INTERNAL VERSUS EXTERNAL REFERENCE PERSPECTIVE IN EFFICIENCY WAGE MODELS: A NOTE

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Abstract

Survey data suggests that in terms of wage rigidity the internal reference is more relevant in US-type firms while external comparisons play a more significant role in European-type firms. We generalize two theoretical approaches in efficiency wage framework to incorporate both the internal and external perspectives as variable that affect individual effort determination. Our framework suggests that the internal reference is essential for the existence of wage rigidity but that wage rigidity already occurs when the internal reference wage plays only a minor part in the workers' effort determination. Our model thus reconciles the standard efficiency wage theory with the empirical finding of nominal wage rigidity for firms acting in various labor market environments.

Keywords: Efficiency wages, wage rigidity, internal and external reference wage.

JEL classification: E24, E32, J50

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1. Introduction

Standard efficiency wage models such as the shirking model by Shapiro and Stiglitz (1984), Akerlof's (1982) partial gift exchange model and the adverse selection model by Weiss (1980) can explain why wages are set by firms above market clearing levels and can thus explain unemployment. These models fail, however, to explain downward rigid wages during a recession, when wages are almost constant as negative aggregate shocks affect labor demand.[1] To find out, why wages actually don't fall, Bewley (1999) interviewed more than 300 business executives, labor leaders, professional recruiters and advisors to the unemployed. From his interviews he concluded that the workers' morale is important for workers performance. The workers' morale depends on being treated fairly *within* firms – for instance by paying "fair" wages according to some established internal pay structure. Concerning fairness comparisons with workers outside the firm, Bewley (1999) reports that

> "workers usually know so little about pay levels of other firms that pay differences among firms have to be large before they affect worker attitudes." (p. 106)

Campbell and Kamlani (1997) report that workers mainly compare their wages with their own past wages, the wages of other workers *within* the firm, and firms' profits. These authors thus reject one of the essentials of efficiency wage models, i.e. the comparison of the own wage with outside wages and outside options when determining individual effort.

In the conventional formulations of efficiency wage models, which rely on workers comparing their wage with external wages, the wage reaction is much more elastic than the employment reaction. Negative shocks that shift labor demand inwards also affect the *external* reference wage and thus induce workers to work harder. This, according to theory, allows employers to cut wages. Thus, these models imply that

[1] Holden and Wulfsberg (2006) report strong evidence for the existence of nominal wage rigidity in 19 OECD countries.

wages are highly volatile over the business cycle – contrary to the empirical findings. To reconcile the theoretical analysis with the empirical facts, Danthine and Kurmann (2006) present a modified version of the standard efficiency wage model, in which they make the reference wage dependent on the firm's output per worker and some exogenous reservation wage. This *internal* reference is a measure of rent-sharing and indicates how fair workers are treated within firms. Their version of the efficiency model covers the reasons of Bewley's interview partners and exhibits a high degree of wage rigidity in a general equilibrium and even a negative relation of wage and employment adjustments.

It is important to emphasize that the neglect of an external reference, however, is not in line with survey data from Europe. Using a random survey of Swedish human resource managers, Agell and Bennmarker (2003, 2006) report that in opposition to what Bewley reports for the US, Swedish employers consider outside comparisons as very important: two-thirds of their respondents believe that an increase in external wages is detrimental to workers' effort. Their survey thus shows results that are in sharp contrast to the results from US surveys:

> "Most Swedish managers indicate that *both* internal and external wages are important considerations in the local wage bargain." (Agell and Bennmarker 2003, p. 25).

Unionization plays a leading role here since it increases workers' knowledge about external wages, which they may not be able to acquire in decentralised labor markets.[2] Furthermore Agell and Bennmarker (2003) report that the external reference is more important in larger firms and that the interest in external wages increases with the job level (also see Andrews and Henry 1963). By contrast, they find little evidence that

[2] In the same line Franz and Pfeiffer (2006) argue that the high degree of unionization may be one explanation why the insider-outsider comparison is more important in German labor markets than in the case of US labor markets.

unemployment benefit payments affect effort although they may be more important for the low-end of the labor market.

