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When does the cost channel pose a challenge to inflation targeting central banks?

A. Lee Smith

Economic Research, Federal Reserve Bank of Kansas City, United States

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ABSTRACT

In a sticky-price model where firms finance their production inputs, there is both a lower and an upper bound on the central bank's inflation response necessary to rule out the possibility of self-fulfilling inflation expectations. This paper shows that real wage rigidities decrease this upper bound, but coefficients in the range of those on the Taylor rule place the economy well within the determinacy region. However, when there is time-variation in the share of firms who finance their inputs (i.e. Markov-switching) then inflation targeting interest rate rules frequently result in indeterminacy, even if the central bank also targets output. Adding a nominal growth target to the policy rule can often alleviate this indeterminacy and therefore anchor inflation expectations.

1. Introduction

The advice to central banks that a well-designed interest rate reaction function mechanically adjusts the policy rate more than one for one to deviations of inflation from target (cf. Taylor, 1993) is one of the most robust policy prescriptions in monetary theory. However, the Taylor principle as described above is not without its caveats. Importantly, Bruckner and Schabert (2003), Surico (2008) and Christiano et al. (2010) show that an upper bound may need to be placed on the central bank's reaction to inflation in order to ensure expectations remain well anchored.[1] This constraint on the central bank arises when there is a timing mismatch between when the firm produces its product and when it gets paid for the product. Firms in this situation will typically have to finance inputs with short-term loans called working capital. This environment introduces a cost channel which works counter to the typical transmission mechanism of monetary policy in sticky-price models.

The typical transmission mechanism of monetary policy in New-Keynesian models suggests that central banks can eliminate self-fulfilling inflation episodes by increasing the nominal interest rate more than the increase in inflation. Such an aggressive interest rate hike shifts consumption to the future and therefore decreases current demand, marginal costs, and prices. Whenever the cost-channel is present, however, the increase in nominal interest rates may actually confirm the expected inflation. This could happen, for example, if the central bank tries to eliminate the inflation scare by forcefully raising nominal interest rates. The aggressive interest rate rise increases firms' financing costs and leads to higher marginal costs and, through the Phillips curve, higher inflation.

In practice, central banks have attempted to avoid this feedback loop by targeting measures of inflation excluding debt-servicing costs. Moreover, central banks which target inflation measures that do include direct interest rate effects typically supplement their policy analysis with alternative measures of inflation. Sweden's Riksbank, for example, officially targets CPI inflation, which includes

E-mail address: andrew.smith@kc.frb.org.

[1] Other apparent failures of the Taylor principle involve the interaction of the inflation response coefficient and trend-inflation (Coibion and Gorodnichenko, 2011) and the timing of the stock of money which enters the utility function (Carlstrom and Fuerst, 2001).

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interest payments on mortgages in the price of housing services, but publishes a forecast of CPIF inflation which measures the change in consumer prices while holding fixed mortgage financing costs. The CPIF is similar in this respect to the PCE inflation rate targeted by the Federal Reserve and the HICP inflation measure targeted by the European Central Bank. However, if price setters pass-on changes in their financing cost to customers, as the cost channel posits, then none of these price measures eliminate the indirect effects that changes in borrowing costs have on inflation.

Despite the knock-on effects of interest rate changes on consumer prices, the cost channel may still not pose a significant hurdle to inflation targeting central banks. For example, targeting current inflation instead of expected future inflation significantly enlarges the determinacy regions of interest rate rules in the presence of the cost-channel (Bruckner and Schabert, 2003). In addition, Surico (2008) shows that a "flexible" inflation target (in the sense that stabilizing prices is not the only concern of the central bank) is less likely to induce self-fulfilling equilibria from an overly hawkish central bank. This type of central bank reaction function is consistent with a Taylor rule which includes a reaction to output as well as inflation. Therefore, the presence of the cost channel may only be a theoretical curiosity and not a serious challenge to inflation targeting central banks.

