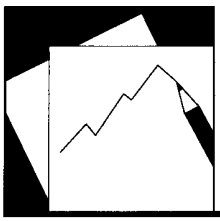

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IMF Working Paper

Is Monetary Policy Effective When Credit is Low?

Ana Carolina Saizar and Nigel Chalk

INTERNATIONAL MONETARY FUND

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IMF Working Paper

Western Hemisphere Department

Is Monetary Policy Effective When Credit is Low?

Prepared by Ana Carolina Saizar and Nigel Chalk[1]

December 2008

Abstract

Monetary policy, at least in part, operates through both an interest rate and credit channel. The question arises, therefore, whether monetary policy is a less potent a device in affecting output and inflation in countries that have low levels of credit and where investment and consumption are not financed by borrowing in local currency. This paper employs a Panel Vector Auto Regression approach to examine the empirical evidence in a broad sample of emerging market countries. The data suggests that the effectiveness of changes in policy interest rates in influencing the path of inflation appear to be unrelated to the level of credit and that, instead, the willingness to allow exchange rate flexibility is a far more important determining factor.

JEL Classification Numbers: E31, E51 and E52

Keywords: Monetary Policy, Bank Credit, Vector Auto Regression, Inflation

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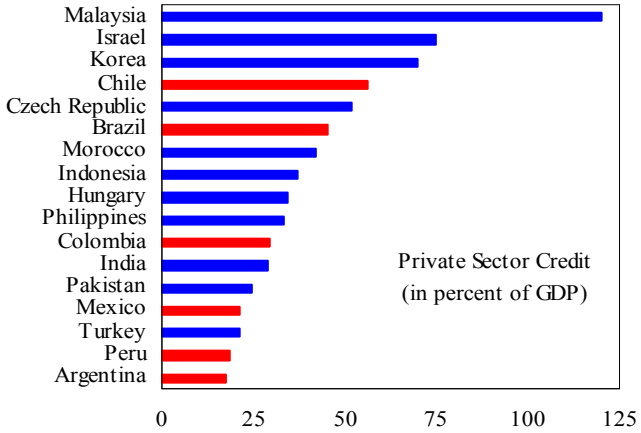
I. BACKGROUND

1. Latin America stands out in the global context as being relatively un-monetized, with low levels of banking sector credit to the private sector. There are several competing explanations for this feature of Latin America which typically revolve around the region's history of high inflations, financial sector crises, government appropriation of bank deposits, weak institutions for the enforcement of property rights, and the relatively high costs of financial services (see Rojas-Suarez (2007)). At the same time, however, monetary policy relies on the belief that, by changing the interest rate in money markets, the monetary authority can impact the cost of credit to households and firms and, through this channel, affect overall economic activity and inflation. Therefore, in economies with relatively low levels of credit and bank intermediation the question arises as to whether monetary policy is, along some dimension, less effective when credit is low?



2. In examining how monetary policy can transmit its effects to the real economy, several channels have been highlighted in the literature. Broadly, these include the interest rate channel, the credit channel, the exchange rate, and through monetary policy's effect on expectations.[2] For at least the first two of these channels, there is clearly a possibility that a low level of borrowing in local currency could lessen the effectiveness of monetary policy. If a relatively small part of investment or consumption is financed at local currency interest rates then changes to policy rates are unlikely to have much impact on aggregate activity. Similarly, if borrowing by households and firms in local currency is low then it seems plausible that the credit channel would be a relatively unimportant determinant of either consumption or investment. This, in the end, is an empirical question. If true, though, monetary policy could find itself constrained in countries where financial intermediaries extend relatively low levels of credit to the economy of particular relevance for Latin America).

3. To examine this contention, this paper looks at monetary policy effectiveness across a range of emerging market countries and investigates the evidence to support an empirical link between the impact of monetary policy and the level of private sector credit. While several different definitions of "effectiveness" are possible, this paper looks at a standardized measure based upon the impact of a one percentage point shock to nominal policy interest rates on consumer price inflation. This metric is identified by applying a uniform vector autoregression framework to the countries in the sample, along the lines of that explored by

[2] See Mishkin (1996) or Kuttner and Mosser (2002) for a discussion on the various channels underlying the monetary transmission mechanism.

Bernanke and Blinder (1992), Bernanke and Mihov (1998) and Sims and Zha (1995) in the context of the United States. Such an approach has been utilized to examine the impact of monetary policy changes in a multitude of countries, including many of the emerging markets in our data sample.[3] Of course, this is not the only possible approach to assessing monetary policy effectiveness. For example, Cecchetti (1998) has taken an entirely different tack in looking at the question of whether monetary policy is efficient.[4] That analysis examines how close monetary policy is to the "optimal" monetary policy that entirely offsets shocks to aggregate demand and minimizes a weighted average of inflation and output volatility (see Clarida, Gali and Gertler (1999)). Krause and Rioja (2006) examine determinants of such policy efficiency, looking at how close central banks get to achieving optimal policy, and find that the level of credit is indeed a relevant factor. The analysis in this paper, however, is distinct from that work and looks at the *effectiveness* of monetary policy rather than examining some notion of optimality.