The paper by Danthine and Kurmann (2006) only allows for internal wage comparisons and thus neglects important general equilibrium effects the influence of an additional external wage reference may have. This partly limits the relevance of their model. As the survey results suggest the internal reference is more relevant in US-type firms while external comparisons play a significant role in European-type firms. Their model only captures the US part of the story but does not cover apparent European experiences. We therefore generalize their model by allowing for both internal and external references to affect individual effort determination. The internal reference is modeled as a rent sharing within the firm while the external reference takes into account the possibility of finding employment elsewhere or becoming unemployed. We show that in the generalized framework, wage rigidity occurs already when the internal reference wage plays a minor part in the workers' effort determination. Our model thus reconciles the standard efficiency wage theory with the empirical finding of nominal wage rigidity for firms with workers having both an internal and external reference perspective and, at the same time, allows for difference in various labor market environments.

2. Model

The set-up of 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

$$y = A(en)^{\alpha} \tag{1}$$

with $0 < \alpha < 1$, where A represents the level of technology and can be interpreted as a shift parameter that reflects exogenous shocks. The price of the output good is

normalized to one. We consider homogenous workers who are willing to provide effort according to the effort function

(2) $$e = -a_0 + a_1 w^{\gamma} w_r^{-\gamma},$$

with a_0, a_1 and $0 < \gamma < 1$ being positive constants (see Akerlof 1982, p. 561). The firm's wage is denoted by *w*, and the reference wage by w_r.

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). Their definition of the reference wage with which workers compare their wage when deciding on their effort is

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

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. In the DK-setting this reservation wage *b* is the minimum wage below which workers prefer to stay at home and collect unemployment benefits. Since, in equilibrium, this reservation wage is a constant share of the own wage, both terms actually reflect only internal reference components. DK thus rule out the importance of external wage comparisons, which plays a more important role in European-type labor markets as we mentioned earlier.

An efficiency wage model that can explain wage rigidity should also include an *external* reference at least for the following four reasons. First, unionization increases labor market transparency and facilitates external wage comparisons. Second, larger firms also seem to be more exposed to external comparisons. Third, external reference importance rises with job level. Fourth, at the lower-end wage scale the comparison

unemployment benefit payments become an external reference since unemployment benefit payments for low-wage jobs are normally bounded from below, and actually become independent of the own previous wage.

Defining the reservation wage of the worker 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 exogenously given unemployment benefit payment, we can define the external component as a geometric average $b = \overline{w}^{\overline{n}}\overline{b}^{1-\overline{n}}$ so that the reference wage can be expressed as

$$w_r = \left(\frac{y}{n}\right)^{v}\left(\overline{w}^{\overline{n}}\overline{b}^{1-\overline{n}}\right)^{1-v}. \tag{3}$$

The firm maximizes profit by maximizing $\pi = A(en)^{\alpha} - wn$ with respect to the wage rate and the employment level subject to the workers' effort function (2) and the reference wage (3). The profit maximization with respect to employment yields

$$w = \alpha\frac{y}{n}(1+\varepsilon_{e,n}), \tag{4}$$

where $\varepsilon_{e,n} = e_n n/e$ denotes the effort elasticity with respect to employment. Using (4), profit maximization with respect to the wage rate yields

$$1 = \varepsilon_{e,w} - \varepsilon_{e,n}, \tag{5}$$

where $\varepsilon_{e,w} = e_w w/e$ is the effort elasticity with respect to wage rate. This is the modified Solow condition as derived by DK. If the internal reference wage is relevant, a marginal wage increase reduces employment, which in turn increases the reference

wage via the consequent rise in y/n. "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 the modified setting, that also allows for an external reference, does. Under the assumption of a constant benefit replacement ratio $\bar{b} = \rho w$, $0 < \rho < 1$, applying the symmetric equilibrium conditions $w = \bar{w}$, $n = \bar{n}$, the modified Solow condition, and the reference wage (3) gives the following optimal effort level

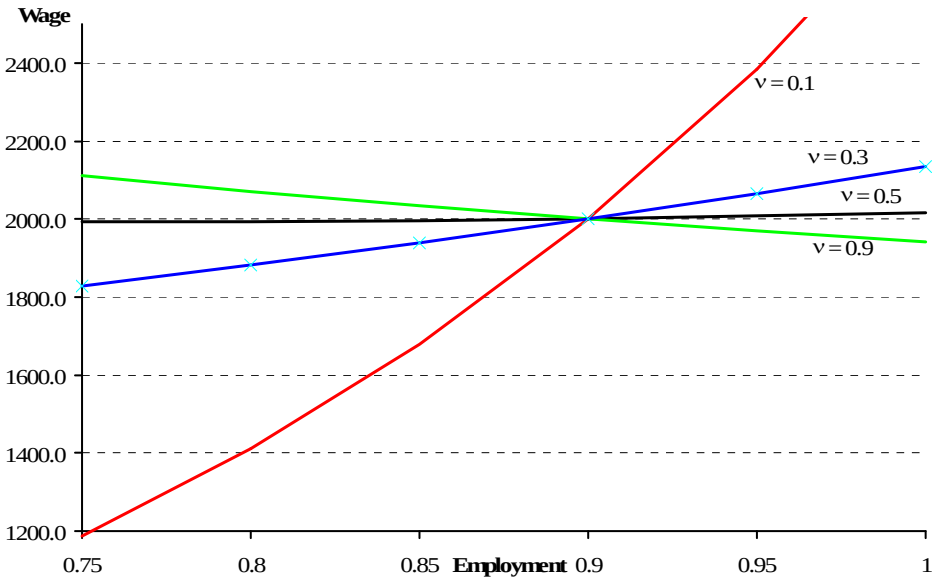
$$e = \frac{\gamma\, a_0 (1-v)}{1-\gamma(1-v)}. \tag{6}$$

