Comments on Search and Matching Frictions and Optimal Monetary Policy

Ester Faia[*]

University of Rome at Tor Vergata and Ente Einaudi Institute for Economics and Finance

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[*]Correspondence to: Ester Faia, Department of Economics, University of Rome at Tor Vergata, Via Columbia 2, 00133, Roma, Italy. E-mail: Ester.Faia@uniroma2.it.

1.   Focus of the paper

The synthesis between new keynesian models and the non-walrasian theory of unemployment moves s step forward in replicating business cycle facts concerning the labour market and provides a useful benchmark for policy analyses[1]. One consequence of this is that researchers also question how and whether prescriptions of optimal monetary policy can change into this new environment. This is exactly the question that motivates Carlos Thomas paper. This paper builds a new Keynesian model with matching frictions and staggered Nash bargained wages (obtained by introducing a Calvo 1983 structure for nominal wage stickiness into an otherwise standard Nash bargaining process) and uses this model economy to analyze the design of optimal monetary policy. The latter is implemented through a micro-founded linear quadratic approach a' la Woodford 2003 which consists in deriving a quadratic loss function by taking second order approximation of agents' utility. This loss function, in combination with the linearized constraints describing the economy's competitive equilibrium, is used to implement the design of optimal monetary policy. Thomas' paper confirms the optimality of price stability in presence of matching frictions and flexible wages, while deviations from zero inflation are optimal in presence of wage rigidity. Deviations from zero inflation occur since real wage rigidity distorts incentives for efficient job creation and since wage dispersion induces inefficient dispersion in hiring rates. Those two distortions are summarized in the gap between the allocation arising under efficient Nash bargaining and the allocation associated with wage rigidity.

The paper also stresses how the introduction of wage rigidity into the matching framework helps to reconcile the Barro 1977 critique which states that for ongoing employment relations we would expect employers and employees to neutralize the distortionary effects of wage stickiness. The combination of matching frictions and Nash staggered wages allows to do so

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[1]This model has now become widely used for empirical and policy analyses. See Thomas' paper for a complete literature review.

as private efficiency of employment relationships is preserved.

2.   Unemployment-Inflation Trade-off, Optimal Policy and Hosios 1990 Condition

Introducing matching frictions into an otherwise standard new Keynesian model allows us to derive a traditional Phillips curve relating inflation and unemployment. This is so even in absence of wage rigidity. The presence of a short run negative relation between unemployment and inflation implies that the monetary authority is now facing a traditional unemployment/inflation trade-off. Because of this we would expect optimal policy to deviate from the flexible price allocation. Surprisingly this is not so in this paper[2] unless it is assumed that wages are rigid.

The reason for this result stems from the assumption that the Hosios 1990 condition holds. The latter states that under certain restrictions on the parameter space (particularly the fact that workers' bargaining power equals the elasticity of the matching function with respect to vacancies) the unemployment rate is Pareto efficient[3]. This assumption is needed as the paper performs the design of optimal policy by employing a micro-founded linear quadratic approach a' la Woodford, which requires, for the welfare ranking to be valid, that the economy evolves around an efficient steady state[4]. For this reason Thomas' paper restricts the analysis to the case in which the steady state is characterized by an efficient unemployment rate. As a result the paper finds that in absence of a genuine congestion externality which raises the unemployment rate beyond the frictional level and in absence of wage rigidity, the zero inflation policy allows us to achieve the first best as it replicates the

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[2]The same is true in Blanchard and Gali' 2006.

[3]Positive frictional and temporary unemployment exists because of workers moving across different jobs.

[4]Benigno and Woodford 2006 have shown that the linear quadratic approach can preserve correct welfare rankings in presence of an inefficient steady state if and only if second order approximations are taken for the full model (rather than only for the utility). I believe this avenue is not undertaken in Thomas' paper as the model contains an additional complication stemming from the fact that employment is a state variable.

flexible price allocation.

Obviously the Hosios condition does not need to hold empirically, and in fact it does not. For this reason it is important to underlie the consequences of relying solely on an efficient steady state.

Let's therefore analyze the implications of imposing the Hosios 1990 condition. As Thomas shows, under the assumption of zero inflation and with a sale subsidy that offsets the monopolistic mark-up, the planner solution in a model economy with search frictions delivers the following efficiency condition:

$$\frac{\chi z_t^{\psi}}{q(\theta_t)} = \beta E_t \{ \epsilon[u'(c_{t+1})mpl_t h_{t+1} + \frac{\psi \chi}{1+\psi} z_t^{1+\psi} - v(h_{t+1}) - b] + [1 - \lambda - (1-\epsilon)p(\theta_{t+1})]\frac{\chi z_{t+1}^{\psi}}{q(\theta_{t+1})} \} (1)$$

where $q(\theta_t)$ is the probability of filling a vacancy, $p(\theta_{t+1})$ is the probability of finding a job for an unemployed worker, ϵ is the elasticity of the matching function with respect to vacancies, h_{t+1} are labour hours, mpl_t is marginal productivity of labour, $v(h_{t+1})$ is labour disutility, $u'(c_{t+1})$ is the marginal utility of consumption, b is home production, λ is an exogenous destruction rate, z_t is the vacancy rate while χ and ψ are parameters governing a quadratic cost of posting vacancies.

