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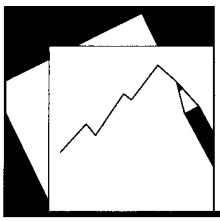

IMF Working Paper

Monetary Policy in Emerging Markets: Taming the Cycle

Donal McGettigan, Kenji Moriyama, J. Noah Ndela Ntsama, Francois Painchaud, Haonan Qu, and Chad Steinberg

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Strategy, Policy and Review Department

Monetary Policy in Emerging Markets: Taming the Cycle[1]

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May 2013

Abstract

In contrast to advanced markets (AMs), procyclical monetary policy has been a problem for emerging markets (EMs), with macroeconomic policies amplifying economic upswings and deepening downturns. The stark difference in policy has not been subject to extensive study and this paper attempts to address the gap. Key findings, using a large sample of EMs over the past 50 years, are: (i) EMs have adopted increasingly countercyclical monetary policy over time, although large differences remain among EMs and policies became more procyclical during the recent crisis. (ii) Inflation targeting and better institutions have been key factors behind the move to countercyclicality. (iii) Only deep financial markets allow EMs with flexible exchange rate regimes turn countercyclical. (iv) More countercyclical policy is associated with far less volatile output. The economically meaningful impact of IT on monetary policy countercyclicality and output variability is another reason in its favor, over and above better inflation outcomes.

JEL Classification Numbers: E52, F41

Keywords: Monetary Policy, Countercyclical Policy, Emerging Markets

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I. INTRODUCTION

Procyclical policy has been a problem for emerging markets (EMs), with macroeconomic policies amplifying economic upswings and deepening downturns.[2] This contrasts sharply with advanced markets (AMs), where policies tend to be countercyclical.

Much attention has been given to the cyclical nature of fiscal policy in EMs. The literature provides ample evidence that fiscal policy in EMs has been procyclical, but with recent work finding it has become less so due to stronger institutions.[3]

By contrast, the literature on monetary policy cyclicality in EMs is sparse.[4] It mostly contrasts the countercyclical nature of monetary policy in AMs and the procyclical stance of EMs. It also provides tentative evidence of a recent shift towards more countercyclical policy ("graduation") in EMs, in parallel with improvements in the cyclical nature of EM fiscal policy. The literature also touches briefly on possible causes of such graduation.

This paper addresses this gap and finds that many EMs have shifted to countercyclical monetary policy, with inflation targeting (IT) and strengthened institutions as key causal factors. This suggests additional policy benefits from moving to IT, and all that it involves, over and beyond its contribution to lower inflation in EMs.

The rest of the paper is as follows. Section II reviews the literature on EM monetary policy cyclicality. Section III measures EM and AM monetary policy cyclicality across time for a wide variety of countries. Section IV examines possible causes. Section V assesses the implications of cyclicality for output variability. Section VI presents a case study of Chile, an EM that has strengthened institutions and adopted IT, allowing it to pursue more countercyclical monetary policy. Section VII concludes. Data and sources are discussed in Appendices I and II.

II. LITERATURE REVIEW

The key findings of the sparse literature of monetary policy cyclicality in EMs are: (i) while AMs are overwhelmingly countercyclical in their conduct of monetary policy, the same does not hold for EMs; and (ii) monetary policy in EMs is becoming more countercyclical, reflecting better underlying macroeconomic conditions and institutional improvements. The main relevant studies are:

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[2] See, for example, Kaminsky, Reinhart and Vegh (2005).

[3] See, for example, Gavin and Perotti (1997), Lane (2003), Akitoby, Clements, Gupta, and Inchauste (2004), Kaminsky, Reinhart and Vegh (2004), Talvi and Vegh (2005), Alesina, Campante, and Tabellini (2008), Ilzetzki and Vegh (2008), and Frankel, Vegh, and Vuletin (2012).

[4] The few studies that exist include Kaminsky, Reinhart and Vegh (2005), Coulibaly (2012), Takáts (2012), and Vegh and Vuletin (2012).

- **Kaminsky, Reinhart and Vegh** (2005) present the first systematic effort to document empirically the cyclical properties of monetary policy in EMs. Using data for 104 countries over 1960-2003, they find that most OECD countries have countercyclical monetary policy, while EMs are mostly procyclical or acyclical.

- **Coulibaly** (2012) focuses on EM policy rates and credit growth during the recent crisis. He finds evidence of "graduation" to countercyclical monetary policy and ascribes this to factors such as macroeconomic fundamentals, vulnerabilities, financial sector reform, and adoption of IT (with more countercyclicality noted in EMs as these factors improved).

- **Vegh and Vuletin** (2012) find evidence of EM "graduation." They find that more than a third of EMs graduated in the 2000s, on top of the third that already had such policies in place. (Only 7 percent reverted to procyclical monetary policy.) They regard the lack of exchange rate flexibility, in turn related to institutional quality, as a key determining factor of procyclicality.

But there are several gaps in the literature. To date, this emerging literature primarily examines the relationship between nominal rates and real output, which could be problematic, especially for EMs with large swings in inflation. Moreover, analysis to date is not focused on the underlying reasons behind these differences in performance over time and across countries, which is critical for policy prescriptions. The aim of this paper is to help address these gaps.

III. Analysis of Monetary Policy Cyclicality

This section documents systematically a major shift in the cyclical behavior of monetary policy over the last half century across a wide sample of AMs and EMs. The cyclicality of monetary policy is measured by the 10-year backward correlation between the cyclical component of real GDP and the cyclical component of the real short-term interest rate, where the latter is taken as a proxy for the stance of monetary policy.[5] [6] A positive correlation is indicative of countercyclical monetary policy, while a negative correlation indicates procyclical monetary policy. We label this new measure the Cyclicality of Monetary Policy (CoMP). Our dataset covers 84 countries—35 AMs and 49 EMs—over 1960 to 2011.[7]

[5] We use the central bank discount rate as our short-term interest rate due to its longer availability than other variables. Interest rates are deflated using current CPI inflation and are cyclically adjusted. The paper also cross checked against a key monetary aggregate (private credit) to detect counter-cyclicality. The main storyline does not change from that based on the real central bank discount rate.