With equilibrium effort being determined by (6), the production function then implies that the modified aggregate wage-setting curve is given by

$$w = \frac{C^{\frac{1}{v\gamma}} A \rho^{\frac{(1-n)(1-v)}{v}}}{n^{1-\alpha}}, \tag{7}$$

where $C = \left[\frac{1}{a_1}\left(\frac{a_0}{1-\gamma(1-v)}\right)\right]^{1+\alpha\gamma v} [\gamma(1-v)]^{\alpha\gamma v}$ is a constant. Figure 1 illustrates the wage setting curve for different weights of the internal reference, described by v. The model is calibrated for a wage share of 2/3, a benefit replacement rate of 65 percent and an equilibrium wage equal to 2,000 Euro for all weights when aggregate unemployment is exactly at 10 percent.

Figure 1: The wage setting curve for different weights of the internal reference



If comparisons are made mainly with respect to external wages (see the line for $v = .1$), the wage setting curve is positively sloped and very steep. The more important the internal reference becomes, however, the less steep the wage curve becomes, i.e. the more nominal wage rigidity is inherent in the model. Even with a moderate degree of external comparison (see the line for $v = .3$), we already observe a rather flat wage setting curve. If the reference is almost internal ($v = .9$), the wage setting curve may even fall whith employment.[3] Formally, the general equilibrium wage elasticity with respect to employment, obtained from (7), cannot be signed unambiguously anymore as we have

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

Condition (8) indicates that the degree of wage rigidity depends on the weight of the internal reference v. To see this, consider the two extreme cases. The limiting case $v = 0$ represents the standard efficiency wage model with an external reference wage

[3] The concavity of the production function ensures that for given effort the internal reference y/n is declining in employment.

only and therefore a 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

$$\frac{\partial w}{\partial n}\frac{n}{w}\bigg|_{v=0} = \frac{n}{1-n}(\ln w - \ln b) = -\frac{n}{1-n}\ln\rho > 0\,. \tag{9}$$

(cf. DK, equation (13)). For an unemployment rate of 10 percent, i.e. $n = .9$ and an unemployment replacement ratio of 65 percent, i.e. $\rho = .65$, which DK mark as their "most favorable" scenario, the wage reaction is almost four times as high as the employment adjustment.

By contrast, we can disregard the labor market conditions in the reference wage by setting $\bar{n} = 0$ in equation (3). Then the model boils down to the model by DK and the elasticity of the wage with respect to employment becomes unambiguously negative:

$$\frac{\partial w}{\partial n}\frac{n}{w}\bigg|_{\bar{n}=0} = (\alpha - 1) < 0\,, \tag{10}$$

which is equivalent to equation (15) of DK. A comparison of (9) and (10) highlights the interpretation of the more general case as represented in (8). Rewriting (8) as

$$\frac{\partial w}{\partial n}\frac{n}{w} = \frac{1}{v}\left[\nu(\alpha - 1) - (1 - v)\, n \ln\rho\right]. \tag{11}$$

shows that the parameter v takes on a meaning that it does not have in the DK framework. In the general case, the parameter v acts like a weight for the two perspectives and becomes decisive for the degree of observed wage rigidity, while it plays no role in the measure of elasticity in the DK framework as can be seen from equation (10). The more important the internal reference relative to the external view becomes, the more rigid wages react to exogenous demand shocks.

