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Policy Conflicts and Inflation Targeting: The Role of Credit Markets

By Woon Gyu Choi and David Cook

I N T E R N A T I O N A L M O N E T A R Y F U N D

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Institute for Capacity Development

Policy Conflicts and Inflation Targeting: The Role of Credit Markets*

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Abstract

A broad set of countries have adopted inflation targeting (IT) monetary policy regimes. We show that stabilizing volatility in credit growth often conflicts with price stability goals: unusual credit expansions often occur when inflation is low relative to goals, and credit slumps often appear when inflation is overshooting. We find that central banks with IT are responsive to credit conditions in both advanced economies and emerging-market economies (EMEs). However, those in EMEs are more sensitive to inflation conditions, responding to credit growth only when consistent with reaching the inflation target. We also find that macroprudential regulations are also used to address volatility in credit growth when orthodox monetary policy moves would be inconsistent with the inflation target, complementing monetary policy.

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I. INTRODUCTION

Over the last twenty years, a wide range of central banks in advanced economies and emerging-market economies (EMEs) have adopted inflation targeting (IT) monetary policies (see Hammond, 2012). Among the extensive set of elements of a full-fledged IT regime, key aspects include the use of the policy rate to achieve price stability as both the ultimate goal and the nominal anchor for the currency. Price stability is one among many possible goals for a central bank. Given a liberalized money market, the central bank with a limited number of instruments may be unable to achieve other potentially important goals including business cycle stability, exchange rate stability, and financial stability among others.

To achieve each independent goal, policymakers must have access to an independent instrument, as implied by Tinbergen's rule. For example, New Keynesian theory suggests that implementing price stability does not conflict with the business cycle stability goal and indeed can achieve first best outcomes, if the economy is subject to standard demand shocks (see Woodford, 2002). Conversely if independent shocks shift inflation and the output gap in opposite directions, policymakers would face a trade-off between alternative goals unless they have an additional independent instrument. As White (2006) noted, policymakers would be mindful of exchange rate movements, external debt and capital flows, and financial overreach (including accelerating credit growth and mounting leverage) as well as price stability to ensure high, sustained growth.

This paper is meant to tabulate potential conflicts between price stabilization and alternative monetary policy goals. While many central banks have price stability as an ultimate objective, IT regimes present clear numerical targets for the inflation rate. Most IT regimes will also allow target ranges for inflation as a target is considered to be missed. We identify periods when a central bank with IT faces constraints on monetary policy by comparing actual measures of inflation with the target range. During periods when inflation lies outside of its target range, the central bank's policy space to address conflicting goals is likely reduced. For example, if inflation rates exceed the target range, monetary policy responses to a business cycle recession or currency appreciation could raise credibility issues regarding the central bank's commitment to its inflation target.

We examine the frequency at which the price stability goal might conflict with other goals associated with the output gap, exchange rates, and credit growth. These conflicts can be particularly pronounced for IT central banks which are explicit about their numerical goals and acceptable range for inflation outcomes. Periods when inflation is out of the target range require policy actions or justifications. We find cases where inflation below the target range suggests looser policy at the cost of excessive credit and opposite cases where inflation above the target range calls for tighter policy at the cost of posing financial stress with lower credit growth.

Stabilizing the output gap and exchange rates sometimes conflict with movements in inflation, but such conflicts are not as frequent as potential conflicts between credit growth and inflation. We find that credit growth is at least as frequently high when inflation is above target as when it is below.

Persistent downward pressures, stemming from low energy and commodity prices, on inflation led to persistent low inflation in open economies including most IT countries. The confluence of low global interest rates and low inflation rendered policy rates persistently low,

and further loosening monetary policy to meet inflation target may run the risk of credit bubbles, mounting debt, or hitting the “effective” lower bound of interest rates.

Against this backdrop, an ongoing debate considers whether an exclusive focus on price stability is appropriate with a financial system out of sync with inflationary conditions. Estimating a monetary policy reaction function with panel data, we find that central banks are responsive to credit growth in setting their monetary policy rates (in addition to inflation and the output gap). In EMEs, however, central bank responses to credit conditions are limited to periods when policy responses to inflation condition are required. In advanced economies, the sensitivity of monetary policy to credit growth is more consistent across inflation conditions.

Recent research using DSGE models with financial frictions have examined how the collaboration of monetary policy and macroprudential policy affects macroeconomic stabilization or welfare: for example, if macroprudential policy is deployed to shore up collateral liquidity or require liquidity buffers in response to financial shocks (Choi and Cook, 2012); if monetary and capital requirements policies collaborate (Angelini et al., 2014); if macroprudential policy responds to financial imbalance (Bailliu et al., 2015); or if monetary policy interacts with macroprudential policy (Mendoza, 2016).

Macroprudential regulatory adjustments are an additional tool that can be used to achieve an additional goal (e.g., Crowe et al. 2011, Kannan et al. 2012, Tovar et al. 2012, and Kim and Mehrotra, 2017). We find that macroprudential actions are used for financial stability when the traditional monetary policy instruments are constrained by the inflation target. We find that when inflation is below the target range, which might constrain a central bank from raising interest rates based on financial conditions, central banks are more likely to implement macroprudential actions that tighten credit. Likewise, we find that when inflation is above the target range, central banks are more likely to implement macroprudential regulations which broaden the availability of credit when interest rates are raised with tighter monetary policy.

The remainder of the paper proceeds as follows. Section II describes the characteristics of the country panel data used for our empirical analysis, and Section III examines policy conflicts between price stability with business cycle stabilization, exchange rate stability, or financial stability. Section IV assesses monetary policy responsiveness to credit growth and to interactions between credit markets and inflation status by estimating a Taylor-type rule extended to country-panel regressions. Section V explores how macroprudential measures have been deployed to lean against the wind in harmonization with inflation targeting. Section VI concludes.

II. DATA

We examine quarterly data from 23 countries identified as implementing IT in Hammond (2012) including Australia, Brazil, Canada, Chile, Colombia, the Czech Republic, Hungary, Iceland, Indonesia, Israel, Korea, Mexico, New Zealand, Norway, Peru, Philippines, Poland, Romania, South Africa, Sweden, Thailand, Turkey, and the United Kingdom. We do not include Armenia, Ghana, Guatemala or Serbia for reasons of data availability. Data on the inflation target are taken from a variety of central bank publications, web sites, and IMF Article IV reports listed in the appendix. Some countries operate a target range without a particular numerical target. In these cases, we use the midpoint of the range as a proxy for the target. Some countries operate point targets without specifying an error band. All inflation targets are specified on an annual basis. Where possible we used ex ante targets, ignoring changes that occur within a year.