[6] The cyclical component is derived from the average of the estimated trend using a HP filter with lambda 100 and 6.25. In order to avoid the usual end-point distortions associated with the HP filter, each data series beyond 2017 is extended using the 2017 growth rate.

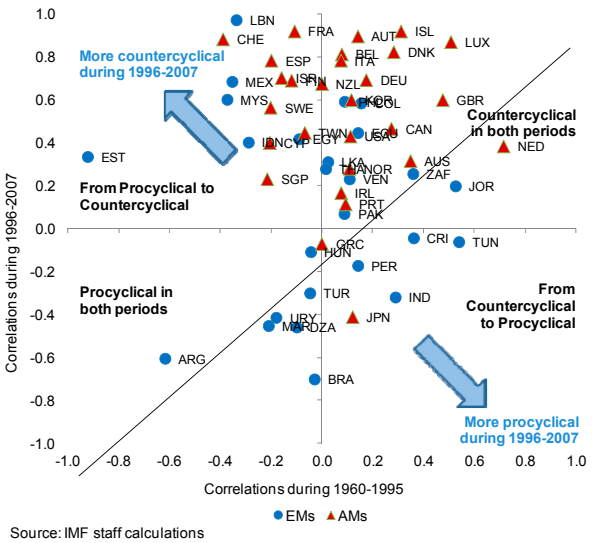
[7] See Table 4 in Appendix I for details, including on data coverage for individual countries.

The analysis confirms that monetary policy in AMs is typically more countercyclical than in EMs, but that both AMs and EMs have become more countercyclical. Figure 14 in Appendix I shows the computed correlation between the cyclical component of GDP and the cyclical component of the real short-term interest rate. A positive correlation is indicative of countercyclical monetary policy, while a negative correlation indicates procyclical monetary policy. The figure is divided into three periods: (i) 1960-2007, the full period (i) 1960-1995, the early period, and (iii) 1996-2007, the latter period. Our analysis, in general, concentrates on the period before 2007 to help abstract from exceptional factors that affected monetary policy most recently (see below). The charts show that AMs are more typically countercyclical in their application of monetary policy than EMs (top panel) and that AMs have become almost uniformly countercyclical since the late 1990s (bottom panel). EMs also improved, although the improvement is less striking. Still, large improvements were seen in, key EMs, including Colombia, Mexico, Malaysia, and the Philippines.[8]

Using nominal, rather than real, interest rates, shows a greater move to countercyclicality, especially for EMs (Figure 15 in Appendix I). Past studies of monetary policy cyclicality have used nominal, rather than real, rates. While a similar pattern emerges for AMs as in the real interest rate figure, EMs show an *even stronger move* towards countercyclical monetary policy using nominal rates. Despite these more promising EM results using nominal rates, for the remainder of the paper we focus on CoMP measures using real rates. This is because there appear more grounds for relating real interest rates to the real output gap—two real variables—rather than linking a nominal variable with a real output gap.[9]

Focusing on CoMP transitions, it is clear that EMs have adopted increasingly countercyclical monetary policy over time. This is apparent in Figure 1, which shows the cyclicality of monetary policy over 1960-1995 on the horizontal axis, and over 1996-2007 on the vertical axis. This figure divides covered countries into four "quadrant" categories along the lines of Vegh and Vuletin (2012), as explained by the chart's four black sub-labels. The countries in the top-right quadrant are countries that have been countercyclical over the past fifty years, and not surprisingly, include many AMs. Over 1960–95, 68 percent of AMs (in red) were implementing counter-cyclical monetary

Figure 1. Transitions



Source: IMF staff calculations

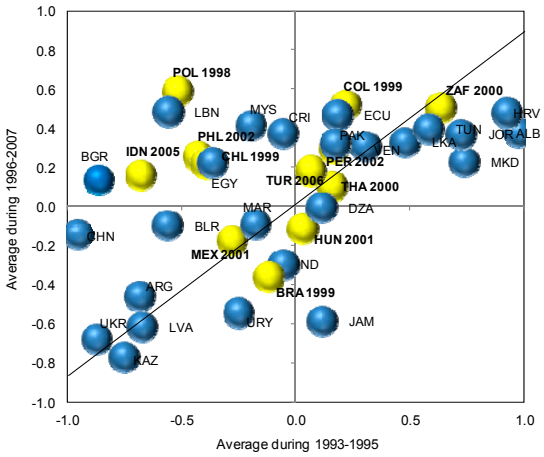
[8] The findings may be less relevant for those countries that have no monetary independence.

[9] That said, the countercyclicality of monetary policy may be understated using real rates if demand-led inflation shocks predominate, reducing measured real rates as output rises.

policy (countries situated on the right side of the figure) compared to 50 percent for EMs (in blue). Over 1996-2007, AMs have become almost uniformly countercyclical and more EMs (60 percent) were implementing counter-cyclical monetary policy (countries situated in the top part of the figure).[10] [11] The countries in the bottom-left quadrant are countries that have always been procyclical, and include mostly EMs. [12]

