(N_e + N_t)}{\partial W_t} = \left(\frac{\eta_e \varepsilon_{N_e/N_n}}{1 + \eta_e \varepsilon_{N_e/N_n}} \frac{N_e}{N_n} - 1\right) \frac{N_t}{W_t} \eta_t - k \frac{N_e}{W_t} < 0. \qquad (28)$$

The bracket is negative because the two inside fractions are less than one. This secures that a possible employment creation in the efficiency wage sector following from an increase of W_t will never be larger than the fall in N_t. With a negative sign before the last term an increase in the trade union low wage W_t inevitably leads to a reduction of the total employment level in the economy.

4. The stylised facts of the labour markets

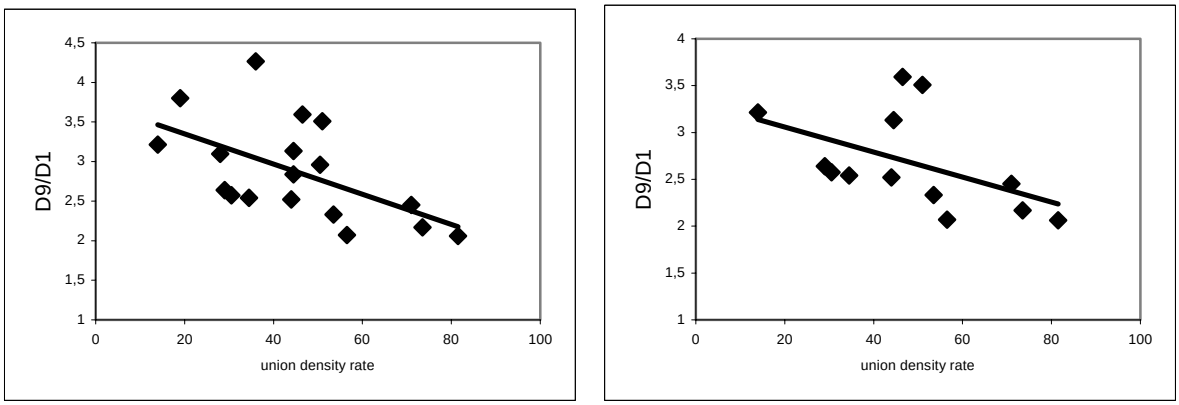
As stated in the introduction, trade unions play an important role for the wage formation on labour markets in the OECD countries. The average trade union density rate in western continental European countries was around 50 per cent in the mid eighties with bargaining coverage rates around 80 per cent. Although such rates are much lower in the big OECD countries the USA and Japan, the stylised fact of trade union influence on the wage setting must be incorporated in any dual model, which tries to cope with OECD labour markets across countries.

Another stylised fact of interest in the present context is the negative correlation between earnings dispersion and trade union density rates shown in Figure 1. A high membership rate for trade unions is often used as an indicator of the bargaining ability of the union, i.e. β, in relation (2). An encompassing trade union movement is less anxious about the continuing support of its members in case of dispute. Moreover, the risk of “attacks” from non-members is less, so that the union’s “patience “ in negotiations is higher. Finally, the threat-point of the employer side may well be lower the higher is the density rate for trade unions, because there are fewer non organized workers to rely on in case of a conflict with the trade union. In Figure

1 the trade union density rate reported by OECD (1997) is pictured against earnings dispersion measured from the top to the bottom of the earnings scale in eighteen OECD countries, see OECD (1996). Earnings dispersion is the best available substitute for wage dispersion, for which no international comparable data are found.

The left panel of Figure 1 illustrates a strongly significant relation where high union density rates, and so bargaining ability, reduce earnings dispersion. This is in line with proposition 4 of the efficiency high wage/trade union low wage model, which says that the wage dispersion, measured by W_e/W_t, is narrower; the higher is the bargaining ability of the trade union, and contrary to the trade union high wage/perfect competition low wage model's proposition 2, which says that the wage dispersion, measured by W_t/W_c, is wider, the higher is the bargaining ability of the trade union.

Figure 1: Earnings dispersion and union density rates in OECD countries.



