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Comment

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This paper represents the latest installment in a highly influential series of papers in which Paul Beaudry and Franck Portier shed light on the empirics and theory of demand shocks. The present paper makes two contributions. One is to show that a standard neoclassical model augmented to allow for labor market segmentation can produce comovement in output, consumption, investment, hours, and the price of capital in response to demand shocks. The second contribution is to argue that labor market segmentation can also improve the prediction of the New Keynesian model for inflation dynamics in response to demand shocks. I find these contributions quite relevant.

In this discussion, I argue that the paper must be interpreted as a very first step, and that whether labor market segmentation is a relevant friction that ought to be incorporated in medium-scale macro models remains to be demonstrated. Specifically, I will argue that it is not clear that existing medium-scale models have a particularly hard time either producing comovement in real variables or explaining observed movements in inflation. I will close by suggesting that a natural next step in this research agenda should be to put labor market segmentation to compete econometrically with other real frictions and nominal rigidities to ascertain whether the data favors its presence.

The New Keynesian Model and Excess Inflation Volatility

Beaudry and Portier motivate their paper by arguing that the standard New Keynesian model predicts that demand shocks are too inflationary, in the sense that the predicted volatility of inflation is much higher than the one observed in reality. I do not concur with this conclusion. I

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believe that it is plagued by both identification and model specification problems. Therefore, I begin by spelling out these concerns and then suggest that the New Keynesian model might not do too badly on the inflation volatility front.

Identification Problems (I)

In arguing that the New Keynesian model predicts too much inflation volatility, Beaudry and Portier use a canonical Phillips curve specification of the form

$$\pi_t = \beta E_t \pi_{t+1} + \kappa y_t + \mu_t, \tag{1}$$

where π_t denotes the inflation rate in period t expressed in deviation from its deterministic steady-state value, y_t denotes the output gap in period t, μ_t is an exogenous and stochastic cost-push shock, E_t denotes the expectations operator conditional on information available in period t, $\beta \in (0, 1)$ is a subjective discount factor, and κ is a parameter that depends, among other factors, on the assumed degrees of price stickiness and imperfect competition.

Beaudry and Portier proceed by assuming that the output gap follows an AR(1) process of the form

$$y_t = \rho y_{t-1} + \epsilon_t, \tag{2}$$

where ϵ_t is an exogenous and stochastic innovation with mean zero and standard deviation σ_ϵ, and $\rho \in (0, 1)$ is a parameter.

To ascertain the implications of the New Keynesian model for inflation volatility conditional on demand shocks, Beaudry and Portier shut off the disturbance μ_t and iterate (1) forward to write

$$\pi_t = \kappa \sum_{j=0}^{\infty} \beta^j E_t y_{t+j}.$$

Then, they use the AR(1) specification for y_t given in (2) to express future expected values of the output gap in terms of its current value. This step yields the following linear restriction involving inflation and the current output gap:

$$\pi_t = \frac{\kappa}{1 - \beta\rho} y_t.$$

This expression implies the following relation between the standard deviations of inflation and the output gap:

$$\sigma_\pi = \frac{\kappa}{1 - \beta\rho}\sigma_y, \tag{3}$$

where σ_π and σ_y denote, respectively, the standard deviations of inflation and the output gap. Beaudry and Portier calibrate β and κ at 0.99 and 0.125 respectively, following Galí (2008). To calibrate the serial correlation and volatility of the output gap, they proxy the output gap by HP-filtered real per capita output. They estimate $\rho = 0.85$ and $\sigma_y = 1.22$ percent at a quarterly frequency. Using this parameters to evaluate (3) yields $\sigma_\pi = 0.96$, or a predicted inflation volatility of almost 1 percent. By contrast, they report an observed inflation volatility of 0.22 for the United States in the post-Volker era, about one-fourth the value predicted by the model. This is the precise sense in which they conclude that the New Keynesian model produces too much inflation volatility.

My first concern with the validity of this result is that it is based on a comparison of unconditional empirical second moments with conditional theoretical second moments. Specifically, in deriving the theoretical restriction (3), linking inflation volatility and the volatility of the output gap, Beaudry and Portier remove the cost-push shock μ_t from the Phillips curve. This means that the relationship between inflation and output-gap volatility given in equation (3) is conditional on no movements in μ_t. However, their empirical estimate of the volatility of the output gap does not control for any sources of disturbance and therefore should be interpreted as an unconditional measure of volatility. The same is true for their empirical estimate of the volatility of inflation. It follows that their finding that the unconditional empirical estimates of inflation and output volatility do not satisfy restriction (3) is not necessarily an indication that the New Keynesian model does not fit the data.

