Design Flaws in the Construction of Monetary Conditions Indices? A Cautionary Note.

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Abstract:

Monetary conditions indices featured prominently as instrument variables or operating targets, particularly in the inflation-targeting countries during the1990s. In this paper, we show that conventional monetary conditions indices are potentially mis-specified. Under a regime of strict inflation targeting, conventional MCIs are unreliable indicator variables or operating targets if there is a direct exchange rate effect on the rate of inflation in the Phillips Curve. We also point to the limitations of a *standard* MCI under strict inflation targeting. The policymaker can circumvent these limitations by redefining the inflation target. Nevertheless, from a general perspective the usefulness of MCIs in the conduct of monetary policy is doubtful in view of their model-specific nature.

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Introduction

In an attempt to make the conduct of monetary policy more transparent, central banks in several countries designed a so-called Monetary Conditions Index (MCI) in the 1990s. This construct is typically a weighted average of the real rate of interest (r_t) and the real exchange rate (e_t), the two variables that lie at the center of the monetary transmission mechanism in an open economy. The weights that appear in the index are thought of as representing the elasticity of output with respect to the real rate of interest (β) and the real exchange rate (δ), respectively, i.e. the parameters that appear in the IS relation. The *conventional* MCI is typically expressed in the following way:

$$MCI_t = \beta r_t + \delta e_t$$

A rise in the MCI is interpreted as a tightening of monetary conditions while a fall is interpreted as an easing of monetary conditions.[1]

In the recent past, MCIs were used as indicator variables by the central banks of Canada, New Zealand, and Sweden. The MCI was central to the conduct of monetary policy in New Zealand from mid-1997 to March 1999 when it served as the operating target. During this period, the MCI figured prominently in monetary policy statements of the Reserve Bank and was reported on a daily basis by the financial press.[2]

The three countries mentioned above share a common approach to the design of monetary policy. The primary objective of monetary policy is to control the rate of inflation.[3] The target rate of inflation is set in terms of the Consumer Price Index (CPI). This is not surprising in view of the fact that the countries are small open economies. Due to their exposure to international trade, imported inflation is important in determining the overall rate of inflation in these countries.

The purpose of this paper is to show that under strict inflation targeting the existence of a direct exchange rate channel in the Phillips Curve invalidates the interpretation of *conventional* MCIs as indicating the ease or tightness of monetary conditions. For an MCI to be a valid indicator variable or an operating target at all, it is necessary that the weights on the real rate of interest and the real exchange rate include the effect of imported inflation and the output gap on overall inflation.

The paper is organized as follows. In section 2 we lay out the model. Section 3 presents two MCIs that are based on the model of section 2. We distinguish between the *standard* and the *alternative* MCI, either of which is associated with a particular definition of the target variable. Section 4 concludes with a cautionary assessment of the usefulness of MCIs in the conduct of monetary policy.

2. The Model

The model of a small open-economy comprises three equations. With the exception of equation (3), the model is identical to the backward-looking framework presented in Ball (1999). The real interest rate serves as the instrument of monetary policy. The rate of inflation is a weighted average of domestic and imported inflation and is expressed as a percentage point. The real exchange rate and the output gap are expressed in logarithms. All parameters are positive. ε_t and η_t are white noise disturbances. The foreign rate of interest r_t^f is an exogenous random variable.[4]

$$y_t = -\beta r_{t-1} - \delta e_{t-1} + \lambda y_{t-1} + \varepsilon_t \quad (1)$$

$$\pi_t = \pi_{t-1} + \alpha y_{t-1} - \gamma(e_{t-1} - e_{t-2}) + \eta_t \quad (2)$$

$$r_t = r_t^f - E_t e_{t+1} + e_t \quad (3)$$

Equation (1) is an open economy IS relation. The output gap decreases in response to an increase in the real rate of interest and an increase (appreciation) of the real exchange rate. There is a one-period lag between a change in the real rate of interest or the real exchange rate and the ensuing effect on real output. The parameter λ measures persistence in real output.[5] Equation (2) represents an open economy Phillips Curve. The parameter γ captures the extent to which changes in the real exchange rate affect the rate of inflation. The rate of inflation also responds to variations in the level of real output from its potential level. This effect is captured by the parameter α. In both cases there is a one-period lag before the rate of inflation responds to changes in the respective variable.

Equation (3) represents the uncovered-interest rate parity condition. Arbitrage ensures that the expected returns on domestic and foreign bonds are equal.[6]

3. The Monetary Conditions Index Under Strict Inflation Targeting

3.1. The Standard Case

As monetary policy in the countries that use MCIs is geared towards targeting inflation, the paper assumes that the monetary authorities pursue a strict overall inflation target. The central bank announces a strict inflation target two periods into the future: $\pi^* = E_t\pi_{t+2} = 0$. In order to avoid whip-lashing the exchange rate, the central bank decides to attain the inflation target over a two-period horizon through managing the level of aggregate demand.