4. The results of the empirical exercise can be summarized in two central messages. First, across the range of emerging markets in the sample, there appears to be little empirical relationship between the level of credit and the impact of an increase in interest rates on consumer price inflation. This result is borne out both in single country models and in a panel VAR framework which aims to exploit the cross-sectional variation in the data. Second, not surprisingly, the responsiveness of consumer price inflation to an interest rate shock is stronger and more persistent in countries where the currency has been allowed to float, even if that float is still managed. However, even among such countries with flexible exchange rate regimes, there is little evidence that higher levels of credit do anything to increase the effectiveness of monetary policy.

5. These results have direct policy implications. Central banks in emerging markets should not be overly concerned about low levels of financial intermediation as a constraint on the conduct of monetary policy. This may be particularly relevant for many Latin American countries. Instead, both theory and evidence suggest that, to maximize effectiveness, central banks need to allow the exchange rate channel to operate fully and to maximize the impact on private sector expectations by establishing credibility through consistently achieving their inflation goals.

II. THE METHODOLOGICAL APPROACH

6. To evaluate the effectiveness of monetary policy across a range of countries it is first necessary to adopt a metric by which to measure what "effective" actually means. As discussed above, one approach is to look at how far away monetary policy is from minimizing fluctuations in inflation and output. However, in a sense, this paper asks a more primitive question of not how good policy is at achieving an optimal combination of output and inflation variance but rather whether a central bank even can even have an impact on

[3] See Gerlach and Smets (1995) or Kim and Roubini (2000) for an application to the G7, Peersman and Smets (2001) and Angeloni et al (2002) for the Euro area countries, Minella (2001) looking at the case of Brazil, and Martinez et al (2001) for Mexico.

[4] See Cecchetti, Flores-Lagunes, and Krause (2006), Krause (2002).

output and inflation. Certainly, effectiveness is a prerequisite for efficiency but is not a sufficient condition. The approach here is to arrive at a measure of effectiveness by applying a vector autoregression framework to monthly data and estimating the response of inflation, at different horizons, to an unanticipated 1 percentage point increase in interest rates on inflation. The larger the impact on inflation of a given change in policy interest rates, the more effective monetary policy is deemed.

7. However, to arrive at that impulse response function requires making some identifying assumptions on the structure of the economic relationship between policy variables, activity, and inflation. Here, we adopt the commonly used assumption of recursiveness in a system of equations that includes, in this order, the change in industrial production (*ip*) as a measure of activity, consumer price inflation (π), wholesale food and oil price inflation (π^f, π^o), the central bank's policy interest rate (*r*), the growth of monetary aggregates (*m1*), and the nominal effective exchange rate (ρ). The recursiveness identifying assumption is by no means innocuous.[5] The assumption is that, at least in monthly data, activity reacts to other economic variables (such as inflation and interest rates) only with a lag while, at the other end of the scale, exchange rates react quickly to the contemporaneous values of these same variables. Inflation, interest rates, and monetary aggregates are in between, reacting contemporaneously to variables that are lower down in the ordering and with a lag to those that are higher up. The intuition is that policymakers, in setting interest rates, have the contemporaneous variables of *m1* and ρ in their information set at the time when interest rate decisions are made but has only lags of π and *ip* in their information set. We find this to be a plausible identification scheme for monthly data but recognize it is certainly not the only possible one.

8. To obtain the impulse responses to a shock to policy rates we, therefore, estimate the functional form:

$$A_0 Y_t = A(L)Y_{t-1} + B(L)Z_t + \varepsilon_t \qquad (1)$$

Where $Y_t = \left[ip, \pi, \pi^f, \pi^o, r, m1, \rho \right]$ and $Z_t = \left[d, r^* \right]$ are exogenous variables that include a dummy for financial crises (*d*), and the federal funds rate (r^*) as a measure of world interest rates. As discussed above, and in line with the recursiveness assumption, A_0 is assumed to be lower triangular with positive terms on the diagonal.

9. The approach of this paper is to first derive impulse response functions by applying a common VAR methodology to a wide set of emerging market countries.[6] The derived effects of a tightening of monetary policy on inflation for each individual country is then compared

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[5] See Christiano, Eichenbaum, and Evans (1998) for a comprehensive discussion of the recursiveness assumption as well as alternative identification schemes. Bagliano and Favero (1998) also discuss the robustness of results to different identification assumptions.

[6] This includes Brazil, Chile, Colombia, Czech Republic, Hungary, India, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, the Philippines, Poland, South Africa, and Thailand.

with the average level of credit across the countries in the sample. Second, the paper employs a panel VAR model to exploit the cross-sectional variability of the data and to look at whether the level of credit has any discernible effect in determining the impact of interest rates on inflation. Finally, some attempt is made to take into account the prevailing exchange rate regime when examining monetary policy effectiveness.

III. A COUNTRY-BY-COUNTRY ANALYSIS

10. For each of the countries in the sample a common specification to the VAR described by equation (1) is used. In particular, for all countries a VAR was estimated on monthly data from 1996 to 2007 using the optimum number of lags indicated by the Akaike information criterion.