Identification Problems (II)

In the Phillips curve considered by Beaudry and Portier, given in (1), the variable y_t denotes the output gap, defined as the difference between output and flexible-price output. Beaudry and Portier evaluate the Phillips curve using empirical proxies of the output gap, such as HP filtered output, among others. This is problematic, because there is no natural empirical counterpart for flexible-price output. For instance, the trend component of HP filtered output, which is one of the measures used by Beaudry and Portier, is not a good proxy because flexible-price output is not a trend. Rather, flexible-price output is the output process induced by the model in the absence of nominal rigidities. As a result, in general, flexible-price output will be driven by all of the usual sources of disturbances included in business-cycle models, such as neutral and investment-specific productivity shocks, government spending shocks, preference shocks, and so forth, and will, therefore, contain a significant business-cycle component. A similar criticism applies to other measures of the output gap used by Beaudry and Portier, such as those in which flexible-price output is proxied by a measure of total factor productivity. It follows that the fact that their measures of the output gap, when used to evaluate restriction (3), induces too much predicted volatility in inflation, cannot necessarily be attributed to poor fit of the New Keynesian model.

If one were to insist on using the output gap to evaluate (3), the correct way to proceed is one that recognizes that flexible-price output is inherently a model-specific concept. A model-consistent procedure for uncovering the flexible-price series of output is as follows: given a set of observables, such as data on output and inflation, and the theoretical model, use a filter, such as the Kalman filter, to estimate the realization of shocks that hit the economy during the sample period in question. Then modify the model by removing all sources of nominal rigidity. Next, simulate this modified model using the estimated series of shocks. The resulting series of output is the flexible-price output series. This measure can then be subtracted from the actual output series to obtain an estimate of the output gap. Clearly, none of the output gap proxies used by Beaudry and Portier is likely to coincide with the one that would result from applying this procedure.

Can the New Keynesian Model Explain Inflation Dynamics?

The canonical New Keynesian model considered by Beaudry and Portier is too stylized to provide a reasonable explanation of observed business cycles.

For this purpose, the existing macroeconometric literature uses medium-scale models with a variety of nominal and real rigidities, including sticky prices, sticky wages, habit formation, investment adjustment costs, and variable capacity utilization.

How do these models perform on the inflation front? Table C1 displays the standard deviation of inflation predicted by three well-known

Table C1
Can the New Keynesian model explain observed inflation volatility?

	Std. dev. Inflation		
Study	Model	Data	Sample
JPT (2011)	0.53	0.63	1954:3–2009:1
JPT (2010)	0.55	0.60	1954:3–2004:4
SW (2007)	0.57	0.62	1966:1–2004:4
SW (2007)	0.34	0.25	1984:1–2004:4

medium-scale, New Keynesian models—Justiniano, Primiceri, and Tambalotti (JPT 2010, 2011) and Smets and Wouters (SW 2007). All three models do quite well in replicating the observed volatility of inflation.

Of particular interest is the last line of the table, displaying the performance of the SW model when estimated using data covering the post-Volker period. Beaudry and Portier argue that business cycles in the United States during the post-Volker era were driven predominantly by demand shocks and that the New Keynesian model has a hard time explaining the response of inflation to this type of shock. Table C1 shows that the medium-scale New Keynesian model performs quite well along the inflation-volatility dimension, even during the post-Volker sample.

But what if the post-Volker era was not characterized predominantly by demand shocks? Then, estimating the New Keynesian model over this period and examining the unconditional behavior of inflation would not be an appropriate test of the ability of the model to explain movements in inflation conditional on demand shocks. A more suitable approach would be to isolate in the data the response of inflation to a particular demand shock and then contrast this response to its theoretical counterpart. This is precisely what Christiano, Eichenbaum, and Evans (CEE 2005) do in their celebrated 2005 paper. The demand shock they study is an exogenous innovation in monetary policy. Figure C1 displays the empirical and theoretical impulse responses of inflation to an unexpected reduction in the nominal interest rate. The figure also displays the 95 percent confidence band associated with the empirical impulse response. The CEE model does a good job at explaining inflation dynamics. The predicted response of inflation is within the confidence band and close to the point estimate of its empirical counterpart.

In my view, the evidence presented in this section shows that the New Keynesian model does not have a serious problem explaining observed movements in inflation.

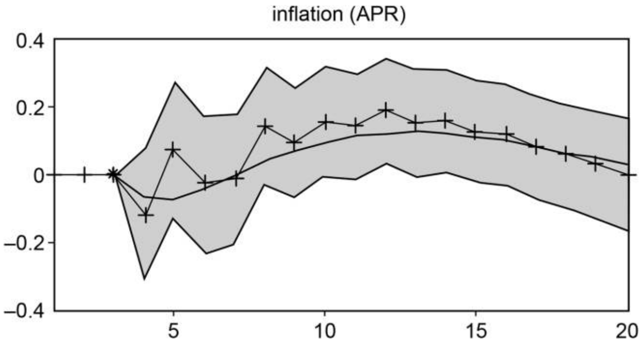

Fig. C1. Inflation response to an expansionary monetary policy shock
Source: CEE (2005).