Table 1. Inflation Outcome by Region

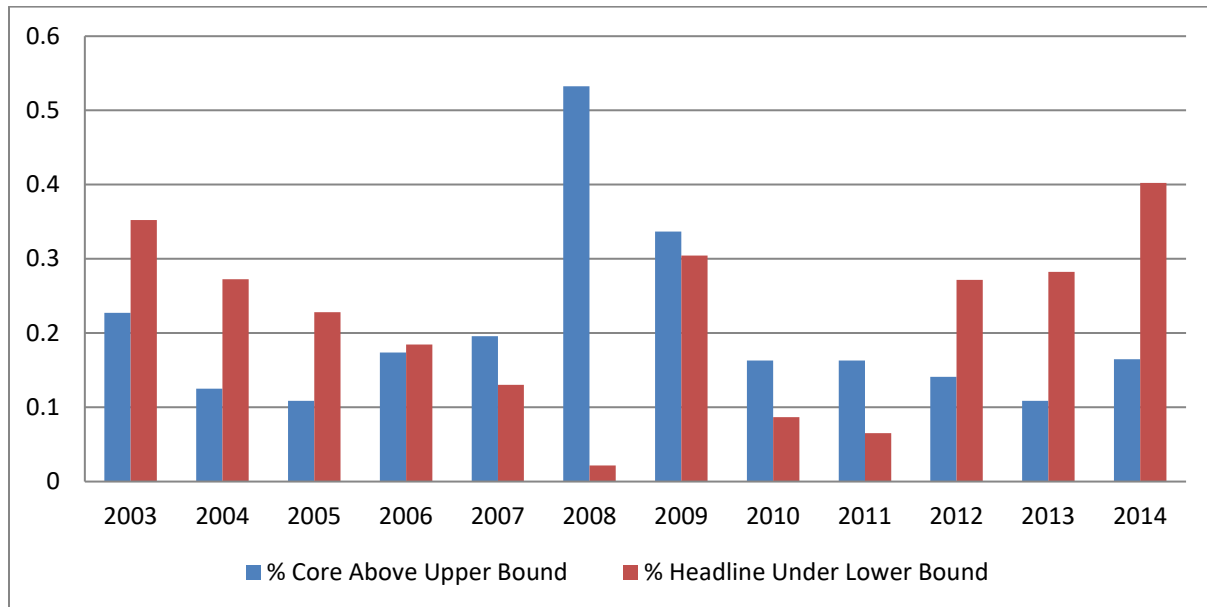
Region	Average Y-o-Y Inflation		Gap from Target		Headline: % of Quarters		Core: % of Quarters	
	(A) Headline	(B) Core	(C) Headline	(D) Core	(E) Above Upper Bound	(F) Below Lower Bound	(G) Above Upper Bound	(H) Below Lower Bound
Anglophone	2.25	1.95	0.09	-0.25	22.4%	13.0%	8.4%	8.9%
East Asia	3.61	2.87	0.30	-0.60	32.3%	25.5%	12.8%	33.3%
Eastern Europe	3.50	2.46	0.37	-0.51	41.3%	30.4%	18.9%	39.5%
Latin America	3.97	3.41	0.69	0.22	33.8%	9.2%	9.2%	18.9%
Scandinavia	2.00	1.10	-0.32	-1.22	25.7%	32.6%	5.52%	55.2%
Miscellaneous	5.28	5.67	0.93	1.31	37.5%	26.4%	50.0%	17.8%
World	3.22	2.66	0.32	-0.24	32.2%	21.6%	20.6%	27.8%

Note: This table shows the average inflation outcomes for inflation target countries and compositions of departures from inflation target levels in various regions using quarterly data for 2003-2014.

We obtain measures of headline CPI inflation from the IMF International Financial Statistics. Data on Core Inflation comes from the OECD Main Economic Indicators and a variety of national statistical agencies and central banks. To measure core inflation for Australia, Canada, Chile, Czech Republic, Hungary, Israel, Iceland, Korea, Mexico, New Zealand, Norway, Poland, Sweden, Switzerland, Turkey, UK, and South Africa, we use *CPI: All Items: Non-Food Non-Energy* from OECD Main Economic Indicators (base 2010). Core inflation for other countries is based on CPI: Lima: Core (Central Reserve Bank of Peru, base 2009=100) for Peru, Core CPI (Philippine Statistics Authority, base 2006=100) for the Philippines, HICP: All Items excluding Energy, Food, Alcohol & Tobacco (Eurostat, base 2005=100) for Romania, CPI: NFB excluding Food and Energy (Bureau of Trade and Economic Indices, base 2011=100) for Thailand, National CPI: IPCA: Core: Exclusion (ex2) (Central Bank of Brazil) for Brazil, and CPI: Core (Central Bureau of Statistics, linking base 2002, 2007, and 2012 successively) for Indonesia.

Table 1 reports statistics for each region (specifying Turkey, Israel and South Africa as “Others”). We show the median level of year-on-year inflation, both headline and core for the period 2003-2014. We see that inflation tends toward the low single digits in the regions of the world. Due to the commodity cycle during this period, headline inflation has tended to be above core inflation by somewhat more than 50 basis points in all the regions of the world except “Others.” In Columns C and D, we show the median deviation of inflation from the inflation target (which varies from country to country and over time). The median gap overall is near zero with headline inflation above target and core inflation typically below target. Within each region, the typical deviation from target also tends to be small, less than 1% point in all cases except Scandinavia where core inflation has generally run more than 1% point below target and Others where core inflation has generally been more than 1% point above target.

Figure 1. Inflation Departures from the Target Range



Note: This figure depicts the fraction of country quarters in which IT countries saw core (headline) inflation above (below) the target range for 2003–2014.

Despite this overall good performance, there have been periods when inflation has deviated from its target range. Columns E–H show the percentage of country quarters in which (year-on-year) inflation is outside the target range for the countries relative to the total number of country quarters for 2003–2014 for each region. Headline inflation has more often been above the upper bound of the target range (Column E) than below the lower bound of the target range (Column F) in most regions except Scandinavia. In contrast, core inflation has less often been above the upper bound of the target range (Column G) than below the lower bound of the target range (Column H) in most regions except Latin America and Others. Also notable is that, in contrast to the Other countries, the Anglophone countries are more likely to shoot headline and core inflation within the target range.

While most IT countries apparently target headline inflation, underlying inflation pressures could weigh in core inflation as well as headline inflation. Figure 1 reports the fraction of country quarters in which IT countries saw core (headline) inflation above (below) the target range for 2003–2014. Given that core inflation has tended in most cases to be under the inflation target, the overshooting by core inflation could offer a clear indicator of overheating. Given that headline inflation in most cases has tended to be above target, the undershooting by headline inflation might offer a clear indicator of disinflationary pressures.

Inflation performance varies periods as shown in the figure, while during most of the previous decade inflation was largely held in check. The fraction of country quarters in which year-on-year core inflation has been over the target range has been in 10–20% except for 2008 and 2009. In 2008, over half of the time core inflation was above the target range, and headline

inflation exceeded the target range in over 80% of country quarters, attributable to the commodity cycle; The occurrence of disinflationary episodes shows more volatility. We can observe that in more than half of the years, headline inflation has been below the lower the bound in more than 20% of country quarters, while in 2008 and 2010-11 only 10% of country quarters display disinflationary pressures. Notably, the crisis year of 2009 displays the greatest dispersion of inflationary and disinflationary conditions. In more than 30% of country quarters in 2009, core inflation was overshooting the target range, possibly owing to pass-through effects of depreciation. Conversely in another more than 30%, headline inflation was undershooting the range, possibly being dominated by the reduced aggregate demand upon the global financial crisis. Interestingly, the most recent year, 2014, displays the greatest frequency of disinflationary outcomes with more than 40% of country quarters, heralding the emergence of disinflationary pressures in many advanced economies and EMEs.

III. INFLATION TARGETING POLICY CONFLICTS

We examine conflicts between price stability and other goals through IT country experiences. To assess more comprehensively the relationship between inflation stabilization and other goals, we construct a discrete variable *Headline (Core) Inflation Status* which equals -2 when headline (core) inflation is below the target lower bound, -1 when headline inflation is below target but within the target range, 1 when headline inflation is above target but within the range, and 2 when inflation is above the target upper bound. We also construct a continuous variable, *Headline (Core) Inflation Gap*: the gap between headline (core) inflation and the inflation target (or midpoint of the target range when a point target is unavailable).

Other goals we consider are trifold. First, business cycle stabilization on the real front may exacerbate inflation or be conducive to price stability, depending on the nature of driving shocks. Second, central banks could be concerned about the stable value of domestic currency or exchange rate stability because of pass-through effects of exchange rates on prices. Third, central banks are keen on credit growth and short-term capital flows for financial stability.

A. Business Cycle Stabilization

To explore the traditional Phillips curve tradeoff between inflation and growth, one can compare periods when inflation is outside of the target range with business cycle outcomes. We measure the output gap as the percentage deviation of seasonally-adjusted real GDP (using the X12 method) from the Hodrick-Prescott (HP) trend using data for 1990-2014. For each country, we construct the standard deviation of the output gap over the period from the inception of the IT regime to the second quarter of 2008 (onset of the Lehman Brothers crisis). If a country's output gap in a given quarter is above (below the negative of) the pre-crisis standard deviation, we characterize the corresponding country quarter as a boom (recession).

