Interacting nominal and real labour market rigidities

Vogel, Lukas

November 2008

Interacting nominal and real labour market rigidities

Lukas Vogel*
OECD

November 2008

Abstract: This note investigates the interaction between nominal and real labour market rigidities. It shows nominal wage rigidity to have little effect on the welfare loss from labour adjustment costs under a labour supply shock. This implies that the second best effect of nominal price stickiness under real wage persistence studied in Duval and Vogel (2007) does not apply to the propagation of supply shocks under nominal wage rigidity and labour adjustment costs.

JEL classification: E24, E32, J23, J30
Keywords: labour adjustment costs, wage stickiness, rigidity interaction

Introduction

The basic New Keynesian (NK) model emphasises the role of nominal rigidities for business cycles and monetary policy transmission. Real rigidities, such as habit persistence on the demand or factor adjustment costs on the supply side, are added to improve the empirical fit. The focus on real rigidities in the NK framework is a recent phenomenon. Blanchard and Galí (2007) analyse the impact of real wage rigidity on the sacrifice ratio and inflation persistence. Ascari and Merkl (2007) investigate the effects of a monetary policy regime shift under real wage rigidity and a given degree of price stickiness. Lechthaler and Snower (2008) analyse the impact of labour adjustment costs on output and inflation persistence for constant price stickiness. Duval and Vogel (2007) depart from this approach of one-dimensional parameter variation. They look at the interaction between nominal and real rigidities and conclude that price rigidity can be second best when real wages are sticky. The latter analysis focuses on the joint effect of nominal price and real wage inertia, i.e. on the interaction between nominal product market and real labour market rigidity. This note extends the analysis of interactions between nominal and real inertia. Looking at nominal wage rigidity and labour adjustment costs it shows that the second-best character of nominal inertia does not equally apply to the interaction of nominal and real labour market rigidities. For given employment adjustment costs, sticky nominal wages have little impact on the welfare loss under supply shocks. The remainder of the

* OECD Economics Department, 2 rue André Pascal, F-75775 Paris. Email: lukas.vogel@oecd.org. The views expressed in the paper are those of the author only and do not necessarily reflect positions of the OECD.

note presents a small model with nominal and real labour market rigidities and illustrates the interaction between the latter under a labour supply shock.

Model

Consider a representative household maximising welfare as the discounted stream of period utility in a closed economy:

$$(1) \qquad W = \sum_{t=0}^{\infty} \beta^t \left(\ln C_t - \frac{\kappa}{1+\varphi} N_{it}^{1+\varphi} \right)$$

where C is consumption, N_i is hours worked, κ is the relative weight of labour effort in utility, β is the discount factor and 1/φ the elasticity of labour supply. The household faces the budget constraint:

$$(2) \qquad W_{it} N_{it} + P_t D_t = P_t C_t + B_{t+1} - (1 + r_t) B_t$$

equating labour and dividend income, on the left side, with nominal consumption expenditure and net saving in risk-free one-period bonds B on the right hand side. W_i is the nominal wage chosen in a labour market with monopolistic competition and staggered wage setting. N is a CES aggregate of differentiated types of labour $N_t = \left[\int_0^1 N_{it}^{\frac{\eta-1}{\eta}} di \right]^{\frac{\eta}{\eta-1}}$ with an elasticity of substitution of η between those differentiated labour inputs. The demand for labour of type i follows:

$$(3) \qquad N_{it} = \left(\frac{W_{it}}{W_t} \right)^{-\eta} N_t .$$

Output of firm j derives from a simple one-factor function $Y_{jt} = N_{jt}$. Households consume a bundle of differentiated goods $C_t = \left[\int_0^1 C_{jt}^{\frac{\varepsilon-1}{\varepsilon}} dj \right]^{\frac{\varepsilon}{\varepsilon-1}}$, where ε is the elasticity of substitution between varieties. For simplicity the adjustment costs are thought of as consuming such bundles of varieties too. Demand for output j is a function of aggregate demand and the relative price:

$$(4) \qquad Y_{jt} = \left(\frac{P_{jt}}{P_t} \right)^{-\varepsilon} Y_t$$

With fully flexible prices there is no price dispersion and aggregate production $\int_0^1 Y_{jt} dj = Y_t$ equals:

$$(5) \qquad Y_t = N_t .$$

Given nominal wage stickiness, wage setting is a dynamic optimisation problem. The wage setters maximise (1) under the budget restriction (2), the labour demand function (3) and the production function (5).[1] The optimal nominal wage for the re-optimising households is:

$$(6) \qquad \left(W_t^*\right)^{1+\eta\varphi} = \kappa \frac{\eta}{\eta-1} \frac{E_0 \sum_{t=0}^{\infty} \left[(\xi\beta)^t W_t^{(1+\varphi)\eta} N_t^{1+\varphi} \right]}{E_0 \sum_{t=0}^{\infty} \left[(\xi\beta)^t \lambda_t W_t^{\eta} N_t \right]}$$

where 1-ξ is the probability of wage re-adjustment, which also corresponds to the share of households resetting wages in a given period, and λ is the marginal utility of consumption. The nominal wage level is a weighted average of reset wages and unadjusted wage contracts:

$$(7) \qquad W_t^{1-\eta} = (1-\xi)\left(W_t^*\right)^{1-\eta} + \zeta W_{t-1}^{1-\eta}.$$

Firms operate in a monopolistically competitive goods market and face quadratic employment adjustment costs, providing them with an incentive to smooth employment adjustment over time. The maximisation of real firm profits:

$$(8) \qquad \max_{P_t^j} D_0^j = E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{P_t^j}{P_t} Y_t^j - \frac{W_t}{P_t} N_t^j - \frac{\phi}{2} \left(N_t^j - N_{t-1}^j \right)^2 \right]$$

under the demand and production functions (4) and (5) yields the profit maximising price. Assuming symmetric behaviour and symmetric constraints among firms the aggregate price level follows as:

$$(9) \qquad P_t = \frac{\varepsilon W_t}{\varepsilon \left[1 - \phi(1+\beta) N_t + \phi N_{t-1} + \beta\phi E_t N_{t+1} \right] - 1}.$$

Aggregate demand in the closed economy is the sum of consumption demand and the employment labour adjustment costs:

$$(10) \qquad Y_t = C_t + \frac{\phi}{2} \left(N_t - N_{t-1} \right)^2.$$

Intertemporal optimizing households that are able to lend and to borrow in order to transfer income in time choose the consumption path:

$$(11) \qquad C_t = \frac{1}{\beta} \frac{1}{1+r_t} E_t \left[\frac{P_{t+1}}{P_t} C_{t+1} \right].$$

Interaction between nominal and real labour market rigidities

To study the interaction of nominal wage stickiness and labour adjustment costs the model is simulated over a grid of parameter combinations for wage stickiness and adjustment costs. The wage rigidity parameter ξ varies between 0.50 and 0.90 on a quarterly basis, comprising the estimates of Sahuc and Smets (2007) and Smets and Wouters (2005) for the euro area and for the U.S. economy,

[1] Detailed derivations of the wage setting dynamics under nominal stickiness can e.g. be found in Canzoneri et al. (2004) and Galí (2008).

and adjustments costs ϕ between 0.0 and 0.2, which is in the order of magnitude of the estimates of Hall (2004) for U.S. industries. The parameter values β=0.99, ε=6, η=6, κ=1 and φ=2.88 and the labour supply shock $\mu_t = 0.88\mu_{t-1}+\nu_t$ on κ with the innovation ν of 0.42 standard errors are taken from the U.S. estimates in Sahuc and Smets (2008) and Smets and Wouters (2005).