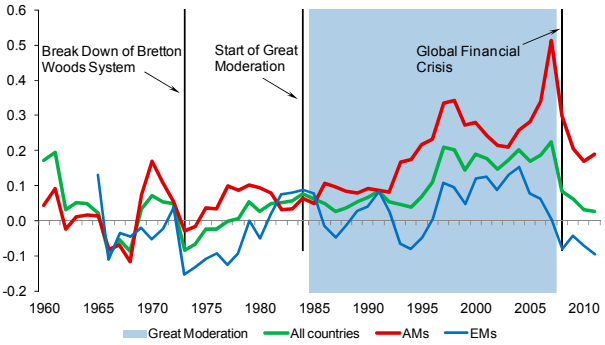
Inflation-targeting EMs appear to have been most successful in implementing countercyclical monetary policy. Figure 2 shows a comparison of correlations over both periods. The earlier period is replaced by a shorter time series reflecting data availability for EMs. As in the earlier chart, observations above the forty-five degree line indicate an improvement in policymaking, with those furthest away from the line showing the greatest improvement. Yellow identifies countries that adopted some version of IT and the label refers to the year the regime was adopted. By and large, a greater proportion of inflation targeters moved to countercyclical monetary policy than non-IT regimes. Notable improvements were made, for example, by Chile, Indonesia, the Philippines, and Poland.

Figure 2. EM Transitions
(Average of Rolling Correlations During Each Period)



Source: IMF staff calculations

Figure 3. CoMP over Time



Source: IMF staff calculations

In the shift toward more countercyclical policy, central banks transitioned through distinct periods. Figure 3 shows the simple average of our CoMP measure for all countries between 1960 and 2011.[13] It illustrates that across the spectrum, central banks have indeed become more

[10] The two periods are chosen based on Taylor rule break points. See below for details.

[11] Results are robust to break point changes.

[12] These results are also broadly consistent with the results presented in Vuletin and Vegh (2012) (Figure16 in Appendix)--- Vuletin and Vegh's analysis, however, uses nominal rather than real interest rates, which shows an even sharper improvement for both advanced and emerging market economies over time. Nominal rates may not capture as accurately the stance of monetary policy, in particular in emerging markets where inflation is often high and volatile.

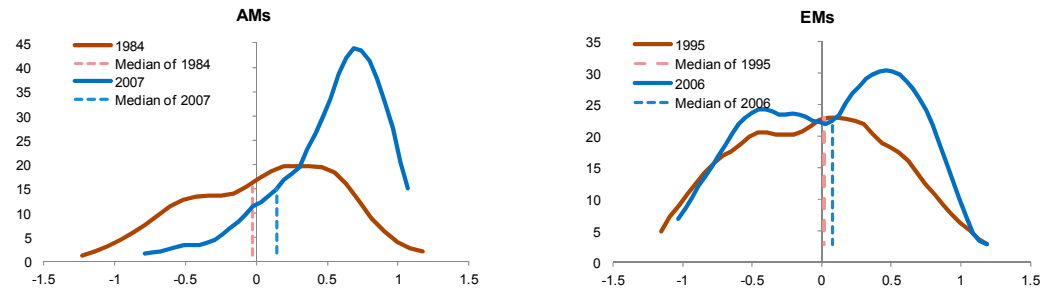
[13] As noted before, our country-specific measure of monetary policy cyclicality is based on the 10-year backward correlation between the cyclical component of real GDP and the cyclical component of the real short-term interest rate. Therefore, the average presented for 1980, is the country average of the correlations for each country over the previous ten years (1971 to 1980).

countercyclical in their monetary policy. We identify two noticeable periods of change. First, with the breakdown of the gold standard and the Bretton Woods system in the early 1970s, AMs steadily moved from acyclical/procyclical to countercyclical monetary policymaking. This likely illustrates the importance of more flexible exchange rate regimes in helping to achieve greater monetary policy independence. Second, during the period of the Great Moderation[14] starting in 1984, countercyclicality improved for both advanced and emerging market economies, with the move especially striking for AMs. We will explore possible explanatory factors in more detail in the following section.

Following the advent of the global crisis, monetary policy has also become decidedly less countercyclical across the board according to our CoMP measure. For AMs this in part likely reflects central banks running into the interest rate lower bound, and their inability to generate persistent negative real interest rates. Instead, many AMs shifted policy implementation from short-term interest rates to quantity-based policies and a heavier reliance on forward guidance. For EMs, global food and commodity price shock may have played a role given their large weight in many EM's CPI baskets. Coming into the crisis, EM central banks were concerned with second round effects from the run-up in commodity prices, meaning that a full response to headline commodity-related inflation increases was not needed. After the crisis hit, inflation fell quickly with commodity prices, but capital also started to quickly flow back to the core. As a result, there was less room for EM central banks to loosen monetary policy, and less need from a strictly inflation viewpoint, increasing measured monetary policy procyclicality.

Although there was an overall increase in countercyclicality prior to the crisis, large variations among EMs remain (Figure 4).[15] From the start of the Great Moderation until the onset of the global financial crisis, AMs showed a clear shift towards countercyclical monetary policy, with the width of the distribution also narrowing as "laggers" caught up to "leaders" in monetary policy implementation. This is largely consistent with our earlier findings. In contrast, while EMs also improved, the advances have not been uniform. A

Figure 4. CoMP Distribution for AMs and EMs



Source: IMF staff calculations

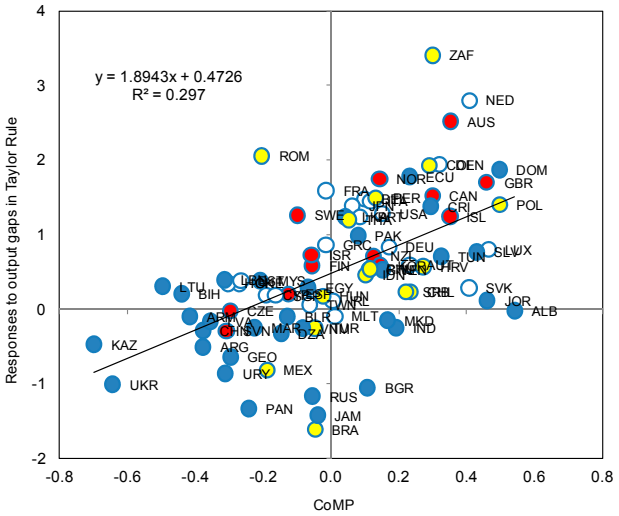
[14] This refers to the period of decreased macroeconomic volatility explained in advanced economies.