We find little evidence of conflicts between inflation stabilization and business cycle stabilization. Table 2 shows the frequency of periods in which headline (Panel A) and core inflation (Panel B), respectively, are outside of the target range for the periods of expansion and recession as defined above. We see that when headline inflation is below the target range, the economy is three times as likely to be in a recession as in an expansion; and when headline

Table 2. Business Cycle Conflicts with Inflation

Panel A	Headline Inflation				
	Below Target Range	Within Target Range		Above Target Range	Total (Obs.)
		Below Target	Above Target		
Output Gap in:					
Recession	45	32	29	42	148
Neither	161	188	197	216	762
Expansion	15	20	37	94	166
Total (Obs.)	221	240	263	352	1,076
Panel B	Core Inflation				
	Below Target Range	Within Target Range		Above Target Range	Total (Obs.)
		Below Target	Above Target		
Output Gap in:					
Recession	42	35	30	41	148
Neither	223	245	162	133	763
Expansion	30	55	36	45	166
Total	295	335	228	219	1,077
Panel C	Dependent Variable				
	<i>Headline Status</i>	<i>Core Status</i>	<i>Inflation Gap</i>	<i>Core Inflation Gap</i>	
Output Gap (Independent Variable)	<u>Without Fixed Effects</u>				
	0.26*** (0.03)	0.07* (0.04)	0.23*** (0.02)	0.08*** (0.03)	
	<u>With Country-Fixed Effects</u>				
	--	--	0.27*** (0.03)	0.12*** (0.04)	

Notes: This table displays how outcomes for the output gap (measured by HP-filtered and seasonally-adjusted real GDP) over business cycles are associated with the achievement of the inflation target. Panel A compares periods (from 2003 to 2014) for which the economy is in recession (more than one s.d. below zero) or expansion (more than one s.d. above zero) coincides with periods in which headline inflation is above, within, or below the target range. Panel B makes a similar comparison with core inflation. Panel C shows the output gap coefficient in a simple regression for the status index of inflation relative to target and the inflation gap (inflation minus its target value). It also includes regression results with country-fixed effect.

inflation is above the target range, the economy is more than twice as likely to be in an expansion as in a recession. This finding is consistent with the idea that business cycles are primarily driven by demand forces which shift the output gap and inflation in the same direction. Core inflation nonetheless has less clear positive links with the output gap. We do see that when core inflation is below the target range, the economy is substantially more likely to be in a recession than in an expansion. However, when core inflation is above the target range, the economy is only slightly more likely to be in expansion than in recession.

Table 2, Panel C shows the regression coefficient from a simple regression of each of these variables on the output gap. The results—broadly consistent with those in Panels A and B—offer little evidence on conflicts between headline inflation and the output gap, especially for headline inflation. In each case, the relationship between headline inflation relative to target and the output gap is positive in the range of 0.2 and 0.3 and significant at the 1% level. Controlling for country-fixed effects provided similar results. The coefficient on the output gap in core inflation regressions is less than a half of that in headline inflation equation. Specifically, the *Core Inflation Status* coefficient is 0.07 and only significant at the 10% level; and the *Core Inflation Gap* coefficient is around 0.1 but significant at the 1% level.

B. Exchange Rate Stability

A floating exchange rate is integral for implementing IT to allow for a focus on internal price stability. Price stability is inherently linked to exchange rate changes which feed into inflation. Beyond its role in determining domestic prices however, exchange rate stability can offer independent benefits in stabilizing external goods and financial markets (e.g., Nordstrom et al. 2009).

We define periods of exchange rate appreciation or depreciation for a subset of IT countries in terms of the behavior of their exchange rates against the U.S. dollar. We restrict our analysis to countries in Latin America or Asia in addition to Anglophone countries. Exchange rate stability versus the euro might be more important for countries in Scandinavia, Eastern Europe or the Near East. For each of the remaining countries, we measure depreciation (appreciation) quarters when the year-on-year growth of the exchange rate against the U.S. dollar is higher (lower) than the rate measured as one-standard deviation above (below) the average for the period between the inception of an IT regime and the second quarter of 2008.

Table 3 tabulates appreciation and depreciation quarters versus *Inflation Status* (Panel A) and *Core Inflation Status* (Panel B). In both cases, when inflation is above the upper target bound, the economy is much more likely to be in a period of depreciation. In contrast, when the inflation rate is below the lower bound, the exchange rate is roughly equally likely to be in a period of depreciation as appreciation. Within the target range, however, appreciation is more likely to be associated with low inflation: for example, in a period of appreciation, the core inflation rate is much more likely to be below target than above target.

Table 3. Exchange Rate Conflicts

Panel A		Headline Inflation			
	Below Target Range	Within Target Range		Above Target Range	Total (Obs.)
		Below Target	Above Target		
Exchange Rate:					
Appreciation	10	34	31	19	94
Neither	73	96	145	131	445
Depreciation	13	18	17	36	84
Total	96	148	193	186	623
Panel B		Core Inflation			
	Below Target Range	Within Target Range		Above Target Range	Total (Obs.)
		Below Target	Above Target		
Exchange Rate:					
Appreciation	16	50	15	14	95
Neither	96	175	110	63	444
Depreciation	15	22	16	31	84
Total	127	247	141	108	623
<i>Dependent Variable</i>					
Panel C	<i>Headline Status</i>	<i>Core Status</i>	<i>Inflation Gap</i>	<i>Core Inflation Gap</i>	
Dependent Variable					
Exchange Rate Growth (Independent Variable)	<u>Without Country-Fixed Effects</u>				
	0.82***	1.62***	0.84***	1.38***	
	(0.29)	(0.30)	(0.24)	(0.31)	
	<u>With Country-Fixed Effects</u>				
			0.74***	1.59***	
			(0.25)	(0.35)	

Notes: This table tabulates outcomes for a measure of exchange rate depreciation (the growth rate of the exchange rate against the U.S. dollar) in comparison with the achievement of the inflation target. Panel A compares periods (from 2003-2014) for which the exchange rate is in appreciation (more than one s.d. below mean) or depreciation (more than one s.d. above mean) with periods in which headline inflation is above, within or below the target range. Panel B makes a similar comparison with core inflation. Panel C shows the exchange rate growth coefficient in a simple regression for the status index of inflation relative to target or the inflation gap (inflation minus its target value). It also includes regression results with country-fixed effect.

We again regress the exchange rate growth rate on *Inflation Status* or *Inflation Gap* (Panel C). Simple regressions or regressions with country-fixed effects indicate a uniformly positive relationship with highly significant coefficient estimates. It is perhaps not surprising that nominal exchange rate movements are positively associated with inflation movements. These results, if not sufficient to minimize the possibility of conflicts between inflation targeting and exchange rate stability, lead us to turn to conflicts between potential goals on the financial front.

C. Financial Stability

C.1. Credit Growth

To examine credit growth (relative to output growth), we use credit to the non-financial private sector from domestic banks as measured by the BIS Long-term Private Credit database.¹ This database has quarterly data for Australia, Brazil, Canada, Czech Republic, Hungary, Indonesia, Korea, Mexico, Norway, Poland, Sweden, Thailand, Turkey, South Africa, and United Kingdom. We augment it with quarterly data on Bank Claims on the Private Sector for Chile, Colombia, Iceland, Philippines, Romania, and Serbia from IMF IFS. Each of these series is deflated by CPI. The year-on-year percentage increase in these series we call credit growth.

