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Turnovsky, S., and V. d'Orey. 1989. The choice of monetary instrument in two interdependent economies under uncertainty. *Journal of Monetary Economics* 23 (1): 121–33.
Woodford, M. 2003. *Interest and prices: Foundations of a theory of monetary policy.* Princeton, NJ: Princeton University Press.

Comment Christopher A. Sims

The chapter sets up a state of the art two-country calibrated model in which monetary policy has welfare effects. It uses a second-order expansion to get accurate calculations of these effects, using the model's own agent utility functions, and thereby gives us a prototype of how this analysis should be done. But as the authors acknowledge in various caveats in the text, it is really only a prototype. There are many aspects of the model that are dubious and likely to be important to the conclusion. Most of my comments, therefore, point out questionable aspects of the chapter. At the end, I provide a constructive suggestion.

The Nature of the Game

The chapter models interaction of monetary authorities as a Nash equilibrium, but the nature of such an equilibrium depends crucially on what variables each player treats as given when choosing the player's own moves. The chapter's central case is that each monetary authority takes the entire past and future of the other's money stock as given in optimizing its own money stock choice. This is certainly unrealistic, and the chapter's own sensitivity analyses show that its conclusion that the welfare gains from cooperation are small is sensitive to this choice.

It is perhaps worthwhile to catalog the results of the chapter's sensitivity analysis: if the policy choice variables are the time paths of interest rates, the result is instability—in other words, extremely large welfare losses from noncooperation. The same is true if the policy choice variable is the producer price index (PPI). If the choice variable is consumer price index (CPI) path, the losses from noncooperation are finite, but ten times larger than in the case where the money time path is the choice variable. When the choice variables are the coefficients in a Taylor rule, the losses from noncooperation are minuscule, but "cooperation" in the choice of these coefficients leaves the equilibrium welfare far from the Ramsey optimal solution—by an amount

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of the same order of magnitude as the cost of noncooperation with the CPI choice variable.

This last observation suggests another reason to consider the chapter's results skeptically: except for the experiment with policy rule coefficients as choice variables, monetary authorities are assumed to set policy with complete information as to the nature of the shocks that have hit the economy, when in fact one of the key conundrums of monetary policy is the difficulty of being sure what the nature of recent shocks has been. This is why both the cooperative and noncooperative Taylor rule equilibria in the chapter give lower welfare than Ramsey: the Taylor rule policies depend only on a few clearly observable variables, while the Ramsey policies (and the other Nash policies in the chapter) do not impose such a constraint.

Notice that I have been talking about the "costs of noncooperation." It is traditional in this literature to study what are called "gains from cooperation." This suggests that we are studying the effects of doing something new in the way of cooperation. But in this chapter, and probably in reality, historically estimated policy rules give rise to behavior that is much closer to the fully cooperative equilibrium than to the noncooperative equilibrium. In fact, central banks are acutely aware of the likely reactions of other central banks to their own policy actions, and few now make policy, or assume that others make policy, based on M time paths. We are probably, therefore, in an equilibrium much more sophisticated than Nash equilibrium, with reputation playing an important role. Nonetheless, it is worth asking what could go wrong if central banks did attempt "beggar thy neighbor" policies, and the chapter should be considered in that light.

There is an interesting and consequential monetary policy game going on right now, involving international policy interactions that are not considered in this chapter. Will the United States take advantage of its ability to reduce domestic fiscal obligations by inflating away the value of its debt? Will non-U.S. monetary authorities be tempted to be the "first to unload" U.S. nominal debt? Doepke and Schneider (2006) argue that the benefits to the U.S. population as a whole of doing this are at an historic high. In the chapter's model, though, only U.S. nominal securities are traded. In fact, valuation effects depend on net positions in assets of both (all) denominations. These effects are large relative to those analyzed in this chapter.