[15] Part of the reason for the more procyclical behavior in the earlier period for EMs may reflect procyclical disinflation from high levels of inflation.

comparison of the distributions between 1995 and 2006 [16] show that while the number of EMs implementing countercyclical policy has increased, so has the number of procyclical EMs partly reflecting the arrival of transition countries with procyclical monetary policy. The resulting distribution shows a bimodal relationship where there are two group of emerging market economies: the countercyclicalists (on the right) and the procyclicalists (on the left).

We check these results by running a multitude of robustness checks. Our main strategy is to use the structure of Taylor rules to estimate Taylor coefficients on each country.[17] Several variants of the Taylor rule are estimated with the full set of results presented in Table 5 in Appendix I. Figure 5 shows a strong and significant relationship between our simple correlation measures and the estimated coefficients from the basic Taylor rules (i.e., that on the output gap) that supports our use of the simple correlations. Interestingly, this relationship is strongest for IT regimes in EMs (yellow dots) and both IT (red) and non-IT (white) AMs. This "better fit" in part reflects a smaller bias in estimated Taylor coefficients for countries with less volatile output gaps.

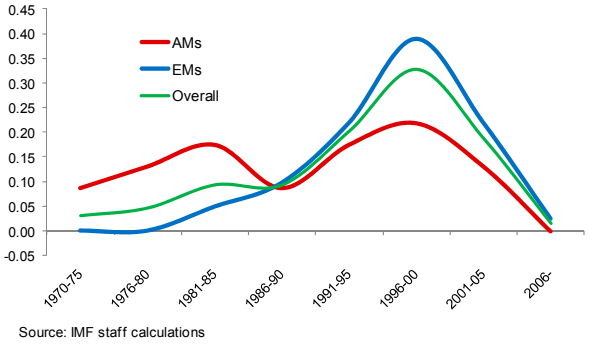
Figure 5. Correlations and Estimated Response to Output Gaps in Taylor Rule
(All Sample Period, Unadjusted Real Interest Correlations)



Source: IMF staff calculations

The Taylor rule estimates also provide evidence of a change in monetary policy cyclicality around 1996-97 (Figure 6). We run Chow tests on country-specific Taylor rules to check for a break in the coefficient on the output gap. Figure 6 shows that the mode of the distribution of break points for EMs is in the 1996-97 period. This is also consistent with the presentation of the data in previous figures. Panel regressions are also supportive of this hypothesis.[18]

Figure 6. Density of Structural Break Year by Chow Test



Source: IMF staff calculations

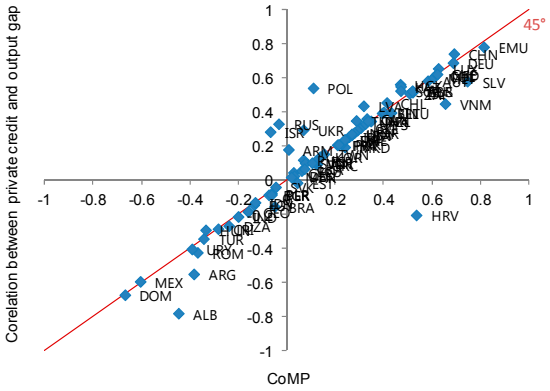
[16] The different time period reflects the different transition period for EMs and data availability.

[17] The Taylor coefficient is defined as the coefficient on the output gap in the Taylor rule formulation in this paper (see Table 5 in Appendix I).

[18] This is tested by inserting a break dummy for 1996 in a fixed-effect panel regression with CoMP as the dependent variable.

Another robustness check is conducted using monetary aggregates, as some EM central banks conduct monetary policy using other instruments. Our findings are broadly consistent with our interest-rate based findings. In particular, our CoMP measure is very strongly correlated to the correlation between monetary aggregate (private credit) and output gaps over the entire sample period, implying that CoMP is a good proxy for monetary policy stance even if the stance is characterized by monetary aggregates (see Figure 7).

Figure 7. Comparison of Our CoMP Measures and Correlation Between Private Credit and Output Gap 1960-2009



Source: IMF staff calculations

Our broad findings thus far are as follows:

- **EMs have adopted more countercyclical monetary policy over time** (at least prior to the recent crisis) and have emulated AMs in this respect;
- **Adoption of IT appears an important supporting factor**;
- **Yet many EMs continue to pursue procyclical monetary policies**, which could have serious economic costs.

IV. Determinants of Cyclicality

The second part of the analysis attempts to explain both the differences across EMs and over time in the degree of monetary policy cyclicality. The policy variable of interest is our measure of monetary policy cyclicality discussed earlier (CoMP). A number of policy instruments are explored as possible explanatory variables, including the monetary policy regime, the exchange rate regime, financial market development, and institutional strength.

The strength of this analysis is bolstered by the large number of countries examined and the extensive period of time covered. As far as we know, this is the first study to systematically examine the determinants of monetary policy countercyclicality in EMs in such a comprehensive manner. To conduct the analysis, we build a cross-country data set covering 64 countries (23 AMs and 41 EMs) between 1985 and 2011.[19] The data set includes variables on both policy regimes and country economic characteristics. The data set is unbalanced with AMs generally covered for longer time periods than EMs. Our main data sources are set out in Appendix II.