Can the New Keynesian Model Generate Comovement?

An important motivation of the Beaudry and Portier paper is the desire to build a transmission mechanism capable of generating comovement in output, consumption, investment, and employment, among other variables in response to demand shocks. This is a legitimate aspiration, for it is well known, at least since Barro and King (1984), that the neoclassical model predicts a negative correlation between consumption and output or hours in response to demand shocks. It is also the case, however, that in the past two decades there has been a significant amount of work devoted to addressing this difficulty. In particular, the literature on endogenous countercyclical markup movements, be they involuntary, as in sticky-price models with imperfect competition (e.g., Galí 2008), or voluntary, as in models with oligopolistic pricing (Rotemberg and Woodford 1992), or with deep habits (Ravn, Schmitt-Grohé, and Uribe 2006), has delivered DSGE models capable of inducing comovement in response to demand shocks.

Table C2 shows that the medium-scale New Keynesian model estimated by JPT (2011) does a very good job at explaining the correlation with output growth of consumption growth, investment growth, inflation, and the growth of the relative price of investment. Other estimated models do equally well. The CEE (2005) model is, again, of special interest because it focuses on the New Keynesian model's ability to explain the effect of a demand shock, which is at the heart of the Beaudry and Portier paper. Figure C2 shows that the model estimated by CEE (2005) captures well the impulse responses of output, consumption, invest-

Table C2
Can the New Keynesian model generate comovement?

	Correlation with output growth JPT (2011) model	
Variable	Model	Data
Consumption growth	0.40	0.58
Investment growth	0.85	0.89
Inflation	–0.13	–0.37
Growth of real. price. inv.	–0.06	–0.17

ment, and the real wage to an unexpected reduction in the nominal interest rate.

Based on the evidence presented in this section, I conclude that the New Keynesian model does not have difficulties generating aggregate comovement. I will argue shortly, however, that this does not mean that there is no room in DSGE models for the friction proposed by Beaudry and Portier.

The Ending That Was Not

The present paper begins by arguing that the canonical Phillips curve does a poor job at explaining inflation volatility during the post-Volker era. As a remedy, the authors propose augmenting the New Keynesian model with labor market segmentation. My expectation was that the paper would end by showing that the Phillips curve that emerges from their proposed model performs better on the inflation volatility front. I also expected, of course, that in doing this, the authors would follow exactly the same methodology they employ to evaluate the standard Phillips curve at the beginning of the paper. My expectations were not fulfilled. The paper does not show this exercise. So in this section I wish to fill this gap.

Can labor market segmentation explain inflation volatility? This is how I imagined Beaudry and Portier would answer: The model with labor market segmentation delivers a Phillips curve of the form[1]

$$\pi_t = \beta E_t \pi_{t+1} + \frac{\kappa}{\xi} y_t + \mu_t.$$

Notice that this expression is identical to its canonical counterpart given in (1), except that the output-gap coefficient is now κ/ξ instead of simply κ, where ξ is a new parameter.