Figure 1: Welfare loss for alternative combinations of nominal and real rigidities

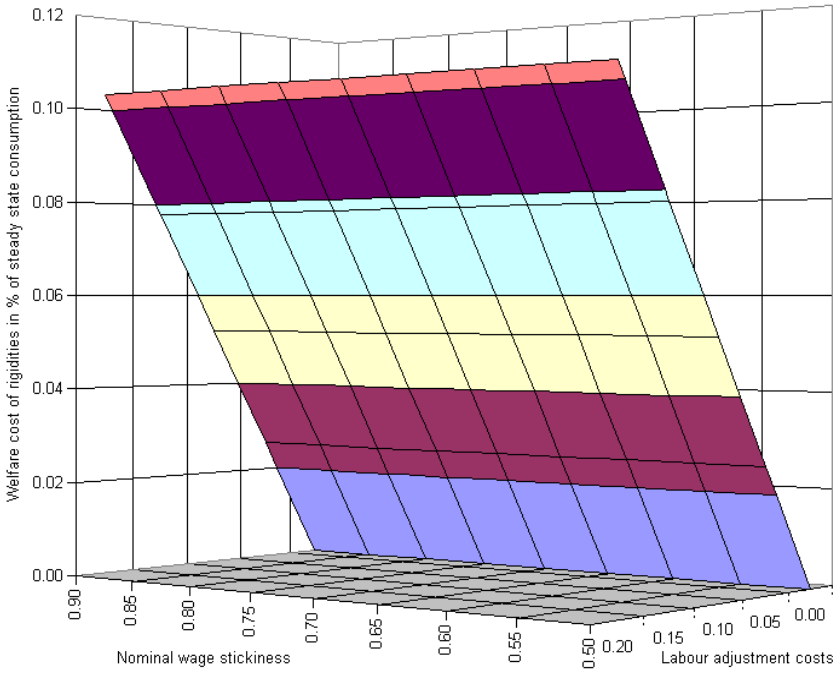

Figure 1 illustrates the welfare consequences of nominal and real labour market rigidities for the labour supply shock. It compares the economy with nominal stickiness and real adjustment costs with the economy where both rigidities are absent. Monetary policy is Ramsey optimal to minimise the welfare loss for given structural parameters. The welfare loss as measured in percent of steady state consumption increases steeply in labour adjustment costs, while nominal wage rigidity has very little effect. Notably, there is no visible interaction between the degree of nominal and real rigidity in the sense of the second best solution in Duval and Vogel (2007). While the reduction of adjustment costs is the only way to limit the welfare costs of supply shocks in this example, the absence of interactions with second best outcome suggest that policy reforms in both areas can be undertaken independently without risking detrimental effects on economic welfare.

Conclusion

This note indicates the absence of sizable interaction between nominal wage rigidity and labour adjustment costs in the case of labour supply shocks. In this case the speed with which nominal wages adjust to the optimal level prevailing under wage flexibility has virtually no impact on the welfare consequences of labour adjustment costs. Consequently, the second best character of nominal inertia

given real rigidities discussed in Duval and Vogel (2007) and its quantitative importance seem to vary across rigidities and shocks.

References

Ascari, G. and Ch. Merkl, 2007, Real Wage Rigidities and the Cost of Disinflations, IZA Discussion Papers 3049.

Blanchard, O. and J. Galí, 2007, Real Wage Rigidities and the New Keynesian Model, Journal of Money, Credit, and Banking 39, 35-65.

Canzoneri, M., R. Cumby and B. Diba, 2004, The Cost of Nominal Inertia in NNS Models, NBER Working Papers 10889.

Duval, R. and L. Vogel, 2007, How Do Nominal and Real Rigidities Interact? A Tale of the Second Best, MPRA Papers 7282.

Galí, J., 2008, Monetary Policy, Inflation and the Business Cycle. (Princeton University Press, Princeton).

Hall, R., 2004, Measuring Factor Adjustment Costs, Quarterly Journal of Economics 119, 899-927.

Lechthaler, W. and D. Snower, 2008, Quadratic Labor Adjustment Costs and the New-Keynesian Model, Kiel Working Papers 1453.

Sahuc, J.-G. and F. Smets, 2008, Differences in Interest Rate Policy at the ECB and the Fed: An Investigation with a Medium-Scale DSGE Model, Journal of Money, Credit and Banking 40, 505-521.

Smets, F. and R. Wouters, 2005, Comparing Shocks and Frictions in US and Euro Area Business Cycles: A Bayesian DSGE Approach, Journal of Applied Econometrics 20, 161-183.