Other Dubious Aspects of the Model and the Results

The model is calibrated to make about 70 percent of output explained by productivity and labor supply shocks in the long run. These long-run percentages are very poorly pinned down in the data; across different early Smets/Wouters papers the percentages jump around, in some cases with technology shocks given a minor role. At one- and two-year horizons, the percentages attributed to productivity shocks are usually much smaller. Is that true here? This chapter's percentages are at the upper end of the range in the literature fitting big, multishock models. The chapter cites papers by Smets and Wouters from 2003 and 2007 that display estimated dynamic stochastic general equilibrium (DSGE) models of the euro area and the United States, respectively, to support its specification that 70 percent of output variance is accounted for by technology and labor supply shocks. But in the first of those papers, for the euro area, the percentages of long-run variance in output accounted for by technology, labor supply, markup shocks, and monetary policy shocks are 8, 33, 3, and 28, respectively, whereas in the current chapter the corresponding percentages are 55, 20, 1, and 6. The percentages in the later paper, about the United States, are in line with the percentages in the current chapter, but in that paper the markup shocks account for almost no long-run variance, even for inflation.

Because technology shocks offer little room for monetary policy to offset them, it seems likely that the large role attributed to technology shocks might be a reason for the chapter's small estimates of the welfare effects of monetary policy coordination. In fact, the chapter's own discussion makes clear that "markup shocks" are the dominant source of gains from cooperation. It would have been useful, therefore, to see a sensitivity analysis in which the relative sizes of the shock variances were varied over the range observed in the empirical literature.

The model assumes full insurance of individual labor income fluctuations. Modeling the distribution of the heterogeneous effects of aggregate fluctuations on individuals may not be important for matching aggregate time series behavior, but for welfare evaluation it is critical. Despite habit in consumption, the model implies very limited welfare losses from volatile responses of interest rates, consumption, and gross domestic product (GDP) to markup shocks in the noncooperative solution. This conclusion would probably change if the limited insurability of the effects of most individual job losses were taken into account.

The chapter's model contains "markup shocks" and "uncovered interest parity" (UIP) shocks. The markup shocks play a central role in generating inflation, while in the calibrated model the UIP shocks, though large, are unimportant in explaining other variables. Because the interpretation of these shocks is unclear, the assumptions about their properties should be checked. The markup shocks are treated in the model as a varying subsidy to production, but there is obviously no such thing in reality. Of course other interpretations are possible, but since the shocks are somewhat ill-defined, the assumption that they are orthogonal to other shocks, and particularly policy shocks, should be checked. The same is true for the large UIP shocks. In both cases, it is assumed that the shocks are orthogonal to other shocks, but by calculating the implied values of the shocks in the actual data, it should be possible to check whether the estimated realized shocks are reasonably close to satisfying these assumptions.

The model does "microfounded" welfare calculations, using the model's own specification of agents' utility function. But in the model the household utility function and the technology include elements (habit persistence, investment adjustment costs, and shocks thereto) that help match macro time series facts but have little direct micro empirical support. The Calvo pricing leads to welfare costs arising from dispersion in output levels across firms. It is doubtful that this is the main source of costs of inflation, and there is again no empirical microfoundation for this aspect of the "microfounded" macro model. Idiosyncratic price volatility, combined with sluggish response of price aggregates to monetary policy, emerges naturally from information-theoretic models. But these would have very different welfare implications.

Because the welfare measure is therefore of uncertain value, it would be interesting to have more discussion of what the effects of noncooperation are on the behavior of the economy generally, as opposed to effects on the one-dimensional welfare measure. The responses of the economies to markup shocks are drastically different in the noncooperative Nash equilibrium. Interest rates, consumption, and GDP oscillate widely for several periods in response to these shocks, as the monetary authorities try, without success, to shift negative effects onto each other. If we thought the model reliable in predicting effects of policy changes on model variables, we might well characterize these differences between noncooperative and cooperative solutions as big, not small.

Reference

Doepke, M., and M. Schneider. 2006. Inflation and the redistribution of nominal wealth. *Journal of Political Economy* 114 (6): 1069–97.