[19] The variables are aligned with CoMP by taking averages over the same 10-year period. Since ICRG data are available only after 1985 and thus its rolling correlations are available only after 1995, the sample period is extended to 2011 in order to increase sample size. Moreover, as these are rolling correlations over the previous ten years, developments since 2008 do not excessively affect the last three years in the sample.

Our priors are as follows:

(i) We expect the *inflation targeting dummy* to enter the equation with a positive sign, meaning that it is expected to help monetary policy become more countercyclical. *A priori*, IT regimes are expected to have strong monetary institutions, be more independent, and are generally thought to have improved monetary policy making within the standard business cycle, including through better communications and the anchoring of inflation expectations.

(ii) We expect the *institutional variable* to also enter the equation with a positive sign.[20] Stronger institutions are generally associated with stronger policies.

(iii) The *exchange rate regime* variable—which takes on a smaller value when the regime is more rigid—is also expected to be positive. In fixed regimes with open capital accounts, capital flows can complicate the conduct of monetary policy, with monetary policy being loosened in periods of strong capital inflows and growth, and being tightened in the event of outflows. But "fear of floating" may run counter to this effect in EMs.

(iv) The *financial reform* index is expected to be positive. Deeper and more liberal financial markets help strengthen the monetary policy transmission mechanism of movements in policy rates. Thus, it should be easier for central banks to conduct countercyclical policy in environments where financial markets are deep, and as a consequence the transmission mechanism is well established.

We find that both inflation targeting and institutions are significant and robust drivers of monetary policy countercyclicality. (Regressions estimated with fixed effects for EMs countries are presented in Table 1.[21]) These results withstand a multitude of specification and robustness checks, with both variables remaining significant and largely unchanged in the multivariate specifications. The signs of the variables are also consistent with our priors. Namely, countries that have implemented IT regimes and/or have improved their institutions tend to have more countercyclical monetary policy. As these results are based on within-country variation regressions, we also test for robustness by running a parallel cross-country regressions (see Table 7 in Appendix I), which confirms the importance of both institutions and IT regimes for the conduct of countercyclical monetary policy.

[20] While central bank independence index is another possible candidate to be used as a proxy for institutional strength, the paper does not use it due to data availability constraints.
[21] Similar regressions for AM countries are presented in Table 6 in Appendix I.

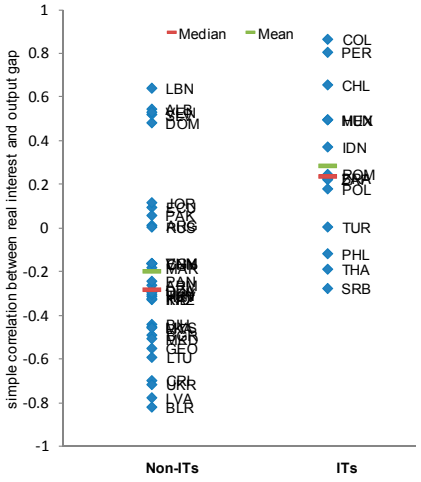
Table 1. Explaining CoMP in EMs

Dependent Variables	(1) CoMP	(2) CoMP	(3) CoMP	(4) CoMP	(5) CoMP	(6) CoMP
IT dummy	0.571 ***				0.598 ***	0.760 ***
	(0.171)				(0.175)	(0.209)
FX regime		-0.204				-1.535 **
		(0.283)				(0.733)
Institution			0.085		0.104 **	0.091 *
(Government stability in ICRG)			(0.054)		(0.049)	(0.055)
Financial deepening				-0.294		-1.359
(Financial reform index)				(0.643)		(1.085)
FX regime*financial deepening						1.344
						(1.029)
Number of samples	710	700	663	623	663	601
Adjusted R^2	0.117	0.046	0.052	0.037	0.138	0.166
Model	FE	FE	FE	FE	FE	FE

Number in parentheses indicate standard errors. *** p<0.01, ** p<0.05, * p<0.1
All variables in the right hand side are 10-year moving averages, consistent with the rolling correlations.
Source: IMF staff calculations

The results are also economically significant, carrying policy implications. Implementation of an IT regime is found to improve the correlation between real interest rates and output by nearly 0.6-0.7. That is a surprising 1.3–1.5 standard deviation improvement. Therefore, the adoption of IT, and all that this typically involves, should help substantially improve effectiveness of monetary policy in stabilizing the economy. Similarly, a one-standard deviation improvement in institution quality is associated with a quarter standard deviation improvement in monetary policy countercyclicality. Although these results are based on within regression results, the cross-section is equally convincing (see Figure 8).

Text Figure 8. 10-year Rolling Correlation Between Real Interest Rates and Real GDP in 2011



Source: IMF staff calculations

Only with deep financial systems in place can EMs with flexible exchange rate regimes turn countercyclical. This relationship is revealed by the positive interactive term between financial deepening and the exchange rate regime.[22] Our results suggest that, typically, only when financial markets are sufficiently developed do countries with what are classified as flexible exchange rate regimes stop reacting to capital flows in a manner that leads to procyclicality. This could be linked in turn to "fear of floating" in less financially developed EMs and improved monetary transmission mechanisms in EMs with more developed financial sectors.

[22] While this should hold in theory, the interactive term is only marginally significant in the presented regression table.

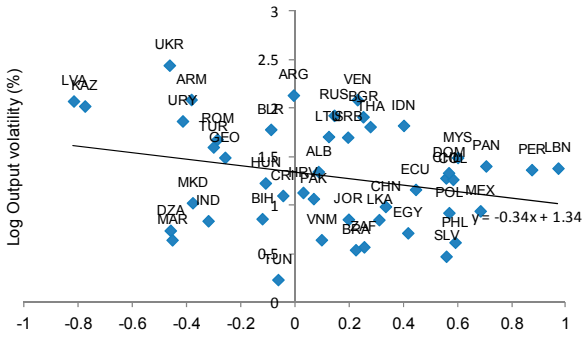
The results were surprisingly weak for the large number of remaining explanatory variables analyzed. The bilateral estimation for exchange rate regime and financial deepening are both statistically insignificant when considered individually. Variables that are not shown, but were also found to be insignificant under various specifications, include private credit, capital account openness, terms of trade shocks, the fiscal deficit, public debt, and GDP growth volatility.

