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Internal versus external reference perspective in efficiency wage models reconsidered

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Abstract

Danthine and Kurmann (2006) show that efficiency wage models may generate wage rigidity when workers not only compare their wage with outside wages but also with an internal reference wage that depends on the firm's ability to pay. We modify their framework in a way that makes the external reference wage component consistent with assumptions normally made. With this generalization we show that although the relative weight of the internal reference wage is decisive for the degree of wage rigidity, the efficiency model already exhibit wage rigidity when this weight is rather modest.

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1. Introduction

In a recent paper Danthine and Kurmann (2006) show that conventional formulations of the efficiency wage **models** fail to generate wage rigidity in general equilibrium and are thus in contrast with empirical findings. Negative shocks that shift labor demand inwards may induce workers to work harder, which according to the theory would lead employers to cut wages. Empirical evidence, however, shows that this is hardly the case (cf. Blinder and Choi 1990, Bewley 1999, Agell and Bennmarker 2003). To provide a theoretical analysis that is more in line with empirics, Danthine and Kurmann (2006) present a modified version of the standard efficiency wage model where they make the reference wage also "dependent on firm-internal measures of earnings per unit of labor". Their version of the efficiency model exhibits a high degree of wage rigidity in general equilibrium.

In the way they modelled the reference wage, however, they actually abolished important general equilibrium considerations and therefore limited the relevance of their model. We thus generalize their model by consistently redefining the external part of the reference wage by taking into account the chance to find employment elsewhere. We show that even in this generalized framework wage rigidity is likely to occur even under the circumstances where the internal reference wage plays only a minor part in the workers' effort determination.

2. Model

Our framework is closely related to the model in Danthine and Kurmann (2006) – DK in what follows. Firms use effective labor en to produce output y, with e denoting work effort and n the level of labor input. The production function is $y = A(en)^{\alpha}$ with $0 < \alpha < 1$, where

A represents the level of technology and can be interpreted as a shift parameter that reflects exogenous shocks. We consider homogenous workers who are willing to provide effort according to the effort function $e = -a_0 + a_1 w^{\gamma} w_r^{-\gamma}$ with a_0, a_1 and $0 < \gamma < 1$ being positive constants (cf. Akerlof 1982, p. 561). The firm's wage is denoted by w, and the reference wage by w_r, respectively.

According to DK, "workers appreciate their salary offer in light of the firm's output per employee y/n and of their reservation wage b." (DK, p. 280) They thus define the reference wage with which workers compare their wage when deciding on **their** effort as

(1) $$w_r = \left(\frac{y}{n}\right)^{v} b^{1-v},$$

where $0 \leq v < 1$ is assumed to be exogenous. The first term represents the maximum wage at which the entire rent is attributed to the worker. The second term denotes the minimum wage below which the worker would prefer the outside option. The first term thus represents the *internal* reference wage determined by the firm while the latter depends on *external* parameters. DK define this outside option as staying at home and collecting unemployment benefit payment b. The assumption that unemployment is the only outside option, however, is very restrictive and is inconsistent with the usual interpretation of external options as used by Akerlof (1982).

Defining the external option in the usual way, the component b should depend on the wage workers obtain if rehired by another firm, on the probability of reemployment, and on the level of unemployment benefits. Using the same functional form as suggested by Akerlof (1982, p. 561) for the external reference wage component and denoting $\overline{w}$ as the equilibrium wage, $\overline{n}$ as the equilibrium employment rate, and $\overline{b}$ as the unemployment benefit payment we can write the external component as a geometric average $b = \overline{w}^{\bar{n}} \overline{b}^{1-\bar{n}}$ so that the reference wage can be expressed as

$$w_r = \left(\frac{y}{n} \right)^{v} \left(\overline{w}^{\bar{n}} \overline{b}^{1-\bar{n}} \right)^{1-v}. \tag{2}$$

It turns out that most of the analysis by DK is not affected by this modification. In particular, the modified Solow condition (9) $1 = \varepsilon_{e,w} - \varepsilon_{e,n}$, where $\varepsilon_{e,w} = e_w w / e$ and $\varepsilon_{e,n} = e_n n / e$, remains valid. If the internal reference wage is relevant, a marginal wage increase reduces employment, which in turn increases the reference wage. "Thus, ceteris paribus, the last wage increase warranted in the external reference case would not pay for itself in the internal reference context." (DK, p. 281).

While the wage setting curve in the DK model does not depend on aggregate employment anymore, the wage curve in our setting does. Assuming a constant benefit replacement ratio $\overline{b} = \rho w$, $0 < \rho < 1$, applying the symmetric equilibrium conditions $w = \overline{w}$, $n = \bar{n}$, the modified Solow condition, and the reference wage (2) gives the optimal effort level $e = \frac{\gamma\, a_0 (1-v)}{a - \gamma(1-v)}$. Allowing for this the production function implies that the modified aggregate wage-setting curve is then given by

$$w = \frac{C^{\frac{1}{v\gamma}} A \rho^{(1-n)\frac{(1-v)}{v}}}{n^{1-\alpha}}, \tag{3}$$

where $C = \left[\frac{1}{a_1} \left(\frac{a_0}{1 - \gamma(1-v)} \right) \right]^{1+\alpha\gamma v} \left[\gamma(1-v) \right]^{\alpha\gamma v}$ is a constant. From this it follows that the general equilibrium wage elasticity with respect to employment cannot be signed unambiguously anymore because we have

(4) $$\frac{\partial w}{\partial n}\frac{n}{w} \equiv \eta = (\alpha - 1) - \frac{(1-v)}{v} n \ln \rho .$$

Conditions (4) indicates that the degree of wage rigidity depends on the weight of the internal reference v. The limiting case $v = 0$ represents the standard efficiency wage model with high variability of the efficiency wage. In this case the reference wage reduces to $w_r = \overline{w}^{\bar{n}} \overline{b}^{1-\bar{n}}$ and the wage elasticity becomes unambiguously positive (cf. DK, equation (13)). For the parameters $n = .9$ and $\rho = .65$ DK calculated a high elasticity of 3.88, i.e. the wage reaction is four times as high as the employment adjustment. With the further assumption of a labor share of $\alpha = 1/3$ in the production function we find the following elasticities for our modified reference wage:

v	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
η	3.16	1.22	0.57	0.25	0.05	–0.07	–0.17	–0.24	–0.29

When the internal reference becomes more important (larger than .5377 in our example), the slope of the wage-setting curve becomes negative. In the interval $v \in [.5, .9]$, the model already exhibits a relative low wage elasticity and thus relative strong wage rigidity. As condition (4) further shows, both an increase of either the replacement ratio ρ or the unemployment rate $1-n$ leads to lower values of the wage elasticity since this puts more weight within the external reference wage component on the income of being unemployed.

3. Conclusion

We have modified the model of Danthine and Kurmann (2006) by making their internal reference wage definition consistent with the standard assumption about the external reference wage component. With this generalization we have shown that although the relative weight of the internal reference wage is decisive for the degree of wage rigidity, the efficiency wage model already exhibits wage rigidity when this weight is only modest.

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