In Table 4, we measure and compare periods of credit contraction and expansion with inflation conditions in terms of the distance from inflation target. A period of credit loosening (tightening) is one in which real credit growth expands at a level higher (lower) than the average level plus (minus) one-standard deviation measured over the pre-crisis inflation targeting period for each country. The association of credit conditions with inflation conditions is a bit mixed. For example, a period in which headline inflation is considerably below the target range is more likely to be in a credit contraction (possibly owing to reduced demand for credit) than in an expansion. The reverse is true for core inflation, however: when core inflation is below the target range, credit conditions are more likely to be loose (possibly with credit provisions to boost inflation). Moreover, in country quarters where inflation is above the target range, credit conditions are more likely to be associated with tightening rather than loosening.

We also find some evidence on a policy conflict between price stability and financial stability from regressions of either *Inflation Status* or *Inflation Gap* on real credit growth (Panel C). While we see the sign of estimated coefficients mixed and insignificant without country-fixed effects, both the *Headline Inflation Gap* and *Core Inflation Gap*, controlling for country-fixed effects, are strongly negatively associated with real credit growth. We could view this as evidence of a conflict, because policy rates are deemed to affect both variables in the same direction: policy rate hikes to temper excess credit would lower inflation, and policy rate cuts to reduce disinflationary pressures would spur credit.

¹ While there is no consensus on what variable to target for financial stability, we look at real credit growth as a metric of financial imbalance (to see whether credit to support fundamentals is well-aligned with output).

Table 4. Credit Growth Conflicts

Panel A	Headline Inflation				
	Below Target Range	Within Target Range		Above Target Range	Total (Obs.)
		Below Target	Above Target		
Credit Growth:					
Tightening	41	35	43	81	200
Neither	122	121	152	173	568
Loosening	28	43	42	51	164
Total	191	199	237	305	932
Panel B	Core Inflation				
	Below Target Range	Within Target Range		Above Target Range	Total (Obs.)
		Below Target	Above Target		
Credit Growth:					
Tightening	33	67	59	41	200
Neither	185	188	105	90	568
Loosening	53	54	33	24	164
Total	33	67	59	41	932
Panel C	<i>Headline Status</i>	<i>Core Status</i>	<i>Inflation Gap</i>	<i>Core Inflation Gap</i>	
Dependent Variable					
Real Credit Growth (Independent Variable)	<u>Without Country-Fixed Effects</u>				
	0.35	0.01	-0.26	-0.12	
	(0.24)	(0.26)	(0.16)	(0.22)	
	<u>With Country-Fixed Effects</u>				
			-0.77***	-1.33***	
		(0.16)	(0.23)		

Notes: This table tabulates outcomes for a measure of real credit growth (growth in claims on the private sector deflated by the CPI) in comparison with the achievement of the inflation target. Panel A compares periods (from 2003-2014) for which the credit is tightening (less than one s.d. below mean) or loosening (more than one s.d. above mean) with periods in which headline inflation is above, within or below the target range. Panel B makes a similar comparison with core inflation. Panel C shows the real credit growth coefficient in a simple regression for the status index of inflation relative to target or the inflation gap (inflation minus its target value). It also includes regression results with country-fixed effect.

Table 5. Hot Money Flow Conflicts

Panel A		Headline Inflation			
	Below Target Range	Within Target Range		Above Target Range	Total (Obs.)
		Below Target	Above Target		
Hot Money :					
Outflows	52	53	38	88	231
Neither	124	152	170	180	626
Inflows	25	22	48	74	169
Total	201	227	256	342	1,026
Panel B		Core Inflation			
	Below Target Range	Within Target Range		Above Target Range	Total (Obs.)
		Below Target	Above Target		
Hot Money :					
Outflows	51	64	60	56	231
Neither	197	197	118	115	627
Inflows	33	58	38	40	169
Total	281	319	216	211	1,027
Panel C		<i>Headline Status</i>	<i>Core Status</i>	<i>Inflation Gap</i>	<i>Core Inflation Gap</i>
Dependent Variable					
Hot Money Flow (Independent Variable)	<u>Without Country-Fixed Effects</u>				
	-0.17	-1.20***	-0.03	-0.79***	
	(0.28)	(0.29)	(0.19)	(0.22)	
	<u>With Country-Fixed Effects</u>				
			0.09	-1.14***	
			(0.21)	(0.28)	

Notes: This table tabulates outcomes for a measure of international capital flows (increases in short term debt as a percentage of nominal GDP) in comparison with the achievement of the inflation target. Panel A compares periods (from 2003-2014) for which there are short-term outflows (less than one s.d. below mean) or inflows (more than one s.d. above mean) with periods in which headline inflation is above, within or below the target range. Panel B makes a similar comparison with core inflation. Panel C shows the hot money flow coefficient in a simple regression for the status index of inflation relative to target or the inflation gap (inflation minus its target value). It also includes regression results with country-fixed effect.

C.2. Hot Money Flows

A more ambiguous form of financial stability in small open economies is associated with the volatility of short-term liabilities. A country experiencing a wave of capital inflows might raise interest rates to slow the expansion of domestic credit, in line with addressing inflationary pressures. Policymakers, being mindful of cross-border financial linkages, might allow for interest rate cuts to reduce incentives to participate in the carry trade (and fend off appreciation pressures stemming from hot money flows), as opposed to a need for tighter policy to fight inflation (alongside appreciation effects on inflation).² Given this ambiguity, it may be interesting to outline whether strong capital flows conflict with inflation targeting at any period.

We measure hot money stocks as the sum of short-term liabilities and short-term international debt securities. Hot money flows are measured as the year-on-year incremental increase in outstanding hot money stocks relative to the previous four-quarter GDP. We categorize the economy as experiencing hot money inflows (outflows) when hot money flows are more (less) than pre-crisis mean plus (minus) one pre-crisis standard deviation. Table 5 tabulates periods of hot money flows relative to periods of inflation vs. disinflation. Overall, there are more periods of hot money outflows, perhaps attributable to post-crisis financial disintermediation. When inflation (either core or headline) is below the target range, outflow quarters are disproportionately more than inflow quarters; but when inflation is above the target range, the difference is small.

We also report regressions of *Inflation Status* or *Inflation Gap* on hot money flows. Despite no significant relationship between hot money flows and headline inflation, we do find a significant negative relationship between hot money flows and core inflation, suggesting some possible conflicts. Whether that relationship indicates a conflict with price stability goals may depend on the transmission mechanism of capital flows and the nature of hot money flows.

IV. CREDIT CONFLICTS AND MONETARY POLICY

To assess the impact of credit markets on monetary policy, we estimate a Taylor-type rule. We define “the interest rate gap” as the interest rate minus the inflation target. We think of the interest rate gap as a quasi-real interest rate that can largely be controlled by the central bank. If inflation expectations were well grounded at the target, the interest rate gap would be equivalent to the real interest rate. Data on short-term nominal interest rates are from IMF International Financial Statistics. We use “Monetary Policy-Related Interest Rate” for Australia, Brazil, Canada, Chile, Colombia, Indonesia, Israel, Korea, Mexico, New Zealand, Norway, Peru, Philippines, South Africa, Sweden, Thailand, Turkey, and United Kingdom. We use Repurchase Agreement Rates for Czech Republic and Romania, and Treasury Bill Rates for Hungary.

² Capital inflows could call for currency appreciation pressures. For example, Bruno and Shin (2015) find evidence that a change in cross-border bank capital flows stemming from U.S. monetary policy shocks is associated with a change in the exchange rate against the U.S. dollar.