Assuming, as Beaudry and Portier do at the beginning of the paper,

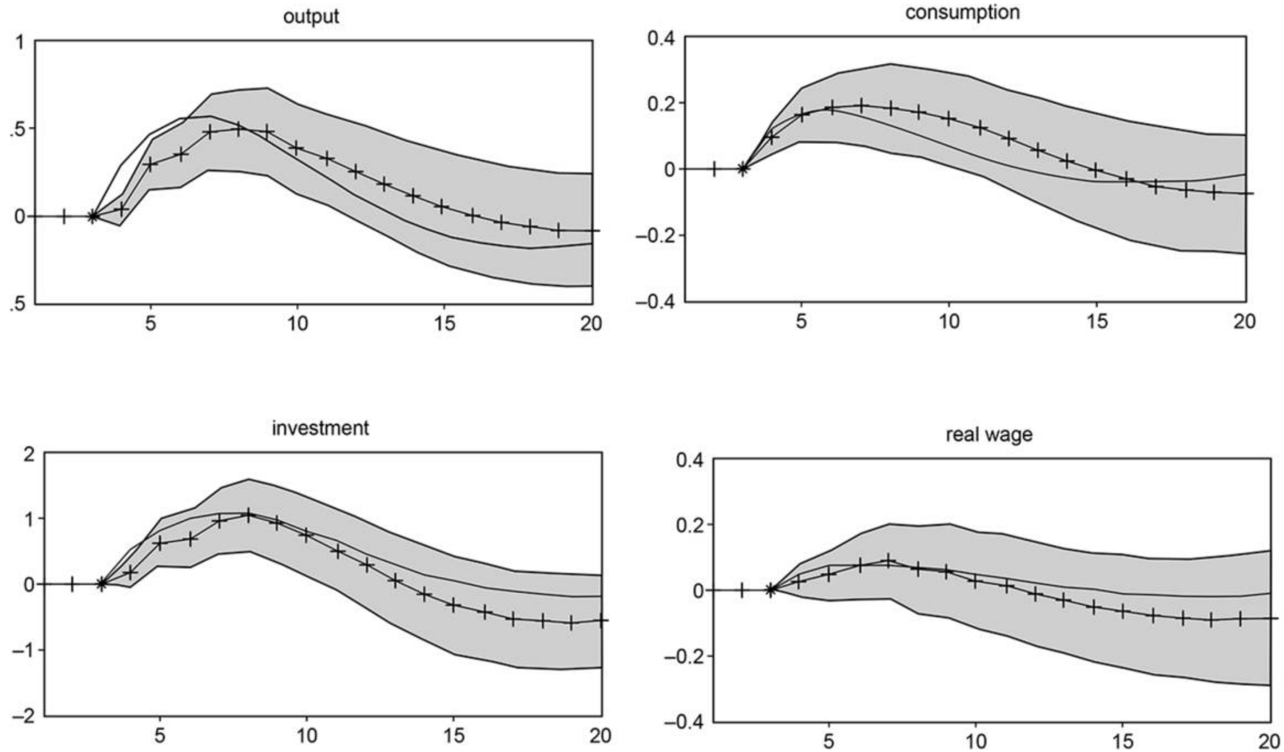

Fig. C2. Response of key macro variables to A monetary easing
Source: CEE (2005).

that the output gap follows the AR(1) process given in (2), and that $\mu_t \equiv 0$, one can solve for inflation in terms of the current output gap to obtain $\pi = [(\kappa/\xi)/(1-\beta\rho)]y_t$. This expression yields the following relation between the volatilities of inflation and the output gap

$$\sigma_\pi = \frac{\kappa/\xi}{1-\beta\rho}\sigma_y.$$

Ceteris paribus, the larger is ξ, the lower is the volatility of inflation associated with a given volatility of the output gap. In this regard, an increase in ξ has the same effect as a reduction in κ caused by raising the degree of price stickiness.

How big does ξ have to be in order for this modified Phillips curve to replicate the observed inflation volatility? If we stick to the methodology of Beaudry and Portier to evaluate the model, the answer is around 4. To see this, recall that under the standard formulation, and after estimating/calibrating κ, β, ρ, and σ_y, Beaudry and Portier find that the volatility of inflation implied by the canonical model is four times as large as its observed counterpart. Setting ξ at 4 would therefore bring model and data together.

Is 4 a reasonable value for ξ? To answer this question, we have to go a bit deeper and express ξ as a function of structural parameters. It can be shown that ξ takes the form

$$\xi = 1 + (1 - s_c s_{cc})\epsilon_{hw},$$

where s_c denotes the consumption share in GDP, s_{cc} denotes the share of consumption of workers in the consumption sector in total consumption, and ϵ_{hw} denotes the Frisch labor supply elasticity. Based on the fact that the investment share in GDP is around 80 percent, and lacking (time to find) information on s_{cc}, as a first approximation I set $s_c = s_{cc} = 0.8$. I then ask how big the labor supply elasticity, ϵ_{hw}, has to be to imply a value of 4 for ξ. According to the formula given earlier, the answer is $\epsilon_{hw} = 8.3$. Is this number reasonable? The answer is not clear. As is well known, the value of the labor supply elasticity is not uncontroversial. Microeconomic evidence suggests that it is close to zero, but macroeconomic studies point at much higher values, possibly closer to 8 than to 0. This is the ending I imagined.[2]

Conclusion

This is an excellent paper. It proposes a transmission mechanism with the potential to improve the New Keynesian model's predictions regarding inflation dynamics and comovement. I argued that existing estimated medium-scale versions of the New Keynesian model do not perform a bad job along these two dimensions. But this does not mean that there is no room for the mechanism proposed by Beaudry and Portier. The relevant question is, in my opinion, what combination of nominal and real rigidities is favored by the data. In this light, I conclude that an econometric estimation of a full-blown DSGE model in which labor market segmentation competes with other real frictions and nominal rigidities will tell whether their proposed transmission channel is here to stay.

Endnotes

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1. A similar expression arises when one replaces the standard assumption of a rental market for physical capital for the assumption of firm-specific capital formation. So the reduced forms of models with labor market segmentation or firm-specific capital formation seem to be homophormic.

2. Of course, if the ending had been this, I would have criticized it on the same grounds as I criticized the author's evaluation of the canonical New Keynesian model.

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