11. The results for many of the countries in the sample broadly replicate the results of previous research work in this area[7] and generally are consistent with the stylized facts outlined by Bernanke and Gertler (1995). In particular, while error bands are large for the impulse response functions, countries tend to follow a typical response of an unanticipated tightening in monetary policy leading, in the short-term, to a slowing of economic activity, an appreciation of the nominal exchange rate and, with a lag, to a decline in inflation. As an illustration, Figure 1 presents the dynamic response of inflation and output to higher interest rates in Brazil, Chile and Pakistan.

12. Looking across the sample, however, there appears to be little systematic relation between the effect of the interest rate on inflation and the level of credit in the economy. To illustrate this, Figure 2 shows a scatter plot of the effect of an unanticipated one percentage point increase in interest rates on inflation at the 3 and 24 month horizon across the countries in the sample (the results are qualitatively similar at other horizons). It is clear that the size of the impact is essentially orthogonal to the level of local currency bank credit to the private sector. The results are unchanged if one looks at total bank credit or the level of monetization (as measured by M2 as a percent of GDP) and also whether the lag length in the VAR is fixed or based on the optimal lag length indicated by the Akaike information criterion.

IV. A PANEL APPROACH

13. To exploit the cross-sectional variation in the dataset, a panel VAR was also estimated across the full sample period of the dataset from 1996 to 2007 with 17 lags as indicated by the Akaike Information Criteria. Fixed effects were included and, while that would suggest a problem of biased coefficients given the presence of lagged dependent variables, the T dimension in the panel is sufficiently large for that to be of less of a concern.[8] Figure 3 presents the impulse response functions for that full panel.

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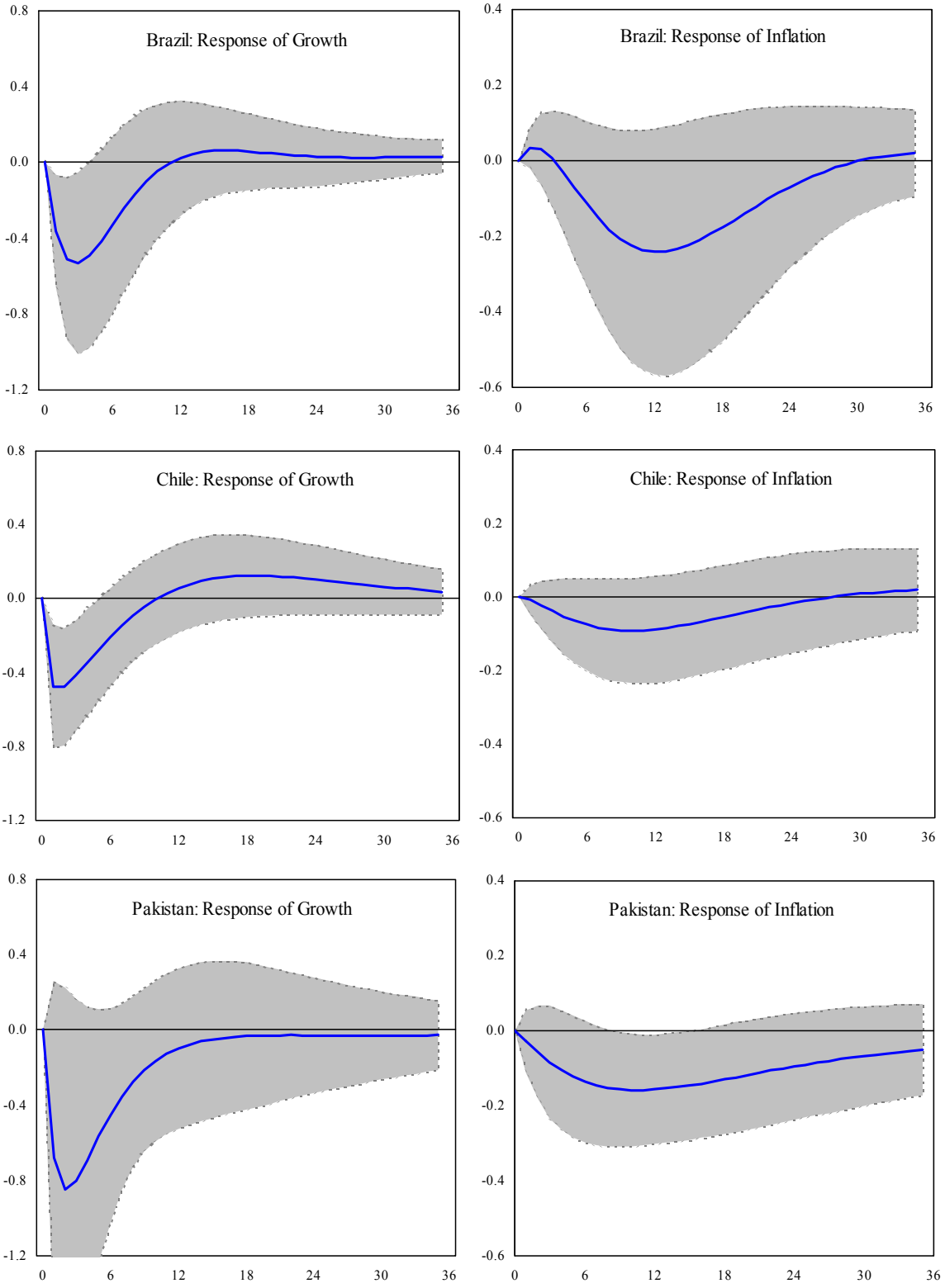
[7] See for example, Minella (2001) for Brazil, Parrado (2001) and Betancour et al (2006) for Chile, Sirivedhin (1998) for Thailand, Martinez et al (2001) for Mexico, Misaico (2001) for Peru, Lyziak (2001) for Poland, De Mello and Moccero (2007) for a sample of several Latin American countries, and Fung (2002) for an analysis of seven East Asian emerging markets.