Table 6. Taylor Rules & Credit Conflicts

	Dependent Variable: Interest Rate Gap _t = $i_t - \pi_t^{TGT}$						
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
Dependent Variables	Whole Sample			Established	EME	Resilient EME	Fragile EME
Interest Gap _{t-1}	0.85*** (0.01)	0.86*** (0.01)	0.86*** (0.01)	0.83*** (0.03)	0.86*** (0.02)	0.82*** (0.03)	0.86*** (0.03)
Output Gap	0.11*** (0.02)	0.09*** (0.02)	0.08*** (0.02)	0.07** (0.03)	0.09*** (0.02)	0.07** (0.03)	0.18*** (0.05)
Inflation Gap	0.09*** (0.01)	0.10*** (0.01)	0.09*** (0.02)	0.20*** (0.03)	0.06*** (0.02)	0.03 (0.04)	0.08** (0.03)
ΔCore Inflation Gap	0.21*** (0.03)	0.26*** (0.03)	0.26*** (0.03)	0.05 (0.06)	0.32*** (0.04)	0.20** (0.08)	0.39*** (0.07)
Real Credit Growth		0.012*** (0.003)	0.006* (0.003)	0.014*** (0.004)	-0.001 (0.004)	-0.004 (0.005)	-0.005 (0.011)
Real Credit Growth x Core Above Range			0.023*** (0.004)	0.011 (0.008)	0.031*** (0.006)	0.042*** (0.008)	0.022* (0.011)
Real Credit Growth x Headline Below Range			-0.005 (0.006)	0.013 (0.011)	-0.006 (0.007)	0.005 (0.01)	-0.031** (0.014)
N	1016	916	916	281	635	269	227
Countries	23	20	20	6	14	6	5
R ²	0.95	0.95	0.95	0.97	0.95	0.92	0.96

Notes: This table shows coefficients from panel estimates of the quarterly monetary policy reaction function (with country-fixed effects) using the gap between the interest rate and the inflation target. The interest rate gap is allowed to respond to real credit growth and interaction between real credit growth and dummy variables for periods when core inflation is above the target range and periods when headline inflation is below the range. All regressions include year dummies, seasonal dummies, and a global financial crisis dummy.

The standard Taylor rule suggests that the policy rate should react to inflation and the output gap. We estimate a Taylor rule for the IT countries using a panel regression of the *Interest Rate Gap* on the *Output Gap* and *Inflation Gap*. To reflect a policy-rate inertia, a lagged term is included. We find that policy rates respond to surges in core inflation, so we also include the first difference in the *Core Inflation Gap*. All regressions include year dummies, seasonal dummies, and a global financial crisis dummy (for the four quarters spanning the third quarter of 2008 to the second quarter of 2009) and country fixed effects.³ We restrict our examination to countries that have brought the inflation target into single digits. The baseline results are reported in Table 6, Column A. We find that all coefficient estimates are positive and significant. The quasi-real rate rises with the inflation gap and output gap, consistent with stabilizing the economy, and involves a substantive inertia with an auto-regressive coefficient above 0.8.⁴

In Column B, we test whether central banks with IT respond to credit growth with possible concerns over financial stability. We add an additional term measuring the year-on-year real credit growth defined in the previous section. We find that the coefficient on credit growth is positive and significant. The coefficient appears quantitatively small. A transitory 1% rise in real credit growth would be associated with slightly more than a basis point immediate policy rate increase. However, policy rates are persistent and credit growth is quite variable. A permanent one standard deviation rise in real credit growth would be associated with a long-term rise in policy rates of nearly 100 basis points given the target inflation. This motivates us to delve into whether the potential conflicts observed between real credit growth and inflation targeting affect the central bank response to credit conditions.

We examine cross-country variation in the response of central banks to credit growth. Table 7, Panel A shows the coefficients on interactions between real credit growth and country dummies (conditioning on the output gap, lagged interest gaps, the inflation gap and surges in the core inflation rate). We find that the monetary policy rate is positively associated with credit growth in most countries (Brazil is the only country for which the coefficient is negative and significant). The coefficient on real credit growth differs across countries: the hypothesis of equal coefficients is rejected at a high significance level.

Larger domestic credit markets are strongly associated with higher credit growth sensitivity of monetary policy, as shown in Figure 2. Central bank responses to credit growth may depend on whether credit growth would undermine financial stability. The figure also suggests the possibility that countries with very high credit exposures relative to GDP have a disproportionately high sensitivity of monetary policy to credit growth.

³ We assume that the time dimension of the panel is sufficient to allow for consistent estimation of the coefficient on the lagged dependent variable with fixed-country effects. The results of the relevant regressions without fixed-country effects are quantitatively very similar to the parallel reported results.

⁴ We tested a second-order specification. The coefficient on the second-order term was small and negative, and its inclusion had little impact on the other coefficients.

Table 7. Country Specific Leaning against the Wind

Country	A. Credit Growth		B. Hot Money	
	Coefficient	T-Stat	Coefficient	T-Stat
Australia	0.011	0.49	0.050	1.56
Brazil	-0.029	-2.42	-0.312	-3.42
Canada	0.021	1.43	-0.014	-0.26
Chile	0.019	0.90	-0.010	-0.19
Colombia	0.018	1.37	0.059	0.73
Czech Republic	-0.001	-0.11	-0.087	-1.65
Hungary	0.024	2.54	-0.018	-0.58
Iceland	0.017	4.62	0.007	3.71
Indonesia	0.021	1.01	-0.246	-1.48
Israel	n/a	n/a	0.092	0.79
Korea	0.004	0.23	-0.044	-0.85
Mexico	-0.002	-0.19	-0.247	-1.72
New Zealand	n/a	n/a	0.027	1.09
Norway	0.019	1.38	0.022	1.46
Peru	n/a	n/a	0.091	1.50
Philippines	-0.001	-0.08	0.006	0.10
Poland	-0.004	-0.45	-0.032	-0.38
Romania	0.016	2.85	-0.007	-0.44
South Africa	0.035	2.60	-0.061	-0.49
Sweden	0.003	0.10	-0.011	-0.59
Thailand	0.015	0.83	0.069	0.82
Turkey	0.003	0.20	-0.030	-0.26
UK	0.048	2.68	0.015	1.83

Notes: This table shows the country-specific responses of monetary policy rates to real credit growth and hot money flows. The coefficient estimates are obtained from an extended form of panel regression (B) of Table 6 to allow for cross-country variation in the response of central banks to credit growth.

Table 6, Column C shows a regression including the interactions of real credit growth with inflation status. To represent times when an IT central bank might conservatively be expected to be constrained by the price stability goal, we use two dummies. The first dummy equals one if core inflation is over the target range and zero otherwise. The second dummy equals one if headline inflation is below the target range and zero otherwise.

Figure 2. Central Bank Credit Sensitivity to Credit Growth and Credit Share in GDP



Notes: This figure depicts the country-specific coefficients on real credit growth in Table 7 on y-axis and the credit to GDP (of year 2000) ratio of respective countries in x-axis. A simple regression of the monetary policy sensitivity of credit growth on the credit- GDP ratio gives R-square of 0.28.

As shown in Column C, the coefficient estimate of real credit growth interacting with core inflation above the target range is positive and statistically significant. The estimated marginal impact of credit shocks on the policy rate is about five times as large when inflation is above its upper bound as otherwise. Conversely, the coefficient estimate on real credit growth interacting with headline inflation below the lower bound is negative but near zero and insignificant. Given a standard deviation of credit growth of 8.4% within this sample, a one-standard deviation rise in credit growth would be associated with a long-term rise in the policy rate by nearly 200 basis point when core inflation is above the target range, in contrast with a long term rise by 50 basis point when inflation is within the target range and a statistically insignificant change when headline inflation is below the target range. An interpretation for this finding is that, when the central bank is unconstrained by the inflation policy goal, they might use those degrees of freedom to address financial stability.

We divide our sample of countries into groups. The first comprises Scandinavian countries and the English speaking countries of Australia, Canada, New Zealand, and the United Kingdom. The rules of the game in financial markets in this group could be considered to be more long-established. We estimate the policy rule for pooled data from six of these seven countries (dictated by the data availability of credit growth for New Zealand).

The Taylor-rule parameters of this “Established” group are quite similar to those of the whole sample (see Column D). Amongst the Established countries, we find that central banks put more emphasis on the headline inflation gap and relatively less on surges in core inflation. Also, central banks increases interest rates with real credit growth to a slightly greater degree than in the whole sample, as implied by the credit growth coefficient estimate being significant at the 1% level. We do not find evidence that central bank sensitivity to credit conditions is dependent on whether inflation is outside the target range: the corresponding coefficient estimates are positive but not significant at the 10% level.