V. Cyclicality of Monetary Policy and Output Variability

Having confirmed that monetary policy has become more countercyclical in EMs, we turn to the question of whether this has led to better macroeconomic outcomes. Up to now we have assumed that countercyclical monetary policy is a good thing. But there are some situations where countercyclical macroeconomic responses could possibly be counterproductive, e.g., in the face of large supply shocks, such as supply-related oil price increases, where output and inflation growth move in opposite directions. Even here, however, monetary policy should work against any second-round effects relating to such shocks.

Simple scatter plots confirm that more countercyclical monetary policy is associated with lower levels of output volatility.[23] Figure 9 illustrates the correlation between the log of output volatility and our measure of monetary policy countercyclicality, CoMP. We focus our analysis on the post-1996 and pre-crisis period, abstracting from current events and including the period in which the largest numbers of EM countries have shown an improvement in monetary policy making.[24]

Figure 9. Log Output Volatility for EMs, 1996-2007



Source: IMF staff calculations

Regression analysis substantiates that this result is robust to controls for external volatility. Countries facing volatile external shocks—like commodity producers—may have higher levels of output volatility regardless of the stance of monetary policy. We thus control for both terms of trade shocks and the share of commodity exports in total exports. The results in the Table 2 confirm that the relationship holds. The size of the coefficient is also noticeably large with a 0.5 increase in the degree of CoMP associated with a 100 percent reduction in output volatility. The signs of the terms of trade shock are also of the right sign and are significant.

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[23] We also investigate the impact on inflation volatility but results are inconclusive despite a tendency for both output variability and inflation variability to be highly correlated.

[24] For several Eastern European countries, output volatility in this period was higher as a result of banking crises during the transition process.

These findings are also consistent with previous work on EMs. Lane (2003), for example, shows that pro-cyclical macroeconomic policies in EMs has been associated with more extreme cyclical fluctuations in output. This analysis also shows a strong inverse relationship between output per capita and volatility. This section thus confirms that better macroeconomic policy making has led to less output volatility.

Table 2. Result of Regression on Log Output Volatility, 1996-2007

Dependant Variables	(1) GDP Volatility	(2) GDP Volatility	(3) GDP Volatility	(4) GDP Volatility
Constant	1.341***	1.142***	1.342***	1.145***
	(0.079)	(0.131)	(0.088)	(0.137)
Degree of monetary policy (counter-) cyclicality	-0.339*	-0.382**	-0.339*	-0.381**
	(0.181)	(0.178)	(0.185)	(0.182)
Standard deviation terms of trade shock		0.022*		0.022*
		(0.012)		(0.012)
Standard deviation export demand shock			0.000	0.000
			(0.006)	(0.006)
Number of sampes	47	47	47	47
R^2	0.072	0.139	0.070	0.139
Model	OLS	OLS	OLS	OLS

Numbers in parentheses indicate standard errors. *** p<0.01, ** p<0.05, * p<0.1
Source: IMF staff calculations

VI. CASE STUDY—THE CASE OF CHILE

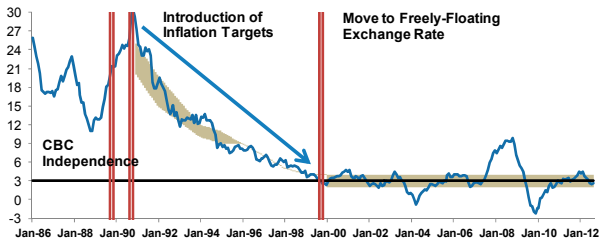
Chile epitomizes the graduation movement from fiscal procyclicality to countercyclicality (see Frankel, Vegh and Vuletin, 2011). Frankel et al. note that this is closely linked to the quality of institutions. In this section we describe Chile's parallel move towards greater monetary policy countercyclicality and link it to macroeconomic stabilization and the introduction of IT.

Chile struggled to find an appropriate monetary policy framework before gradually introducing IT in 1990.[25] During the early 1970s, Chile experienced hyperinflation as monetary policy was subordinated to fiscal policy. In the second half of the 1970s, fiscal deficits were reduced significantly and a fixed exchange rate regime was introduced limiting the ability of the Central Bank of Chile (CBC) to conduct an independent monetary policy. After a recession and a banking crisis in the early-1980s, capital account liberalization was curtailed and monetary policy aimed at affecting domestic policy rate while the exchange rate was allowed to fluctuate within a narrow band.

[25] For a more detailed discussion on the evolution of monetary policy in Chile, see Eyzaguirre (1998), Valdes (2007), and Betancour, De Gregorio and Medina (2008). In particular, the CBC was granted autonomy from political authority in 1990.

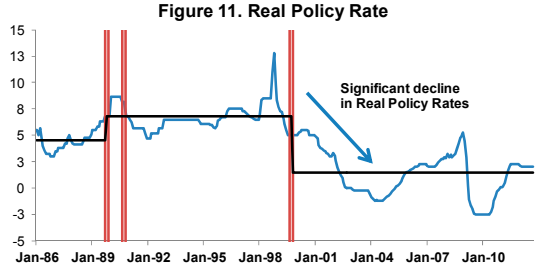
The gradual introduction of IT in 1990 ushered-in a new era of monetary policy in Chile.[26] Over 1990-99, Chile's monetary policy could be characterized as a partial IT – while the central bank targeted a gradual reduction in inflation over time (Figure 10) it also targeted the real exchange rate to help safeguard external competitiveness (to that effect, capital controls were introduced, including unremunerated reserve requirements). The bands around the real exchange rate were loosened throughout the 1990s. At the time, a gradual reduction in inflation was envisaged in order to build CBC credibility, recognizing the significant persistence of inflation (wide-spread indexation), and a legacy of the years of hyper-inflation. Tight monetary policy (Figure 11) combined with a managed but gradual real exchange rate appreciation (Figure 12), reflecting positive productivity shocks, helped reduce inflation from close to 30 percent at the end of 1990 to about 3 percent by the end of the decade.

