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Discussion

Francesco Giavazzi opened the discussion by following up on Charles Engel's comment that the response of the nominal and real exchange rates imply that a contractionary monetary shock raises domestic inflation relative to foreign inflation. Giavazzi asked whether this empirical result is simply a manifestation of the price puzzle documented in VAR studies for US data and whether this might be addressed by using other observables to control for price markup shocks. He also noted that changes in fiscal policy are not considered as a possible explanation for monetary policy shocks. Giavazzi suggested that fiscal shocks might explain both monetary shocks and the resulting behavior of the exchange rate.

Lars Hansen suggested that the authors could link their work to a related finance literature using recursive utility to explain other asset-pricing puzzles and examine how their parameter values compare. Hansen also emphasized that stochastic volatility operates through two distinct channels. Stochastic volatility is directly priced and changes risk premia associated with other shocks. He suggested that the authors try to decompose the effect of stochastic volatility through these channels. Lastly, Hansen advocated caution in using volatility indices like the VIX to proxy for real volatility, as some financial shocks are unlikely to spill over to the real economy.

Marjorie Flavin was not surprised by the authors' finding that increased volatility of monetary shocks leads to a dollar appreciation. She argued that the monetary policy shocks identified by the authors may reflect periods of heightened uncertainty that lead to greater deviations of monetary policy from a standard rule. The association of larger monetary policy deviations and a dollar appreciation reflect a flight to qual-

ity due to some underlying shocks to the financial markets or global economy.

Albert Marcet noted that two-country models with complete markets often generate counterfactual predictions for capital flows in terms of volatility and direction and asked what predictions the authors' model delivers in terms of flows. Marcet also suggested that, given data with many countries, the authors may be able to estimate a panel VAR to reduce standard errors.

Jordi Galí sought clarification on the quantitative size of the effects of uncertainty shocks. He noted that one of their figures illustrated the effect of a 1 percentage point increase in the variance of monetary shocks and asked how large a typical change in the volatility of monetary shocks might be.

Xavier Gabaix argued that the authors' treatment of monetary policy volatility might be too focused on the United States and that a more symmetrical model could use monetary policy shocks overseas to distinguish between country-specific shocks and the type of global financial shocks described by Flavin. For instance, the shock to the Fed funds rate in 2008 was clearly a response to the credit crisis rather than a pure monetary policy shock. Gabaix also asked about the level of exchange rate volatility in the model, noting that two-country models often exhibit very low levels of exchange rate volatility. He pointed to his work with Emmanuel Farhi that could explain deviations from uncovered interest rate parity using both disaster and business cycle shocks.

Marc Giannoni, reiterating comments by Giavazzi and Flavin, noted that the price puzzle could be addressed by using factor analysis to identify the monetary policy shocks, as shown in Bernanke, Boivin, and Eliasz (2005). He cited his recent work with Jean Boivin and Dalibor Stevanovic using factor-augmented VARs in Canadian data to mitigate the overshooting puzzle and deviations from UIP that are found in standard VAR analyses.

James Kahn asked about how the authors addressed issues raised by a binding zero lower bound. Kahn emphasized that at low interest rates, the distribution of monetary policy shocks is skewed and monetary policy may be operating by channels distinct from changes in the interest rate.

Pierpaolo Benigno responded to Engel's comment that the authors could not explain deviations from UIP using shocks to the *level* of monetary policy. Benigno noted that UIP holds to a first-order approximation in their model, so level shocks could not result in any deviations.

Benigno argued that financial frictions would be needed to break UIP in a first-order approximation, or that a level shock may affect UIP in a third-order approximation. Benigno also noted that US inflation falls on impact with a contractionary monetary policy shock but rises in subsequent periods, which causes difficultly in matching the correlations between interest rate differentials and exchange rate differentials.

Benigno acknowledged the concerns of Martin Uribe and Hansen that the VIX may not be a suitable proxy for the volatility of productivity, but noted that estimating the model would be difficult given the model is nonlinear and emphasized this would be the subject of future work. Benigno further explained the intuition behind the result that increases in monetary policy uncertainty appreciate the dollar. He noted that agents prefer dollars in the event of a dollar appreciation due to a contractionary monetary policy shock. A rise in the volatility of monetary shocks magnifies disproportionately the benefit of holding dollars given a contractionary shock implying a dollar appreciation due to an increase in the volatility of monetary shocks.

Responding to Giavazzi, Benigno stated that the nonsystematic response of monetary policy to fiscal policy should be considered a monetary policy shock, but also acknowledged that fiscal policy may be an important factor behind the inflation target shocks. Responding to Gabaix and Flavin, Benigno emphasized that the flight to quality channel is analogous to the hedging motive driving dollar appreciation in the model. Responding to Hansen, Benigno noted that the role of recursive utility may be quite different in a setting where income is not an exogenous process, in contrast to its use in the finance literature. He noted differences relative to models in finance in the response of the yield curve in their model to changes in the risk aversion parameter, stating that future work would focus on ascertaining differences in the behavior of their model versus standard finance models with Epstein-Zin preferences and an exogenous consumption process. Responding to Marcet, he noted that, even with complete markets, recursive utility posed new challenges for solving the model.

Salvatore Nisticò responded to the discussion by Uribe, noting that the authors used Eichenbaum and Evans (1995) as an empirical benchmark, thereby using the one standard deviation error bands. He agreed with Uribe that their VIX measure might not be the cleanest measure of the volatility of productivity shocks but noted its use in related literature. He justified the use of the MOVE index (Merrill Lynch Option Volatility Estimate) to identify time-varying volatility in the inflation tar-

get shocks by citing their theoretical results that inflation target shocks must shift the level of the yield curve. Moreover, to further ensure that their measure of time-varying volatility is capturing changes in the inflation target shock, the authors extract the component of the MOVE index orthogonal to the other volatility measures. Nisticò noted that the ordering of the variables in the VAR is also consistent with their theoretical results since innovations to the level variables can only affect volatility in the next period. As a result, the volatility variables are ordered before the level variables in the VAR. Nisticò closed by acknowledging that Epstein-Zin preferences were not essential for all their results but emphasized that using recursive utility would be necessary for their objective of building a model with realistic asset-pricing behavior that could potentially match multiple facts.

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