The estimated result of the remaining countries comprising 14 EMEs ⁵ (Column E) shows significant coefficients for the lagged dependent, output gap, inflation gap, and surges in core inflation. While the coefficient on real credit growth is essentially zero, the coefficient on the interaction term is positive and highly significant, meaning that EME central banks adjust policy rates in response to credit growth only when core inflation is above the target range. When inflation is below the target range, we find a negative but insignificant link between policy rates and credit growth.

Choi and others (2016) argue that EMEs have diverse responses to shocks depending on the strength of fundamentals. We estimate the monetary policy response for resilient EMEs (the Czech Republic, Korea, Mexico, Poland, Romania, and Thailand) and fragile EMEs (Brazil, Chile, Hungary, Indonesia, and Turkey). Columns F and G report estimates for these two groups. In general, the policy rates in the resilient EMEs are more sensitive to the output gap. We also find that the response of interest rates to credit expansion is significantly positive in both groups only when core inflation is above the target range. When headline inflation is below the target range, however, policy rates are negatively associated with credit growth. This might suggest that these countries accommodate credit expansions when inflation undershoots its target.

Table 8 focuses on whether the policy rates of IT central banks respond to hot money flows in light of capital flow management. Short-term-external borrowings or debt issuance can be used as an alternative to domestic credit as a channel for financing the credit cycle. Column A reports the whole sample estimate of the Taylor rule that includes a measure of hot money flows as defined in Section III.C.ii. The inclusion of a possible policy response to hot money flows have no substantial impact on the estimate of the coefficients on lagged interest rates, the output gap, or the inflation gap. We find that, conditioning on inflation and the output gap, hot money flows relative to GDP are associated positively and significantly with the policy rate. The coefficient is relatively small. Given the interest rate inertia and the sample standard deviation of hot money flows being above 14%, the long-term adjustment of interest rates to a one-standard-deviation shocks would be around 70 basis points. One interpretation is that in periods in which foreign borrowing is growing, the central bank raises interest rates to limit the impact on the domestic financial sector.

To show how policy responses are affected by the inflation status, Column B adds hot money flows interacting with dummy variables for periods when core inflation is above the inflation target and when headline inflation is below the target. In addition to a positive response to hot money flows, the coefficient on the interaction with periods when core inflation is above the upper bound is positive and significant at the 1% level. Effectively, the response of the policy rate when inflation is above the target range is more than double that seen otherwise. The coefficient on the interaction term with the dummy for periods when headline inflation is below the lower bound is nil. These findings may suggest a policy reconciliation between hot money flow management and inflation targeting.

⁵ Peru and Israel are excluded owing to the unavailability of credit data.

Table 8. Taylor Rules & Hot Money Conflicts: Country Panel Regressions

	Dependent Variable: Interest Rate Gap _t = $i_t - \pi_t^{\text{TGT}}$					
	(A)	(B)	(C)	(D)	(E)	(F)
Independent Variables	Whole Sample	Whole Sample	Established	EME	Resilient EME	Fragile EME
Interest Gap _{t-1}	0.86*** (0.01)	0.85*** (0.01)	0.85*** (0.03)	0.86*** (0.01)	0.83*** (0.03)	0.86*** (0.03)
Output Gap	0.10*** (0.02)	0.11*** (0.02)	0.04* (0.02)	0.13*** (0.02)	0.11*** (0.03)	0.18*** (0.05)
Inflation Gap	0.10*** (0.01)	0.10*** (0.01)	0.17*** (0.03)	0.08*** (0.02)	0.06** (0.03)	0.11*** (0.03)
Δ Core Inflation Gap	0.22*** (0.03)	0.22*** (0.03)	0.05 (0.05)	0.26*** (0.04)	0.09* (0.05)	0.40*** (0.07)
Hot Money Flows	0.007*** (0.002)	0.005** (0.002)	0.005** (0.002)	-0.012 (0.014)	-0.013 (0.014)	-0.013 (0.05)
Hot Money Flows x Core Above Range		0.008** (0.004)	0.009** (0.004)	0.016 (0.029)	-0.022 (0.046)	0.007 (0.064)
Hot Money Flows x Headline Below Range		-0.005 (0.011)	0.001 (0.01)	-0.005 (0.027)	0.006 (0.026)	-0.218* (0.116)
N	1016	1016	315	701	305	217
Countries	23	23	7	16	7	5
R ²	0.95	0.95	0.97	0.94	0.91	0.95

Notes: This table shows coefficient estimates from panel regressions of the quarterly monetary policy reaction function (with country-fixed effects) using the gap between the interest rate and inflation target. The policy reaction function allows for reactions to hot money flows and interactions between hot money flows and dummy variables for periods when core inflation is above the target range and for periods when headline inflation is below the range. All regressions include year dummies, seasonal dummies, and a global financial crisis dummy.

Returning to Table 7 (Panel B), we find considerable country variations in the policy response to hot money flows when the policy responses to hot money flows are allowed to vary across countries. Among the established countries, five of the seven raise interest rates in response to hot money flows. While five of sixteen EMEs raise interest rates, eleven cut interest rates: especially, Brazil, Indonesia, and Mexico display sharply negative responses.

We also estimate policy responses separately for different country groups to examine divergent policy responses to hot money flows. The estimates from seven Established economies amongst the Anglophone and Scandinavian countries (Column C) are quite similar to those from the broad set of countries except that they are less responsive to changes in the core inflation gap. In contrast with the significant positive response of Established economies to hot money flows, the coefficient on hot money inflows is essentially negative, if insignificant (Column D). EMEs, on average, tend to cut their interest rates on average when faced with inflows. Since short-term external liabilities for EMEs tend to be dominated in foreign currencies, cutting domestic interest rates might discourage the carry trade. The coefficients on the interaction terms are also economically significant but statistically insignificant, perhaps enunciating that on average EMEs react to capital inflows during inflationary times by raising rates but react by cutting rates in disinflationary periods

There may be divergence among EMEs in policy responses to capital inflows. Among seven resilient countries (the six mentioned above plus Israel), we again find no statistically significant response to hot money inflows (Column E). Among the five fragile countries, we do find that EMEs experiencing capital inflows in deflationary times are likely to cut sharply interest rates (possibly fending off appreciation pressures from capital inflows on domestic inflation as well) even though this outcome is significant only at the 10% level (Column F).

We also consider how central banks respond to exogenous financial market shocks. The spread between Moody's Seasoned Baa Corporate Bond Rate and the Federal Funds Rate from FRED—we call this “Risk Spread”—includes both the bond risk premium and the yield curve slope in the U.S. We can think of innovations in this indicator as the global risk premium that is relatively exogenous to domestic conditions in smaller open economies with IT regimes.

Table 9 summarizes the estimated results of policy reaction functions including quarterly changes in the Risk Spread. In general, when global bond market risk increases, central banks would respond by cutting interest rates and easing domestic liquidity. This prediction is supported by the estimated coefficient of the Risk Spread that is negative and significant at the 1% level for the whole sample (Column A). Nonetheless the policy reaction to such exogenous shocks will be influenced by the constraints imposed by the inflation target, as shown for the whole sample (Column B). When inflation is largely in the target range (normal times), the negative coefficient estimate (-0.10, significant at the 10% level) suggests that IT central banks lowers policy rates upon global risk shocks. When the core inflation above the target range, however, the positive coefficient estimate on the interaction with the risk shock (0.12, significant at the 10% level) suggests that the net effect of the shock on policy rates is muted. In contrast, when headline inflation is below the target range, the interest rate response is much more substantial than at normal times, as indicated by a significantly negative coefficient (-0.16) on the related interactive term.