Figure 10. Inflation (Y/Y) and Changes in Monetary Policy



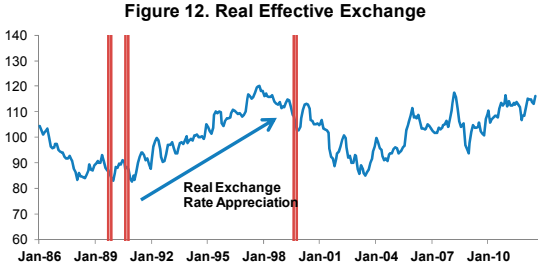
Source: Banco Central de Chile, IMFstaff calculations

Figure 11. Real Policy Rate



Source: Banco Central de Chile, Haver, IMF staff calculations

Figure 12. Real Effective Exchange



Source: IMF staff calculations

A more permanent inflation target, centered around 3 percent, was introduced once low and stable inflation was achieved in 1999.[27] In addition, Chile moved to a freely-floating exchange rate and liberalized its capital account, after financial markets deepened (including the use of foreign exchange derivatives) and the supervision and regulation of financial system was improved.

These developments allowed the CBC to become more counter-cyclical in its conduct of monetary policy. Simple 5-year backward rolling correlations suggest that monetary policy was pro-cyclical before the mid-1990s, and gradually moved to being more counter-cyclical, especially once inflation was stabilized at a low level (Figure 13).[28]

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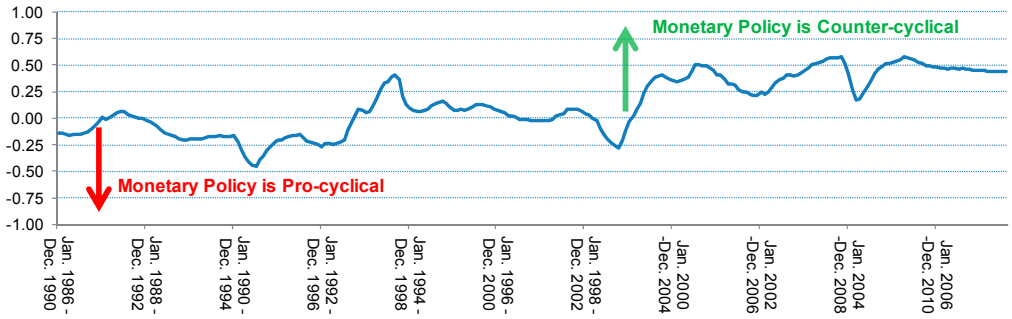
[26] This followed a concerted effort by major central banks to rein-in inflation which began in 1979, as discussed in Clarida, Gali and Gertler (1998).

[27] In September 1999, a target band of 2-4 percent was announced. In early 2007, the target was set at 3 percent, with a tolerance interval of +/- 1 percentage points.

[28] The cyclical component of the real policy rate is the difference between the real policy rate of the central bank and its trend component estimated using a simple Hodrick-Prescott filter. The results for the "neutral" real interest rates are broadly in line with Fuentes and Gredig (2007). The output gap is estimated in a similar way,

(continued…)

Figure 13. A Simple Measure of Chile's Monetary Stance:
5-Year Backward Rolling Correlations of the Cyclical Component of the Real Policy Rate and the Output Gap



Source: Banco Central de Chile, IMF staff calculations

Empirical evidence confirms this move to a more counter-cyclical monetary policy.[29] The sample is divided into three sub-periods: (i) before the introduction of inflation targeting (1986 -1991);[30] (ii) the disinflation period (1991-1998); and (iii) the period after the stabilization of inflation at a low level (1999 - 2012). While the coefficient on the output gap is positive for all three periods (see Table 3), indicating that a counter-cyclical monetary policy was undertaken in Chile, it is much higher (and more significant) for the poststabilization period.[31] This would suggest that stabilizing inflation (through the introduction of IT) and moving to a flexible exchange rate regime, allowed the CBC to undertake more forceful counter-cyclical monetary policy. The results also suggest that, once low and stable inflation was achieved, the CBC was in a position to loosen monetary policy, as evidenced by the large decline in the estimated natural real interest rates, while remaining vigilant to changes in inflation.

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using the monthly indicator of economic activity and industrial production. The estimated output gap presented here is broadly consistent with Magud and Medina (2011) and Fuentes, Gredig and Larrain (2007).

[29] We use an ex ante real interest rate specification consistent with Clarida, Gali and Gertler (1998). It is a forward-looking monetary policy reaction function, where the real interest rate is a function of the lagged real interest rate (persistency), natural rate of interest (average monetary policy stance), expected inflation compared to the one-year ahead inflation target, and the output gap. Including the real or nominal exchange rate in the specification, or changing the expectation horizon (to 3 months or 2 years), does not materially change the results.

[30] Data on real policy rates is not readily available prior to January 1986.

[31] Note that the coefficients are insignificant for the pre-IT period and the disinflation period.