The first step in the construction of the MCI consists of updating equation (2) by two periods and taking conditional expectations. Doing so yields:

$$E_t\pi_{t+2} = E_t\pi_{t+1} + \alpha E_t y_{t+1} - \gamma(E_t e_{t+1} - e_t) \qquad (4)$$

Imposing the target value for the rate of inflation results in:

$$0 = E_t\pi_{t+1} + \alpha E_t y_{t+1} - \gamma(E_t e_{t+1} - e_t) \quad (5)$$

By drawing on equation (3), we can replace the term involving the real exchange rate with the real interest rate differential:

$$\gamma(r_t^f - r_t) = E_t\pi_{t+1} + \alpha E_t y_{t+1} \quad (6)$$

Updating and taking expectations of equations (1) and (2) produces expressions for the two terms that appear on the right-hand side of equation (6).

$$E_t y_{t+1} = -\beta r_t - \delta e_t + \lambda y_t \quad (7)$$

$$E_t\pi_{t+1} = \pi_t + \alpha y_t - \gamma(e_t - e_{t-1}) \quad (8)$$

Substituting (7) and (8) into (6) yields the monetary conditions index in the standard case of inflation targeting:

$$\omega r_t + (1-\omega)e_t = \frac{\pi_t + \gamma e_{t-1}}{\alpha(\beta+\delta)} + \frac{(1+\lambda)y_t}{(\beta+\delta)} - \frac{\gamma r_t^f}{\alpha(\beta+\delta)} \quad (9)$$

where

$$\omega = \frac{(-\gamma + \alpha\beta)}{\alpha(\beta+\delta)} \text{ and } 1-\omega = \frac{(\gamma+\alpha\delta)}{\alpha(\beta+\delta)}$$

The monetary conditions index appears on the left-hand side of equation (9) while the variables that the index responds to appear on the right-hand side. There are three noteworthy features about this monetary conditions index. Firstly, ω, the weight on the real rate of interest, depends on parameters from *both* the IS relation and the Phillips Curve. Secondly, ω is of indeterminate sign. The magnitude of the weight depends on the relative strength of the *indirect* effect of the real rate of interest on the rate of inflation ($\alpha\beta$) relative to the *direct* effect of the real rate of interest (through the real exchange rate via the UIP condition) on the rate of inflation ($-\gamma$). Thus a rise in the interest rate, which is usually associated with a tightening stance of monetary policy, would lead paradoxically to a loosening of monetary conditions if $\gamma > \alpha\beta$.[7] Clearly, this case underscores the limitations of an MCI – even if amended - as an instrument in explaining to the public current monetary conditions, particularly in small open economies.[8]

The possible paradox inherent in the amended MCI can be illustrated in the case of New Zealand by means of empirical estimates for the parameters $\alpha, \beta,$ and γ. Employing New Zealand data, Dennis (1997) estimates the short-run elasticity of the output gap with respect to the real interest rate (β) to be between *0.16* and *0.13*. With a longer sample period, Hampton (2002) estimates the short-run elasticity of consumer price inflation with respect to the output gap (α) to be *0.11*, and the elasticity of inflation with respect to import prices to be *0.04*. Therefore, if we consider the latter to be a reasonable proxy for γ in our model, an MCI defined by equation (9) will indeed produce the paradoxical result that $\omega < 0$ as $0.04 > 0.01$.

Finally, apart from responding to current inflation and the lagged real exchange rate ($\pi_t + \gamma e_{t-1}$) as well as the output gap (y_t), the monetary conditions index responds to the foreign rate of inflation. Thus, shocks that originate in financial markets abroad and lead to a change in the real exchange rate require an adjustment in the setting of the MCI.

3.2. The Alternative Case

The problems associated with the MCI of equation (9) can be avoided if the policymaker redefines the target for the rate of inflation.[9] When setting the target, the policymaker ought to consider the *direct* effects of expected changes in the real exchange rate on the rate of inflation. Factoring in this effect would necessitate defining the target rate in the following way:

$$\pi^* = E_t\pi_{t+2} + \gamma(E_t e_{t+1} - e_t) = 0 \qquad (10)$$

Equation (10) implies that the target for inflation now resembles a target for domestic inflation as it is purged of the direct effects of expected exchange rate fluctuations. Combining equation (10) with equation (4) yields:

$$0 = E_t \pi_{t+1} + \alpha E_t y_{t+1} \tag{11}$$

After inserting equations (7) and (8) into equation (11), we obtain the alternative monetary conditions index:

$$\omega r_t + (1-\omega) e_t = \frac{\pi_t + \gamma e_{t-1} + \alpha(1+\lambda) y_t}{\alpha(\beta+\delta)+\gamma} \tag{12}$$

where

$$\omega = \frac{\alpha\beta}{\alpha(\beta+\delta)+\gamma} \quad \text{and} \quad 1-\omega = \frac{\alpha\delta+\gamma}{\alpha(\beta+\delta)+\gamma}$$