Table 9. Taylor Rules and Global Risk Shocks: Panel Regressions

	Dependent Variable: Interest Rate Gap _t = $i_t - \pi_t^{TGT}$					
	(A)	(B)	(C)	(D)	(E)	(F)
Independent Variables	Whole Sample	Whole Sample	Established	EME	Resilient EME	Fragile EME
Interest Gap _{t-1}	0.83*** (0.01)	0.83*** (0.01)	0.76*** (0.02)	0.86*** (0.01)	0.83*** (0.02)	0.85*** (0.03)
Output Gap	0.08*** (0.02)	0.08*** (0.02)	0.06** (0.03)	0.10*** (0.02)	0.05*** (0.02)	0.16*** (0.05)
Inflation Gap	0.14*** (0.01)	0.14*** (0.01)	0.19*** (0.03)	0.12*** (0.02)	0.17*** (0.02)	0.16*** (0.04)
ΔCore Inflation Gap	0.22*** (0.03)	0.21*** (0.03)	0.06 (0.05)	0.28*** (0.03)	0.20*** (0.05)	0.35*** (0.08)
ΔU.S. BAA-Fed Funds Spread	-0.12*** (0.04)	-0.10* (0.05)	-0.14** (0.07)	-0.01 (0.08)	0.00 (0.10)	-0.18 (0.18)
ΔU.S. BAA-Fed Funds Spread x Core Above Range		0.13* (0.07)	0.38*** (0.13)	-0.06 (0.09)	-0.04 (0.11)	-0.03 (0.22)
ΔU.S. BAA-Fed Funds Spread x Headline Below Range		-0.16** (0.08)	-0.05 (0.1)	-0.28** (0.11)	-0.27** (0.12)	-0.31 (0.46)
N	1360	1360	529	831	400	236
Countries	23	23	7	16	7	5
R ²	0.95	0.95	0.93	0.95	0.95	0.95

Notes: This table shows coefficients from panel estimates of the quarterly monetary policy reaction function (with country-fixed effects) using the gap between the interest rate and inflation target as the dependent variable. The policy reaction function allows for a reaction to global risk shocks (represented as the spread between Moody's BAA spread and the Fed Funds rate) and interactions between global risk shocks and dummy variables for periods when core inflation is above the target range and periods when headline inflation is below the range. All regressions include year dummies, seasonal dummies, and a global financial crisis dummy.

Are policy responses to the global risk premium different across country groups? In the subgroup of seven established economies (Column C), the response to a rise in the global risk premium is to cut interest rates in normal times (significant at the 5% level). However, the coefficient on the interactive term with core inflation above the target range is large and significantly positive (at the 1% level). Thus, the net effect of heightened global risk when inflation is above the target range is thus to raise policy rates, possibly reflecting proactive responses to potential financial risk amid inflationary pressures. In contrast, the coefficient on global risk premium shocks is nil for sixteen EMEs (Column D), while the coefficient on its interaction with headline inflation below the target range is large and significantly negative (at the 5% level) for these EMEs except fragile EMEs (Columns E and F). This result suggests that, upon heightened global risk, resilient EMEs ease monetary policy only when inflation target is undershot whereas other Fragile EMEs do not change policy rates.

V. MACROPRUDENTIAL MEASURES

When confronted with credit conditions that are inconsistent with inflationary conditions, policy authorities constrained by anchoring to inflation target may use alternative policy instruments.⁶ A variety of potential administrative and regulatory tools might be adjusted to the economic environment under the rubric of macroprudential measures. Lim (2011) show that 40 out of 49 countries surveyed have undertaken macroprudential actions. Macroprudential measures could affect other goals as well as financial stability (Bayoumi et al., 2014). Kim and Mehrotra (2017) find from Indonesia, Australia, Korea, and Thailand using structural VARs that macroprudential policy shocks have impacts on credit growth and inflation. Schularick and Shim (2016) from 12 Asian panel data analysis using a local projection approach find that the effect of macroprudential policy pronounced on credit growth but not on output and inflation.

To measure official policy actions for financial stability, we use the Shim et al. (2013) database of macroprudential measures for advanced and EM economies over the period to the middle of 2012.⁷ The database divides prudential actions into regulatory tightening actions to restrain credit issuance and regulatory easing actions to advance lending. We construct a dummy variable equal to one for each country quarter with one or more macroprudential actions to tighten credit; and zero for each country quarter with no such action. Another dummy variable equals one for each country quarter with at least one macroprudential action to ease credit conditions; and zero with no such action. For a small number of country quarters, there may be both tightening and easing actions. In those cases, we classify the country quarter as being either

⁶ A conflict between price stability and financial stability (e.g., Borio and Lowe 2002, and Smet 2013) renders credibility difficult to establish unless interest rate policy is well-coordinated by macroprudential policy. Issues on coordination for monetary policy and prudential policy among authorities, which are beyond the scope of this paper, are discussed in Bayoumi et al. (2014).

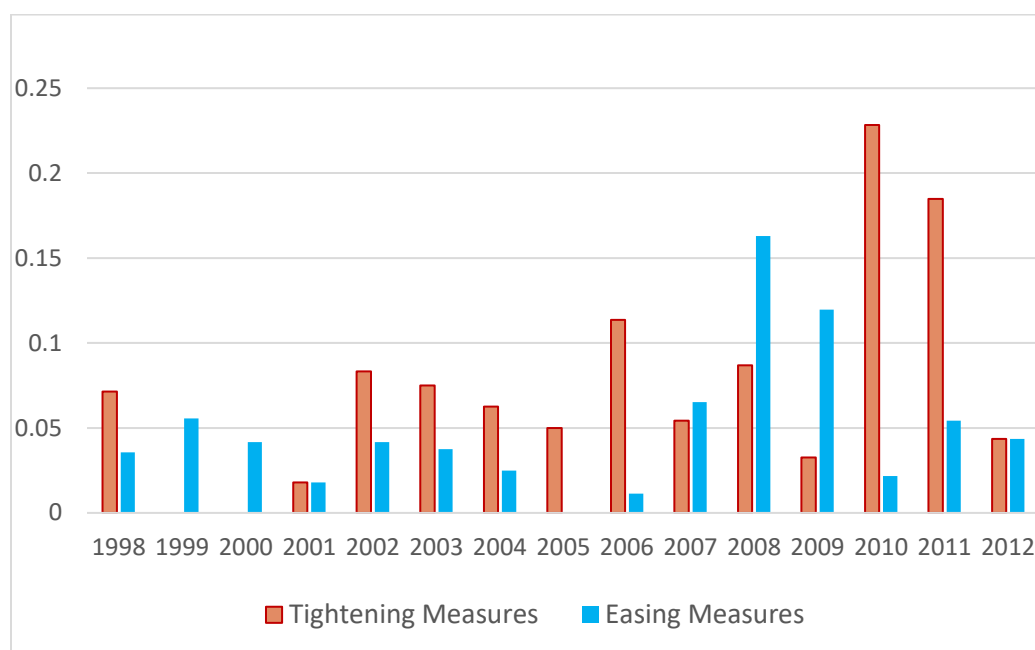
⁷ Shim et al. (2013) construct a database of macroprudential measures implemented by a large number of central banks (including the IT countries we examine here). Using information from central bank publications to identify official actions, the database comprises monetary adjustments to banking regulations including reserve or liquidity requirement adjustments as well as direct regulations on mortgage lending including adjustments in loan-to-value or debt-to-income ratio and aggregate credit growth ceilings.

tightening or easing depending on whether the corresponding quarter entails more tightening or easing actions or on the general tendency of the country's policymakers in adjacent quarters.

For our sample of IT countries with credit growth data, we calculate the percentage of country quarters in which there were macroprudential actions during IT periods. We find that some sort of macroprudential tightening (easing) actions were undertaken in 7.8% (5.8%) of the country quarters in our sample. The evolving percentage of country quarters depicted by Figure 3 suggests that IT countries have undertaken more prudential easing measures after the 1997 Asian crisis and GFC and more prudential tightening measures in 2010-2011 following continued monetary easing after the GFC.