The positive appeal of the cost channel is its ability to explain the empirical regularity that an exogenous monetary policy tightening results in a lower price level only several periods after the policy disturbance (see for example Barth and Ramey, 2001). VAR evidence suggests that prices may increase in the short-run in response to a monetary policy shock before falling. This "price-puzzle" was originally identified by Sims (1992) as a robust feature across several economies, including the U.S., Germany, and France. In an effort to reconcile the puzzling, or at least inertial, response of prices following a monetary policy shock in the data with sticky-price equilibrium models, Christiano et al. (2005) and Henzel et al. (2009) use a minimum distance estimator which reveals that, on average, there is a cost-channel present in the U.S. and the Euro area which helps to explain the gradual fall in prices following a monetary contraction.[2]

These findings are conditional on underlying real-rigidities in addition to the cost-channel and sticky prices. Intuitively, to generate the gradual response of prices in the data to a monetary policy shock, it is necessary to have other frictions, in addition to the cost-channel, which prevent the demand channel from affecting marginal cost in the short-run. Of these frictions, sluggish wage-adjustment is key since it prevents non-financial input cost from changing for firms who rely on labor for production. Therefore, the cost channel, when paired with wage rigidities, is able to generate empirically plausible responses to monetary policy shocks. However, the aforementioned studies of equilibrium determinacy in the presence of the cost channel have typically focused on the case of no wage frictions.

In this paper, I characterize the determinacy regions of interest rate rules when real wages only gradually adjust to the marginal rate of substitution between consumption and labor. I show that for interest rate rules which satisfy the Taylor principle, the determinacy regions shrink when the degree of wage rigidity increases. Although the resulting determinacy regions are smaller, they still imply that interest rate rules with coefficients in line with the Taylor rule place the economy well within the determinacy region.

In addition to relaxing the assumption that real wages are flexible, I also allow the share of firms that need to finance their wage bill to vary over time. Empirical evidence suggests the degree of the cost channel has evolved over time. Whereas, Bruckner and Schabert (2003), Surico (2008) and Christiano et al. (2010) assume a constant fraction of firms finance their inputs, I model the share of firms who are subject to the cost-channel as a 2-state Markov-switching process. In this Markov-switching DSGE (MS-DSGE) model, inflation targeting regimes can induce indeterminacy even if they include a reaction to output. Therefore, the Taylor rule is indeterminate for a wide range of parameters governing the Markov-switching process.

Other nominal targets are not subject to the same pitfalls that plague inflation targeting rules. A small coefficient on nominal money growth in the central bank's reaction function can often eliminate the multiple equilibria that appear under inflation targeting in this MS-DSGE model. Since nominal money demand is a function of interest rates and nominal output, adding nominal money growth to a Taylor rule transforms it into a Taylor rule with interest rate smoothing and a nominal GDP growth reaction. Analytic results from the constant parameter model and sensitivity analysis in the MS-DSGE model suggest that nominal GDP growth targeting plays a key role in anchoring inflation expectations independent of interest-rate smoothing. In other words, once the central bank establishes an intermediate nominal GDP growth target, which could possibly be implemented by way of targeting nominal money growth, inflation targeting can then be pursued without producing sunspot equilibria.

This finding is perhaps not surprising considering the existing literature on the global equilibrium determinacy of Taylor rules. In particular, Christiano and Rostagno (2001) and Behabib et al. (2002) find that the global determinacy of the Taylor rule can be restored once the central bank commits to switching to a money-growth targeting regime. The results in this paper are similar in spirit. However, this is the first study which shows that a money growth target can restore local determinacy of an otherwise indeterminate Taylor rule.[3] Implicit in this interpretation of the results is the existence of a stable money demand relationship, thereby allowing the central bank to effectively influence money growth. However, if this were not the case, then the determinacy results would still apply to a Taylor rule with interest rate smoothing and a nominal GDP growth target. Throughout the paper, these two interpretations are equivalent; however, in Section 6, the former interpretation is applied to understand the European Central Bank's "two-pillar" approach to price stability in the context of this model.

[2] These findings corroborate the single-equation estimates of Phillips curves (Ravenna and Walsh, 2006; Chowdhury et al., 2006) and multi-equation decompositions of inflation (Tillmann, 2008) which find the short-term interest rate plays a significant role in shaping inflation in the U.S. and euro area.

[3] Another distinction is that I assume that fiscal policy is passive in the sense of Leeper (1991).

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