[8] See, for example, Judson and Owen (1999) for a discussion of the size of bias that concludes it is of less importance in cases where T>30.

Figure 1. Selected Impulse Response Functions of a One Standard Deviation Shock to Interest Rate



Note: Shaded area indicates +/- 2 standard deviations.

Figure 2. Cross-Country Impact on Inflation of a 1 Percent Shock to Interest Rates

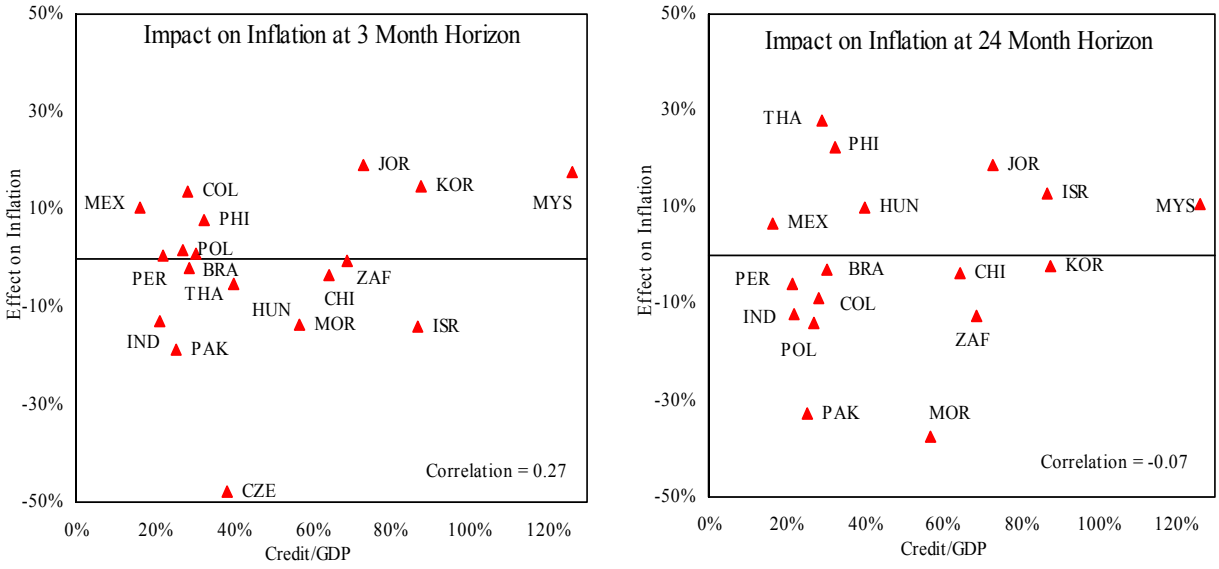
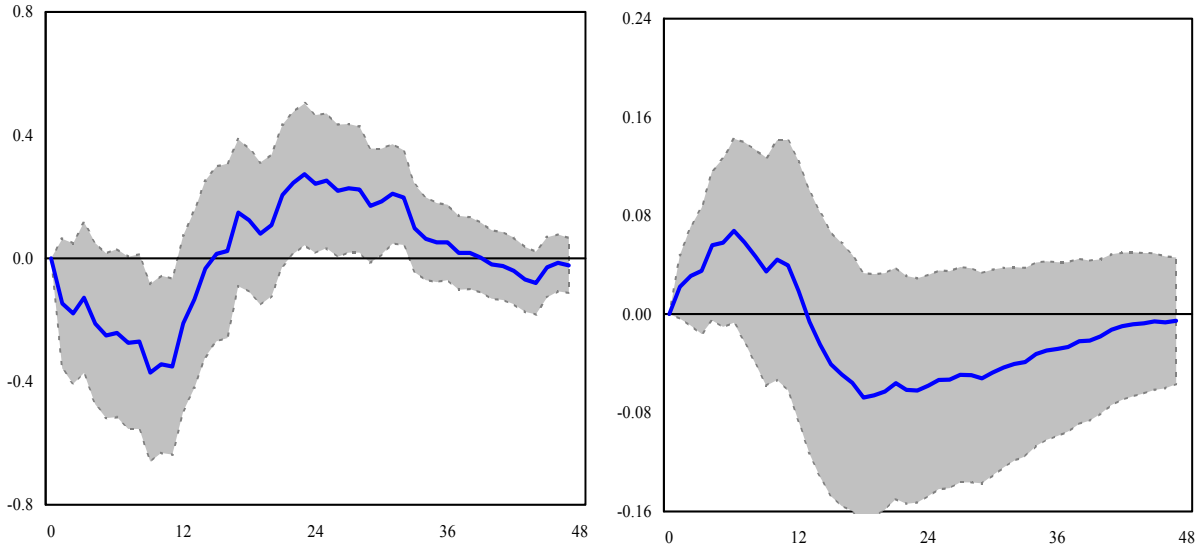


Figure 3. Panel VAR: Impulse Response Function of a One Standard Deviation Shock to Interest Rates



Note: Shaded area indicates +/- 2 standard deviations.