Note: Union density rates are averages of data for the two years 1980 and 1990, see source. D9 and D1 refer to upper earnings limits of, respectively, the ninth and the first deciles of employees ranked in order of their earnings from the lowest to the highest. Earnings dispersion is average of the years shown in OECD (1996), Table 3.1. Where data have been missing for intermediate years, linear interpolation has been employed.
Source: OECD (1996) and (1997)

If only the thirteen European countries of the sample are included, the regression is as shown in the right panel of Figure 1, and the relation is weaker, yet significantly different from zero at the 5 per cent level. The strong significance for all eighteen OECD countries indicates that the efficiency high wage/trade union low wage model is generally the most appropriate dual model of labour markets of industrialised economies.

The union density rate is an objective measure based on statistical facts, but it is not the same as the bargaining ability of unions. An indicator of the centralisation of wage negotiations is an alternative measure and may better reflect the bargaining ability of unions, as the main argument for unionisation of workers is the bargaining power obtained by the movement of negotiations from the individual to the collective or centralised level. Wallerstien (1999) investigates the explanatory power of various variables, including a new constructed index of centralisation on wage dispersion, and concludes that centralisation has the highest explanatory power. It is not the purpose of the present paper to further into this, besides mentioning that this new index of centralisation actually gives a better fit than the density rates behind Figure 1.

The third stylised fact of interest is the lack of a firm correlation between the level of the minimum wage and employment in countries with a statutory minimum wage. Twenty OECD countries have a statutory minimum wage, so possible employment effects of a minimum wage are of great interest. In the above two dual models a statutory minimum wage could be introduced as externally fixed wage lying above the equilibrium wage of the low wage sector. In both models this would reduce employment in the low wage sector, so the overall employment effect depends on what happens in the high wage sector. As stated in proposition 1 of the trade union high wage/perfect competition low wage model, “an increase of the competitive low wage leads to a reduction of employment in the trade union high wage sector”, so a working minimum wage should unambiguously reduce the overall employment level. Contrary to this proposition 3 of the efficiency high wage/trade union low wage model says “an increase of the trade union low wage will have ambiguous effects on employment in the efficiency high wage sector”. However, according to (28), a working minimum wage has a negative effect on the overall employment level.

The stylised fact is that empirical evidence on employment effects of statutory minimum wages is not clear-cut. However, the following sentence from the surveying paper of Paul Gregg (2000): “… estimates of the employment effects of minimum wages suggest a much greater impact on teenage employment than overall, whereas prime men, if anything, have slightly improved employment prospects from minimum wages” resumes the stylised fact

from the weight of empirical evidence, and this supports proposition 3 of the efficiency high wage/trade union low wage model.

The conclusion of the above is that some important stylised facts point towards the efficiency high wage/trade union low wage model as a better variant than the trade union high wage/perfect competition low wage model. The reason why the trade union high wage/perfect competition low wage model has become so popular is no doubt that early empirical evidence has demonstrated a positive wage premium for unionised workers compared to non-unionised, but otherwise similar, workers. However, a recent paper by Booth and Bryan (2001) questions the validity of former studies and shows that "when account is taken of membership endogeneity – with appropriate instruments whose selection is guided by relevant theory – this wage premium vanishes". Moreover, the efficiency high wage/trade union low wage model does not say anything on whether or not the efficiency wage is paid to unionised workers, and the same is the case in the trade union low wage sector. So, old (false or not) evidence of a wage premium to unionised workers is not contradictory to this variant.

5. Concluding remarks

One way to improve our understanding of the complex labour market is to use dual models. However, even though no model has found general support as the best one, the trade union high wage/perfect competition low wage model seems to be the favourite with the efficiency high wage/perfect competition low wage variant coming next. The paper questions this choice and proposes the efficiency high wage/trade union low wage model as a better one. A formal presentation of the trade union high wage/perfect competition low wage, and the efficiency high wage/trade union low wage model, shows two disaccords.

One is about the implications for an economy's wage dispersion of variations in the bargaining ability of trade unions. Here the first model predicts increasing wage dispersion if the bargaining ability of trade unions improves, whereas the second model predicts falling wage dispersion. A confrontation with the stylised empirical fact of a negative correlation between earnings dispersion (the available measure of wage dispersion) and trade union

density rates (one measure of trade union bargaining ability) across OECD countries significantly supports the second model.

The other disaccord concerns the effect on employment in the high wage sector when the wage of the low wage sector is increased. Here, the first model predicts a fall of employment in the (trade union) high wage sector, whereas the second model is ambiguous about the employment effect in the (efficiency) high wage sector. Again, the stylised fact from the weight of evidence on the effects of increasing statutory minimum wages is supportive of the second model.