Macroprudential actions to check cumulating financial imbalances can supplement monetary policy by curbing credit growth. In Table 10, we report the results from logit regressions of macroprudential actions on business cycle conditions and indicators of constrained monetary policy under IT.⁸ The data include those periods after Hammond (2012) identifies the central bank as implementing an IT regime (being dictated by the availability of credit growth, Israel, New Zealand, and Peru are excluded). The logit regressions here include year dummies, a dummy covering the global financial crisis, and seasonal dummies.

Figure 3. Percentage of IT Country Quarters with Macroprudential Measures Taken



⁸ While we estimate reaction functions of monetary and macroprudential policies for most IT countries, Shim and Schularick (2016) estimate the impact of monetary and macroprudential policies on household credit growth for 12 Asian Countries.

Table 10. Macroprudential Actions: Panel Logit Regressions

	Implement Macroprudential Tightening				Implement Macroprudential Easing			
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Independent Variables	Whole Sample	Whole Sample	EME	Whole Sample	Whole Sample	Whole Sample	EME	Whole Sample
Output Gap	0.16 (0.10)	0.17* (0.10)	0.15 (0.12)	0.17* (0.10)	-0.12 (0.08)	-0.12 (0.08)	-0.08 (0.10)	-0.12 (0.08)
Inflation Gap	0.16** (0.07)	0.16** (0.07)	0.15* (0.08)	0.17** (0.07)	-0.07 (0.08)	-0.05 (0.07)	-0.06 (0.08)	-0.07 (0.08)
Credit Growth	0.05*** (0.02)	0.06*** (0.02)	0.07*** (0.02)	0.06*** (0.02)	-0.01 (0.01)	-0.01 (0.01)	-0.03 (0.02)	-0.01 (0.01)
Headline Below Range	0.84* (0.45)							
Headline Below Range for 1 Year		1.70*** (0.52)	1.50** (0.66)					
# of Quarters Headline Below Range				0.27*** (0.08)				
Core Above Range					0.66* (0.42)			
Core Above Range for 1 Year						0.77* (0.45)	0.57 (0.51)	
# of Quarters Core Above Range								0.15** (0.07)
N	966	966	589	966	966	966	589	966
Countries	20	20	14	20	20	20	14	20

Notes: This table shows coefficients from quarterly panel logit regressions for 2003-2013 of indicators of the implementation of macroprudential actions from the Shim et al. (2013) database. Israel, New Zealand, and Peru are excluded owing to the availability of credit growth. Regressors include indicators of constrained monetary policy. All regressions include year dummies, seasonal dummies, and a global financial crisis dummy.

Column A in Table 10 reports a logit regression of the dummy variable for tighter macroprudential actions on the output gap, inflation gap, and CPI-adjusted real credit growth, along with a dummy variable indicating that headline inflation is below the target range. Macroprudential tightening could be viewed as complementary to raising interest rates in tempering inflation pressures or slowing credit growth. Macroprudential tightening is more likely when the economy is booming because the estimated coefficients on the output gap, inflation gap, and real credit growth are all positive. While the coefficient on the output gap is marginally insignificant at the 10% level, the coefficients on the inflation gap and real credit growth are significant at the 5%, and 1% level, respectively. Macroprudential tightening is also likely to occur to check credit expansions when inflation is below the target range, while monetary policy space is limited in achieving price stability goals. The coefficient on the dummy for inflation being below target is positive (significant at the 10% level).

Since macroprudential adjustments may be less flexible than monetary policy changes, they may be likeliest when monetary policy has been constrained for a substantial period. When headline inflation is persistently undershot, monetary easing may exacerbate credit expansions as a side effect. To offset or prevent such a side effect, prudential tightening could be deployed. To examine this idea, we first estimate a regression where the dummy variable for headline inflation being below the target range for at least four quarters. The coefficient on this dummy variable is strongly positive at 1.70 (significant at the 1% level) for the whole sample (Column B) and similar for EMEs (Column C). We then replace the dummy variable with a measure of the number of consecutive periods in which headline inflation is below the target range (up to 3 years), representing the degree of prolonged target breach. We find that the number of periods in which headline inflation is below the target range is also associated positively with the likelihood of implementing macroprudential tightening for the whole sample (Column D). These findings reconcile well increasing needs for the mix of accommodative monetary policy and tighter macroprudential policy at low inflation and low growth as experienced in recent years.

We also report the logit regression results of macroprudential easing measures on macroeconomic conditions and indicators of constrained monetary policy (Columns E-H). We find that macroprudential easing is more likely when economic conditions are poor—as implied by negative coefficients on the output gap, inflation gap, and real credit growth—although the associated coefficients are not significant (at the 10% level). Prudential easing is less dependent on business or credit cycles than prudential tightening.

Macroprudential easing could be deployed to moderate the negative impact on credit growth of tighter monetary policy when inflation stays above the target range. There is somewhat weak evidence that macroprudential easing is more likely when monetary policy is otherwise constrained. The coefficient on a dummy variable for country quarters when core inflation is above the target range (thus posing constraints on cutting interest rates) is positive but statistically insignificant (Column E). The coefficients on a dummy variable for periods when core inflation has been above the target range for at least one year is positive and significant at the 10% level for the whole sample (Column F) and is positive but statistically insignificant when the sample is limited to EMEs (Column G). Lastly, macroprudential easing is positively (significant at the 5% level) associated with the number of consecutive quarters that core inflation had been above the target range (Column H).

VI. CONCLUDING REMARKS

Credit-market or financial stability and price stability might be at odds as policy goals. We find that central banks lean against the wind to an extent even in IT countries—as implied by ‘flexible’ IT. However, this behavior is sharply attenuated in EMEs when leaning against the wind conflicts with price stability. Our findings suggest that macroprudential actions are more likely to be undertaken during booms (output, inflation, and especially credit growth) or when monetary policy space is constrained by price stability concerns—as a complement for monetary policy. Macroprudential easing is more likely when tighter monetary policy to control for inflation is prone to constrain credit growth.

This paper shed light on how central banks conduct monetary policy concerns about inflation and credit growth which are off the track. A natural question is whether the constraints of inflation targeting lead to financial instability when inflation is outside of the target range. We seek evidence on the complementarity between monetary policy and macroprudential policy to square inflation targeting with financial stability. Especially when inflation is off the target range but monetary policy space is constrained, policymakers could deploy macroprudential measures to offset at least partly the side effects of IT-focused monetary policy (such as excess credit or hot money flows).

The well-woven policy mix of monetary and macroprudential policies will help address conflicts among goals including price stability and financial stability. The undershooting of inflation target could be prolonged if lower policy rates runs the risk of excess credit in some sectors. To prevent the deterioration of credit situations, tighter macroprudential measures (such as the loan-to-value and debt-to-income ratios) could be deployed depending on the scope and degree of financial spillovers. Our findings are consistent with the deployment of macroprudential policy when monetary policy is constrained.

Also, our findings on divergent policy responses to hot money flows and global risk shocks suggest that policy conflicts are not uniform among IT countries. Established economies weigh in inflation targeting more than EMEs do in response to hot money flows or global risk sentiments. First, Established economies reconcile hot money flows and inflation pressures through tighter monetary policy. In contrast, EMEs’ responses to HM are largely muted possibly because hot money flow transmission entails both an inflationary effect through credit expansion and a disinflationary effect through appreciation, offsetting each other. When inflation undershoots the target range, however, they lower interest rates to boost inflation through funneling domestic liquidity and reversing the appreciation pressure of hot money flows. Second, Established economies lower interest rates to buffer global risk shocks while they raise them to fight inflation when inflation is above the target range. In contrast, in the face of global risk shocks, EMEs deploy monetary policy only when inflation is below the target range without involving a conflict between handling heightened global risk and inflation targeting.

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