14. As in the individual country cases, a shock to interest rates lowers output initially and, with a lag, reduces consumer price inflation.[9] The VAR impulse responses also suggest the presence of a "price-puzzle" whereby tighter monetary policy initially increasing prices before reducing them at a horizon of around 18 months. This is a common feature of other work in the literature also (see Eichenbaum (1992), Sims (1992), Bernanke and Blinder (1992), Christiano, Eichenbaum and Evans (1998)). It is conjectured that the "puzzle" arises because the specified model omits relevant variables in the information set of the policy maker and, as a result, impulse responses confound the underlying policy shock with nonpolicy (possibly supply or financial market disturbances) that the monetary authorities recognize as signals for an increase in future prices. In U.S. data the inclusion of a series for sensitive materials prices is able to remove the price puzzle.[10] In this specification, despite inclusion of both wholesale food and fuel prices in the VAR, the price puzzle remains in the early months following a shock to interest rates.

15. Taking this baseline VAR model, the next step was to examine whether the level of credit in the economy has an effect on the impact of interest rates on inflation in the broader sample. This was done in two ways. First, the level of credit was interacted with the interest rate variable. And second, to look for possible threshold effects, a dummy variable was interacted with the interest rate for cases where credit was below 40 percent. While interest rates clearly have a significant impact on inflation, as determined by a Wald test on the coefficients, the credit dummy and the level of credit itself interacted with the interest rates are not significant (see Table 1). This would suggest that in countries with higher credit a similar sized shock to interest rates does *not* have a larger impact on inflation than in countries with low levels of credit. This reaffirms the findings from the country-by-country estimates that there is little relationship between the level of credit and the effectiveness of monetary policy.

V. The Importance of The Exchange Rate Regime

16. In the emerging markets sample chosen here, the data spans a range of countries that maintained very different exchange rate regimes through time. Theory would suggest that the exchange rate regime is likely to have an important relationship to the effectiveness of monetary policy. To examine this empirically, the sample was split into either fixed (pegged or crawling bands) or floating (either managed or independently floating) regimes as classified by the IMF Annual Report on Exchange Arrangements and Exchange Restrictions.[11]

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[9] The picture looks qualitatively similar for a shock to monetary aggregates instead of interest rates.

[10] Inclusion of a commodity price index, to clean the monetary policy shocks of the effects of those nonpolicy disturbances that indicate an increase in future inflation, has now become standard practice following Sims and Zha (1995) and Christiano, Eichenbaum and Evans (1996).

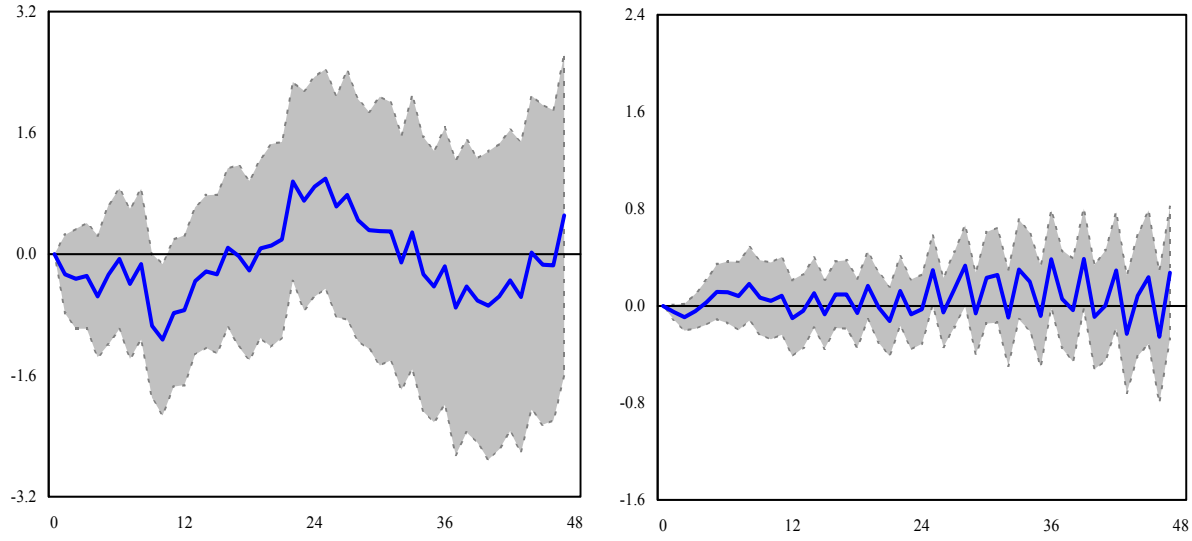
[11] See IMF (2007).