Some numerics should illustrate how important the relative weight is. With the further assumption of a labor share of $\alpha = 2/3$ in the production function, we obtain the following elasticities for our modified reference wage:

Table 1: wage rigidity and the weight of the internal reference

Unemployment rate $1-n$	Weight on internal reference ν								
	.1	**.2**	**.3**	**.4**	**.5**	**.6**	**.7**	**.8**	**.9**
5.0%	3.35	1.30	.62	.28	.08	–.06	–.16	–.23	–.29
10.0%	3.16	1.22	.57	.25	.05	–.07	–.17	–.24	–.29
15.0%	2.96	1.13	.52	.22	.03	–.09	–.18	–.24	–.29
20.0%	2.77	1.05	.47	.18	.01	–.10	–.19	–.25	–.30

The calculations presented in table 1 illustrate as figure 1 suggested that the degree of wage rigidity increases with the weight given to the internal reference. Furthermore, the calculations indicate that this result is rather insensitive to the actual labor market performance. Almost complete wage rigidity is observed when the internal and external references are almost equally important for individual effort determination. When the internal reference becomes more important (larger than .6 in our example), the slope of the wage-setting curve becomes negative which is not in line with empirical evidence. In the interval $v \in [.3,.6]$**,** the model already exhibits a relative low wage elasticity and thus relatively strong wage rigidity. Thus**,** though the reference weights may be different, we may not observe much difference in the degree of wage rigidities among countries with different labor market institutions. This conclusion is very much in line with Knoppik and Beissinger (2005, p. 14) who do not find conclusive empirical evidence for systematic differences between Europe and the US with respect to downward nominal wage rigidity. As condition (8) further shows, an increase in the replacement ratio ρ also leads to lower values of the wage elasticity since this puts more weight within the external reference wage component on income in the presence of unemployment.

3. Conclusion

Workers normally compare their own wage with both internal and external reference wages when determining their individual work effort, but they do so in different ways in different labor market environments. The standard efficiency wage models neglect

the internal reference and focus on an *external* reference only. This leads to wage reaction over the business cycle that are much more elastic than the employment reaction. Substituting an *internal* reference wage for an external reference wage, as suggested by Danthine and Kurmann (2006), can explain wage rigidity within the efficiency wage framework but fails to explain the results from survey data for European workers. Furthermore, this modification leads to a counterfactual negatively sloped aggregate wage setting curve.

In this paper we have reconciled the two theoretical approaches and presented a generalized efficiency wage model that incorporates both an internal and an external perspective. This model captures the essence of efficiency models, i.e. that firms will set the wage above market clearing level and it also exhibits a strong degree of wage rigidity as long as the weight attached to the internal wage comparison is non-negligible. In so far the reference wage is a weighted average of internal and external components it also allows for differences as suggested by the survey data for the US and Europe and would predict that wage rigidity is more pronounced in labor markets where internal references matter more – although the differences might be very small.

References

Agell, J. and H. Bennmarker, 2003. *Endogenous wage rigidity,* CESifo Working Paper No 1081, November.

Agell, J. and H. Bennmarker, 2006. Wage incentives and wage rigidity: a representative view from within*, Labour Economics*, Article in Press.

Andrews, I. R. and M. M. Henry, 1963. Management attitudes toward pay, *Industrial Relation* 3, 29-39.

Akerlof, G. A., 1982. Labor contracts as partial gift exchange. *Quarterly Journal of Economics* 97, 543–569.

Bewley, T. F., 1999. *Why Wages Don't Fall During A Recession*. Harvard University Press, Cambridge.

Blinder, A. S. and D. H. Choi, 1990. A shred of evidence on theories of wage stickiness, *Quarterly Journal of Economics* 105, 1003-1015.

Campbell C. M. and K. S. Kamlani, 1997. The reasons for wage rigidity: evidence from a survey of firms, *Quarterly Journal of Economics* 112, 759-789.

Danthine, J. P. and A. Kurmann, 2006. Efficiency wages revisited: the internal reference perspective. *Economics Letters* 90, 278-284.

Franz, W. and F. Pfeiffer 2006. *Reasons for wage rigidity in Germany*, IZA Discussion Paper No. 2017, March.

Holden, S. and F. Wulfsberg, 2006. *Downward nominal wage rigidity in the OECD*, manuscript, June.

Knoppik, C. and T. Beissinger, 2005. *Downward nominal wage rigidity in Europe: an analysis of European micro data from the ECHP 1994-2001,* IZA Discussion Paper No. 1492, February.

Shapiro C. and J. E. Stiglitz, 1984. Equilibrium unemployment as a worker discipline device, *American Economic Review* 74, 433-444.

Weiss, A. 1980. Job queues and layoffs in labor markets with flexible wages, *Journal of Political Economy* 88, 526-538.