The alternative MCI disposes of the indeterminate sign of the weight on the real rate of interest and thus allows for a straightforward interpretation of the MCI. A rise in the real rate of interest is associated with a rise in the monetary conditions index. The parameter γ is still important in the determination of the size of the weights on the two variables that make up the MCI. As γ rises the size of ω decreases. The weights on the real rate of interest and the real exchange rate have a very natural interpretation. $\alpha\beta$ captures the effect of the real rate of interest on the rate of inflation while $\alpha\delta+\gamma$ captures the indirect and direct effects of the real exchange rate on the rate of inflation.[10] In sharp contrast to the MCI of equation (9), the alternative MCI does not respond to foreign shocks, i.e. the foreign rate of interest. The alternative MCI responds, however, to the output gap, inflation and the lagged real exchange rate.

According to equation (12), the setting of the MCI responds to the observed rate of inflation adjusted for the effect of the lagged real exchange rate. By adding and subtracting γe_{t-2} on the right-hand side of equation (12), we can express the observed rate of inflation in exactly the same way as it appears in the definition of the target for inflation. The MCI now responds to the adjusted rate of inflation (π_t^{Adj}):

$$\omega r_t + (1-\omega)e_t = \frac{\pi_t^{Adj} + \gamma e_{t-2} + \alpha(1+\lambda)y_t}{\alpha(\beta+\delta)+\gamma} \tag{13}$$

where $\pi_t^{Adj} = \pi_t + \gamma(e_{t-1} - e_{t-2})$.

4. Conclusion

Monetary conditions indices featured prominently as instrument variables or operating targets, particularly in the inflation-targeting countries during the 1990s. In this paper, we have shown that conventional monetary conditions indices are potentially mis-specified. Under a regime of strict inflation targeting, conventional MCIs are unreliable indicator variables or operating targets if there is a direct exchange rate effect on the rate of inflation in the Phillips Curve. We also point to the limitations of a *standard* MCI under strict inflation targeting. These problems are disposed of if the policymaker narrows the definition of the inflation target.

Obvious problems with the design, construction, and interpretation of MCIs remain, however. To illustrate: while the uncovered interest rate parity condition enters into the process of constructing of the *standard* MCI, it does not feature in the construction of the *alternative* MCI. The two cases considered underscore the fact that a MCI is not only a model-specific but also a rather arbitrary construct. There is thus reason to believe that the usefulness of a MCI in the conduct of monetary policy is somewhat questionable.

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Endnotes:

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1 A decrease in e_t signifies a depreciation of the real exchange rate.

2 Hunt (1999) describes the exchange rate and interest rate elasticities of demand as the determinants of the weight on the exchange rate in the MCI designed by the Reserve Bank of New Zealand.

3 Siklos (1999) provides an exhaustive list. See Ericsson et al (1997) or Mayes and Viren (2000) for background information on the construction and use of MCIs and Nadal-De Simone (2001) for a discussion of inflation targeting in small open economies.

4 For expositional ease we assume that $r_t^f \sim N(0, \sigma^2_{rf})$.

5 The restriction that $0 < \lambda < 1$ applies.

6 In view of the high integration of international financial markets, this assumption is more realistic than the one proposed by Ball (1999). He assumes a simple linear relationship between the real rate of interest and the real exchange rate.

7 Alternatively, the MCI could be expressed as follows:

$$r_t + \phi e_t = \frac{\pi_t + \gamma e_{t-1} + \alpha(1+\lambda) y_t - \gamma r_t^f}{(\alpha\beta - \gamma)}$$

where $\phi = \dfrac{\gamma + \alpha\delta}{\alpha\beta - \gamma}$. The relative weight on the real exchange rate is of indeterminate sign. In addition, the response of the MCI to the right-hand side variables depends on the relative magnitude of α, β, and γ. Notice that in case the direct exchange rate effect in the Phillips Curve is absent, the MCI reduces to the conventional specification, the case where the relative weight on the real exchange rate equals $\frac{\delta}{\beta}$.

[8] Small open economies are likely to have larger parameters attached to the real exchange rate in the IS and Phillips relations (i.e. γ and δ will be large) relative to less open economies. Thus, if the MCI is specified as in equation (9), small open economies will be more likely to face the paradox.

[9] If the target for inflation is defined in terms of what Ball (1999) calls "long-run" inflation, then the MCI works as envisaged. But in practice it would be difficult to define a target for $\pi_t + \gamma e_{t-1}$ as it involves the *rate of change* of prices but the *level* of the real exchange rate.

[10] The total effect is given by $\alpha\delta + \gamma + \alpha\beta$ and appears in the denominator of ω.