Table 1. Panel VAR: Wald Test Results

Dependent variable: CPI inflation				Dependent variable: CPI inflation			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
Industrial production growth	27.9	17	0.05	Industrial production growth	27.3	17	0.05
Food producer price inflation	43.3	17	0.00	Food producer price inflation	42.4	17	0.00
Oil producer price inflation	31.1	17	0.02	Oil producer price inflation	31.7	17	0.02
Interest rates	27.6	17	0.05	Interest rates	41.7	17	0.00
Interest rates x Level of credit	14.7	17	0.61	Interest rates x Level of credit dummy	19.1	17	0.32
M1 growth	27.3	17	0.05	M1 growth	24.0	17	0.12
NEER	21.4	17	0.21	NEER	27.6	17	0.05
All	246.7	119	0.00	All	249.6	119	0.00

17. Not surprisingly, a unit shock to domestic interest rates is not relevant for either output or prices in a fixed exchange rate regime (Figure 4). In the floating regime, however, as pictured in Figure 5, higher interest rates reduce both inflation and output over the long run.[12] Nevertheless, the short-run price puzzle still appears to be present. Despite interest rates having a clear impact on output and inflation, however, this effect does not appear to be connected to the level of credit in the economy. Specifically, neither the credit nor the threshold dummy have a significant effect on the size of the interest rate effect on inflation in the subsample of floating regimes. Specifically, the interaction variable is not significant as determined by a Wald test of the coefficients (see Table 2). This appears to confirm that, if some exchange rate flexibility is allowed (either by freely floating or maintaining a managed float) monetary policy can have an impact on inflation but that this effectiveness is not dependent on the level of credit.

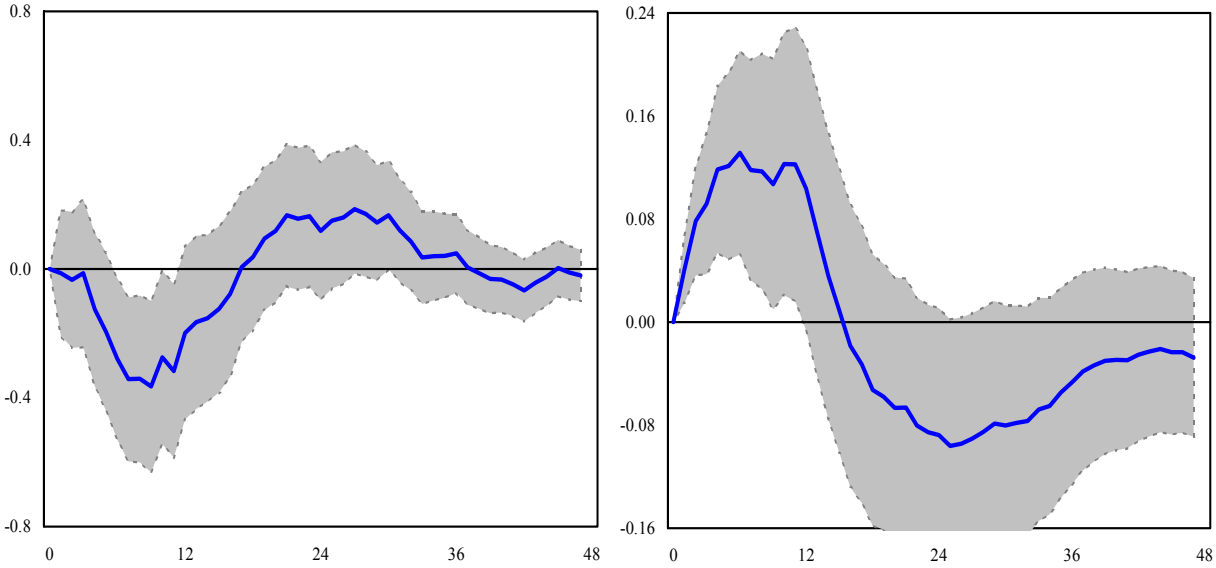
Figure 4. Panel VAR: Impulse Response Function of a Shock to Interest Rates (Fixed Exchange Rate)



Note: Shaded area indicates +/- 2 standard deviations.

[12] In the floating regime, the long run coefficient on the rate of inflation is significant and equals to -0.41.

Figure 5. Panel VAR: Impulse Response Function of a Shock to Interest Rates (Floating Exchange Rate)



Note: Shaded area indicates +/- 2 standard deviations.