On the other side, in the competitive equilibrium firms' optimal decision delivers the following evolution for labour market tightness:

$$\frac{\chi z_t^{\psi}}{q(\theta_t)} = \beta E_t \{ \xi[u'(c_{t+1})mpl_t h_{t+1} + \frac{\psi \chi}{1+\psi} z_t^{1+\psi} - v(h_{t+1}) - b] + [1 - \lambda - (1-\xi)p(\theta_{t+1})]\frac{\chi z_{t+1}^{\psi}}{q(\theta_{t+1})} \} (2)$$

where ξ is workers bargaining power and the term $\frac{\chi z_t^{\psi}}{q(\theta_t)}$ is a proxy for labour market tightness: the lower is the probability of filling a vacancy the tighter is the labour market. Condition (1) is equivalent to (2), which means that the competitive equilibrium replicates the planner solution, if and only if $\xi = \epsilon$ at all dates and states. This is the Hosios 1990 condition for constrained Pareto efficiency. When workers bargaining power is too high ($\xi \geq \epsilon$), firms have little incentives to post vacancies as their share of matching' surplus is low. In

this case there is an excess of searching workers so that the actual unemployment rate is above the Pareto efficient one. This is the sense in which matching frictions generate congestion externalities that produce involuntary unemployment. Whenever the unemployment rate is above the Pareto efficient one the monetary authority faces an incentive to inflate the economy: the increase in demand raise firms' profits and incentives to vacancy creation thereby reducing the unemployment rate. Such incentives exist independently from the assumption of wage rigidity and are typically associated to search externalities.

Let's now analyze the dynamic implications of inefficient unemployment evolution by inspecting equation (2). Consider a shock which increases expected labour market tightness. The same shock will have a bigger impact on current labour market tightness the higher is value of the bargaining power. When the bargaining power is very high (particularly higher than the elasticity of the matching function with respect to vacancies), those additional fluctuations in labour market tightness produce inefficient unemployment fluctuations. The gap between the inefficient unemployment rate and the frictional one enters the new keynesian Phillips curve in a way that resembles a cost-push shock. The classical analyses of the optimal policy design in new keynesian framework (see for instance Clarida, Gali' and Gertler 1998) shows that costs push shocks generate trade-offs for monetary policy that imply optimality of non-zero inflation policies. In the context of search models with inefficient unemployment fluctuations cost push shocks arise endogenously as a result of congestion externalities.

3.   Wage Rigidity and Matching Frictions

In Thomas' analyses the assumption of wage rigidity is a prerequisite to obtain deviations from price stability. The main policy prescriptions are therefore conditional to the existence of wage rigidity. For this reason it is essential to question the validity of this assumption and of all its aspects particularly in the context of matching models. There are two issues

that pertain to the nature of wage rigidity in this context.

Wage rigidity is introduced into the model through a staggered structure: as in the Calvo 1983 model it is assumed that an exogenously given fraction of firms does not renegotiate wages in every period. This implies that wage stickiness is exogenously imposed even when firms optimize the discount sum of future profits. Alternatively wage rigidity can arise endogenously as result of agents optimizing decisions. Consider the following two alternatives. Holden 1994 considers a bargaining process with cost of conflict. In this case the threat point depends from the possibility of invoking a conflict, in which case payoffs are shared according to the Rubinstein-Sthal bargaining game. Wage rigidity arises in this context since firms might decide not to change wages to avoid costs of conflicts. A second example is in Hall and Milgrom 2006 who adopt a sequential bargaining approach as in Binmore, Rubinstein and Wolinski 1986. Threat points in this case depend on delaying rather than abandoning the firm/worker relation and it is the delaying choice to induce wage persistence. This feature appears particularly appealing also as delaying sounds as a more credible threat than abandoning the firm/worker relation. Overall as one of the goals of the synthesis between new keynesian models and non-walrasian theory of unemployment is to provide convincing micro-foundations for labour market relations, the choice of modelling wage rigidity through Calvo exogenous probabilities might appear unsatisfactory.