In general, many models are required to describe all parts of a complex market like the labour market. At the same time, many models may blur the contours of the most important characteristics. It is important to know the contours and the present paper, trying to unveil the scene, indicates that the efficiency high wage/trade union low wage model is the best dual model of the market.

Annex

This annex gives a numerical example of an efficiency high wage/trade union low wage model with only one output Y produced according to the Cobb-Douglas decreasing-returns-to-scale production function $Y = (N_e^{\alpha} N_t^{1-\alpha})^{\nu}$, with $\alpha = 0.8$ and $\nu = 0.8$. A single production function for the whole economy of this kind implies that the labour demand of each sector is strongly influenced by the wage paid in the other sector. The price P of the output is exogenously given as a world market price, and also the trade union wage, W_t, is exogenously given from (18) with β assumed fixed, and η_t, and γ being fixed by the Cobb-Douglas technology. Finally, assuming $N_t = 0.4N_n$ and, for later use, an unemployment rate equal to 10 per cent, the following numerical model appears:

The demand for labour in the trade union low wage sector is, confer equation (19)

$$\dot{N}_t = 5(\dot{P} - 0.64\dot{W}_e - 0.36\dot{W}_t). \qquad \text{(A1)}$$

Where $\dot{W} = dW/W$. Relation (20) can now be changed into the following equation

$$\dot{N}_n = -0.4\dot{N}_t. \tag{A2}$$

The demand for labour in the efficiency high wage sector is, confer equation (10)

$$\dot{N}_e = 5(\dot{P} - 0.84\dot{W}_e - 0.16\dot{W}_t). \tag{A3}$$

Finally, equation (12) is made linear in relative changes under the assumption that ε_{N_e/N_n} = 0.5:

$$\dot{W}_e = \dot{W}_t + 0.5\left(\dot{N}_e - \dot{N}_n\right). \tag{A4}$$

The four endogenous of this system are $\dot{W}_e, \dot{N}_t, \dot{N}_e,$ and $\dot{N}_n$, with $\dot{W}_t$ and $\dot{P}$ exogenous. Thus, the trade union wage model may be seen as the best one sector model of the economy, even though the trade union wage sector is smallest, as assumed here. Plugging (A1) into (A2), and then (A2) + (A3) into (A4) gives

$$\dot{W}_e = 0.064\dot{W}_t + 0.936\dot{P}. \tag{A5}$$

The wage-wage elasticity $\dot{W}_e/\dot{W}_t$ is 0.064 or close to zero, indicating that a change of the trade union low wage has very little influence on the efficiency high wage. Thus the model follows proposition 4 of section 3. The elasticity could even go into the negative with a higher efficiency wage-employment rate elasticity ε_{N_e/N_n} . Equation (A5) also shows that a rise in the world price *P* leads to a nearly proportional rise in the efficiency high wage. This implies a rise in the wage spread, as the trade union low wage is assumed exogenously fixed.

Further, solving for $\dot{N}_e$ gives the following equation

$$\dot{N}_e = 1.069\dot{P} - 1.069\dot{W}_t. \tag{A6}$$

Which shows an employment-wage elasticity $\dot{N}_e/\dot{W}_t$ of minus 1.069. This may be seen as somewhat contradictory to proposition 3 of section 3 that speaks about an ambiguous effect on employment in the efficiency wage sector. The reason why a change of the trade union low wage reduces employment in the other sector, in spite of the fact that it is literally without influence on the wage of this sector, is because the model describes a one product economy and so internalises a general loss of international competitiveness, which hits employment in both sectors. The solution for $\dot{N}_t$ is

$$\dot{N}_t = 2.005\dot{P} - 2.005\dot{W}_t. \tag{A7}$$

The effect of a change in W_t on employment N_t is, naturally, much bigger than on N_e. Moreover, so is the effect of a change of P on employment with the wage of this sector assumed exogenously fixed.

Invoking the assumption of an initial unemployment rate of ten per cent, the relative change of total employment E, being a weighted average of the change of each sectors relative employment changes, becomes

$$\dot{E} = \frac{N_e}{E}\dot{N}_e + \frac{N_t}{E}\dot{N}_t. \tag{A8}$$

Which leads to a total employment- wage elasticity $\dot{E}/\dot{W}_t$ equal to minus 1.366.

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