Table 2. Panel VAR: Floating Exchange Rate: Wald Test Results

Dependent variable: CPI inflation				Dependent variable: CPI inflation			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
Industrial production growth	25.73	17	0.08	Industrial production growth	26.06	17	0.07
Food producer price inflation	49.61	17	0.00	Food producer price inflation	46.41	17	0.00
Oil producer price inflation	17.93	17	0.39	Oil producer price inflation	16.14	17	0.51
Interest rates	25.69	17	0.08	Interest rates	39.85	17	0.00
Interest rates x Level of credit	17.06	17	0.45	Interest rates x Level of credit dummy	19.32	17	0.31
M1 growth	28.08	17	0.04	M1 growth	31.22	17	0.02
NEER	17.23	17	0.44	NEER	14.72	17	0.62
All	231.85	119	0.00	All	230.29	119	0.00

VI. CONCLUSIONS

18. A sample of emerging markets was used to examine whether monetary policy effectiveness is dependent on the level of credit in a country. This is an important issue particularly for Latin America where levels of credit are typically much lower than those for other emerging markets. It is somewhat reassuring that, in looking at individual countries or at the combined experience of countries in a panel framework, there appears to be little empirical evidence that the level of credit or the degree of monetization represents a constraint on monetary policy. When controlling for the exchange rate regime it is clear that allowing for exchange rates to move flexibly is a far more important factor in ensuring that monetary policy can influence domestic inflation. Finally, even in the subsample of countries with floating exchange rates, there is no evidence that the level of private sector credit has a meaningful impact on the effectiveness of monetary policy.

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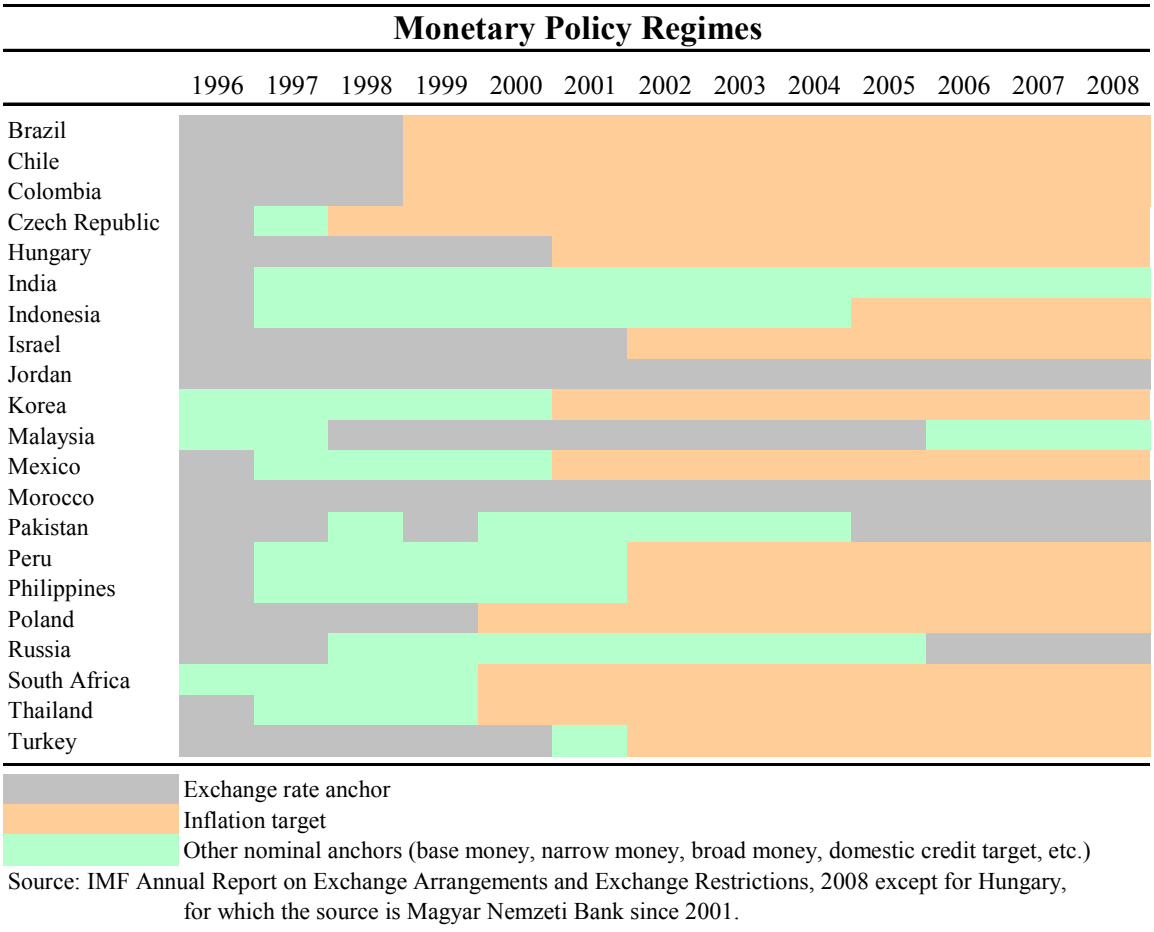
Annex I. Description of the Data