The second issue is more specific to the nature of wage rigidity into matching models. In these models wage rigidity applies only to new hirings rather than on ongoing job relationships. While it is widely recognized that aggregate wages show significant persistence, there is currently a debate on whether individual wage rigidity applies to new hirings or to ongoing job relationships (see for instance Pissarides 2007, Haefke, Sonntag and van Rens 2007). In fact so far evidence based on individual/panel data analysis documents wage rigidity for ongoing employment relationships (see for instance Bils 1985, Solon, Barsky and Parker 1994, Beadry and Di Nardo 1991). Furthermore Devereux and Hart 2006 and Barlevy 2001

find that for job movers wages are flexible while Haefke, Sonntag and van Rens 2007 show evidence that wages for newly hired workers are much more volatile than aggregate wages and that they move one-to-one with productivity. The verdict is not definite as the jury is still out there, however those different views make us question whether the introduction of wage rigidity into matching models is an appropriate choice. It is certainly true that wage rigidity in matching models helps in reproducing high employment volatility[5], however one could consider alternative models which deliver wage rigidity *for ongoing relationships* and reproduce high employment volatility: some examples are the implicit contract theory (Bewley 1989), union agreements and efficiency wages (Akerlof 1982, Yellen 1984).

4. Conclusions

Thomas' paper presents a careful and detailed analysis of optimal policy in a model with matching frictions and wage rigidity and it moves a step forward toward designing principles of optimal policy in new Keynesian models. In fact introducing real distortions into the new Keynesian framework adds realisms to the model and improves its ability in providing policy guidelines.

The introduction of matching frictions into the new Keynesian framework provided a useful benchmark for policy analyses as it revived the traditional unemployment-inflation trade-off in a microfounded context. However additional empirical tests to validate the model are needed as many issues still remain unresolved. For instance Krause and Lubik 2006 show that the same model is unable to account for the observed inflation persistence even under the assumption of high wage rigidity. Also an empirical comparison between this model and a new keynesian model embedding alternative theories of non-walrasian unemployment determination (such as implicit contracts, unions agreements, efficiency wages) is needed to provide full validation.

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[5]Shimer 2005 and Hall 2005.

References

Barlevy, G.. (2001) "Why Are the Wages of Job Changers So Procyclical.". *Journal of Labor Economics*, 19, 837–878.

Barro, R.. (1977) "Long-term Contracting, Sticky Prices and Monetary Policy". *Journal of Monetary Economics,* 3(3), 305-316.

Beaudry, Paul and John DiNardo. (1991) "The Effect of Implicit Contracts on the Movement of Wages over the Business Cycle: Evidence from Micro Data". *Journal of Political Economy*, 99(4), pp.665-88.

Bils, M.. (1985) "Real Wages Over the Business Cycle: Evidence From Panel Data". *Journal of Political Economy*, 93, 666–689.

Blanchard, Olivier, and Jordi Gali'. (2006) "A New Keynesian Model with Unemployment". Mimeo.

Calvo, G. (1983). "Staggered Prices in a Utility Maximization Framework", *Journal of Monetary Economics*, 12, 383-98.

Clarida, R., J. Gali' and M. Gertler. (2001) "Optimal Monetary Policy in Open versus Closed Economies: An Integrated Approach". *American Economic Review,* 91(2), 248-252.

Devereux, Paul J. (2001) "The Cyclicality of Real Wages Within Employer-Employee Matches". *Industrial and Labor Relations Review,* 54(4).

Haefke, Christian, Marcus, Sonntag and Thijs van Rens. (2007) "Wage Rigidity and Job Creation". Economics Working Papers 1047, Department of Economics and Business, Universitat Pompeu Fabra.

Hall, Robert. (2003) "Wage Determination and Employment Fluctuations". NBER W. P. #9967.

Hosios, Arthur J.. (1990) "On the Efficiency of Matching and Related Models of Search and Unemployment". *Review of Economic Studies*, 57(2), 279-98.

Krause, Michael and Thomas Lubik. (2006) "The (Ir)relevance of Real Wage Rigidity in the New Keynesian Model with Search Frictions". *Journal of Monetary Economics*.

Mortensen, D. and Christopher Pissarides. (1999) "New Developments in Models of Search in the Labor Market". In: Orley Ashenfelter and David Card (eds.): Handbook of Labor Economics.

Shimer, Robert. (2005) "The Cyclical Behavior of Equilibrium Unemployment and Vacancies". *American Economic Review*,vol. 95(1), 25-49.

Solon, G., R. Barsky, and J.A. Parker. (1994) "Measuring the Cyclicality of Real Wages: How Important is Composition Bias?" *Quarterly Journal of Economics*, 109, 1–26.

Yellen, Janet L. (1984) "Efficiency Wage Models of Unemployment". *American Economic Review Papers and Proceedings*, 74(2).

Woodford, Michael. (2003) Interest and Prices : Foundations of a Theory of Monetary Policy.