Variables and Sources

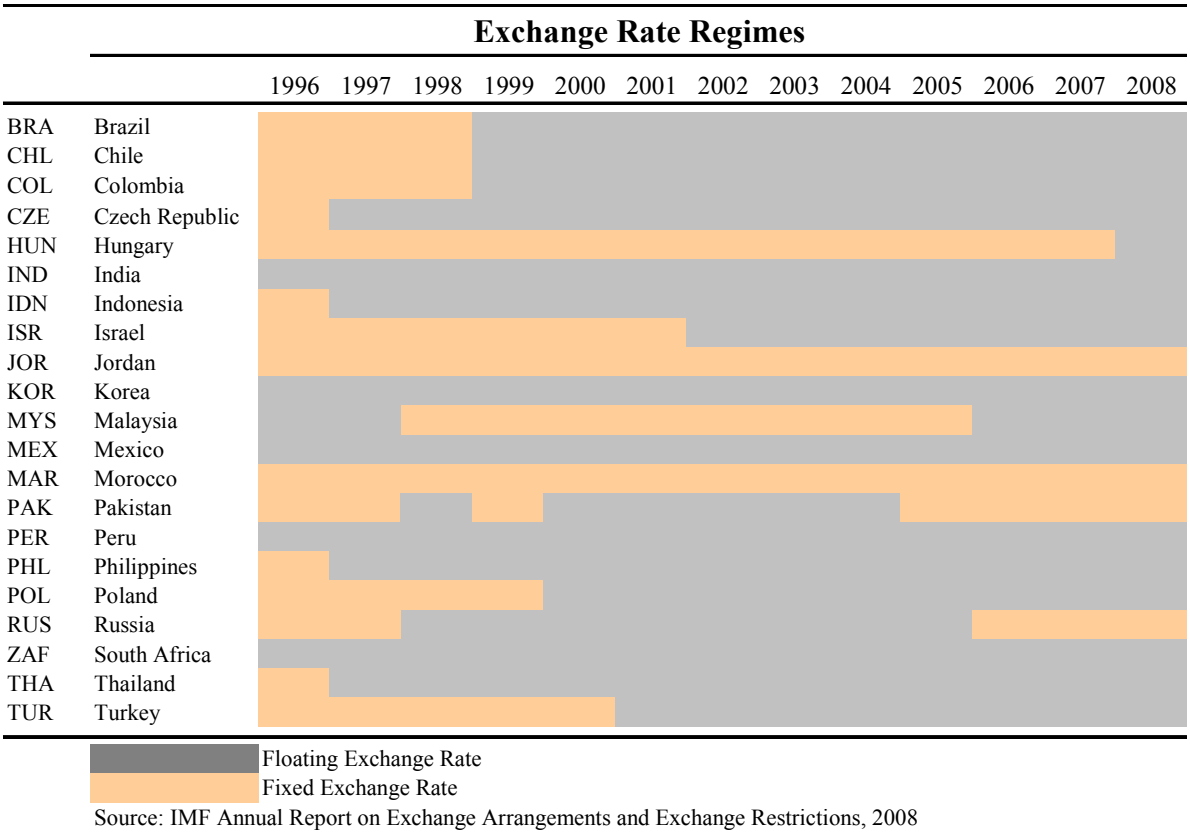
Variable	Definition	Sources
Endogenous		
Industrial Production (ip)	Annual rate of change of the industrial production index	Haver Analytics.
Consumer Price Inflation (π)	Annual rate of change of the consumer price index	Haver Analytics.
Wholesale Food Price Inflation (π^f)	Annual rate of change of the food producer price index. In the case of Brazil and Morocco such data is not available, hence we constructed an index by using food commodity prices and nominal exchange rate. In the case of Peru, we constructed and index using weighted average of domestic and imported food price.	Haver Analytics, IMF International Financial Statistics and DX database.
Oil Price Inflation (π^o)	Annual rate of change of the energy producer price index. In the case of Brazil and Morocco such data is not available, hence we constructed an index by using West Texas Intermediate petroleum prices and nominal exchange rate. In the case of Peru, we constructed and index using weighted average of domestic and imported fuel price.	Haver Analytics, IMF International Financial Statistics and DX database.
Policy Interest Rate (r)	Central Bank policy interest rate expressed in percentage. In some cases, only a short sample for policy interest rate was available, hence other short-term money market interest rates were considered in the analysis as a proxy.	Haver Analytics and National authorities.
Monetary Aggregate ($m1$)	Annual rate of change of broad money supply.	IMF International Financial Statistics
Nominal Effective Exchange Rate (ρ)	Nominal effective exchange rate.	IMF Information Notice System (INS)
Exogenous		
Dummy for Financial Crisis (d)	Dummy variable for financial crisis take the value of 1 if a crisies occurred and zero otherwise.	Cavallo, E. A. and Frankel, J. A. (2004). Does Openness to Trade Make Countries More Vulnerable to Sudden Stops, or Less? Using Gravity to Establish Causality. NBER Working Paper No. 10957.
Fed Fund's Interest Rate (r^*)	Fed Fund's interest rate expressed in percentage.	IMF International Financial Statistics

Annex II. Monetary Policy Regimes



Source: IMF Annual Report on Exchange Arrangements and Exchange Restrictions, 2008 except for Hungary, for which the source is Magyar Nemzeti Bank since 2001.

Annex III. Exchange Rate Regimes



Source: IMF Annual Report on Exchange Arrangements and Exchange Restrictions, 2008