Table 3. Result of Regression on Cyclicality of Monetary Policy in Chile

Dependent Variables	(1) CoMP	(2) CoMP	(3) CoMP
Time Period	Before Inflation Targetting (1986-1991)	Disinflation Period (1991-1998)	Post Stabilization of Inflatior (1999-2012)
Persistency	0.964***	0.886***	0.972***
	(0.0232)	(0.0429)	(0.00763)
Average Monetary Policy Stance	6.497***	6.379***	1.501*
	(0.785)	(0.223)	(0.769)
Inflation Deviation	1.065***	1.087**	1.611**
	(0.0698)	(0.430)	(0.735)
Output Gap	0.291	0.121	0.905**
	(0.674)	(0.0832)	(0.370)
Number of samples	57	93	148
Model	GMM	GMM	GMM

Numbers in parentheses indicate standard errors. *** p<0.01, ** p<0.05, * p<0.1
Source: IMF staff calculations

VII. CONCLUSIONS AND POLICY RECOMMENDATIONS

Procyclical monetary policy has been a problem for EMs, amplifying, rather than dampening, economic cycles. The costs of such policies can be very damaging. This contrasts sharply with AMs, where monetary policy has tended to be countercyclical.

Despite the costs for EMs, these stark differences in the behavior of monetary policy across EMs and AMs have not been subject to extensive study. The literature that does exist brings out the contrast between the countercyclical nature of monetary policy in AMs and the procyclical stance of EMs, at least until recently, where tentative evidence suggests that a shift towards more countercyclical policies may have taken place. Some initial attempts at uncovering underlying causes of these moves have also been made.

This study fills the critical gaps in the literature. The key findings, using a large sample of EMs over the past 50 years, are as follows:

- **EMs have adopted increasingly countercyclical monetary policy over time.** That said, large differences remain among EMs, with signs of a bimodal distribution of monetary policy behavior emerging. And policies have become more procyclical during the recent crisis.

- **Inflation targeting and better institutions have been key factors behind the move to monetary policy countercyclicality in EMs**. IT and institutions are not only statistically significant, but also matter in an economically meaningful sense.

- **Only with deep financial markets in place can EMs with flexible exchange rate regimes turn countercyclical**. Our results suggest that, typically, only when financial markets are sufficiently developed do countries with what are classified as

flexible exchange rate regimes stop reacting to capital flows in a manner that leads to procyclicality.

- **More countercyclical policy is associated with less volatile output, suggesting large economic benefits**. For a typical EM, putting in place inflation targeting, and all that it entails, would tend to be associated with a drop in output volatility of about a quarter.

We supplement our empirical work by describing Chile's increasing monetary countercyclicality, following macroeconomic stabilization and the introduction of IT. The results suggest that the introduction of IT and a flexible exchange rate regime allowed the CBC to undertake more forceful counter-cyclical monetary policy.

On the policy side, the economically meaningful impact of IT on monetary policy countercyclicality is another reason in its favor. Already IT is associated with generally better inflation outcomes. Based on the paper's analysis, more countercyclical monetary policy and lower output variability also follow from IT.

Box 1. Estimates of Taylor Coefficients in Literature

Literature suggests three variations in reduced form estimation of Taylor coefficients. The first is, like Taylor (1999), to simply estimate a Taylor rule by ordinary least squares (OLS), with the policy rate a function of inflation and the output gap. The second variation estimates a generalized form of a Taylor rule assuming inertia/smoothing of policy interest rate by applying OLS with the lagged policy rate added as a regressor, as in Judd and Rudebusch (1998). The third variant was pioneered by Clarida et al. (2000) in which a generalized form of Taylor rule is estimated by GMM, assuming forward looking behavior of a central bank and rational expectations for its expectation of inflation and output gaps.

Most of the past studies on Taylor coefficients in emerging markets (EM) countries have followed the second methodology, while those for advanced countries have followed the third. Corbo et al. (2001) applied country-by-country OLS to 25 countries, of which 6 countries are EMs. Schmidt-Hebbel et al. (2002) estimated the coefficients for Brazil, Chile and Mexico. Mohanty and Klau (2004) applied both OLS and GMM for 16 EMs. Aizenman et al. (2008) studied Taylor coefficients for 16 EMs using fixed effect least-squares estimation procedures. Takáts (2012) jointly estimated a generalized form of Taylor rule with exchange rate component (vis-à-vis US$) and fiscal policy reaction function using SUR for 19 advanced and 14 EM countries.

APPENDIX I. ADDITIONAL TABLES AND FIGURES

Table 4. Country Data Coverage of CoMP

AM	Start Year	End Year	EM	Start Year	End Year
Australia	1972	2011	Albania	1994	2011
Austria	1968	2011	Algeria	1976	2011
Belgium	1960	2011	Argentina	1993	2011
Canada	1977	2011	Armenia	1998	2011
China, Hong Kong	1994	2011	Belarus	1998	2011
Cyprus	1971	2011	Bosnia & Herzegovina	2004	2011
Czech Republic	1998	2011	Brazil	1997	2011
Denmark	1968	2011	Bulgaria	1993	2011
Estonia	1996	2011	Chile	1995	2011
Euro area	2001	2011	China	1992	2011
Finland	1963	2011	Colombia	1966	2011
France	1960	2011	Costa Rica	1966	2011
Germany	1962	2011	Croatia	1995	2011
Greece	1963	2011	Dominican Republic	1998	2011
Iceland	1963	2011	Ecuador	1972	2011
Ireland	1963	2011	Egypt	1966	2011
Israel	1987	2011	El Salvador	1999	2011
Italy	1962	2011	Georgia	1998	2011
Japan	1960	2011	Guatemala	1966	1998
Korea	1966	2011	Hungary	1987	2011
Luxembourg	1982	2011	India	1966	2011
Malta	2002	2011	Indonesia	1976	2011
Netherlands	1983	2011	Jamaica	1966	1997
New Zealand	1967	2011	Jordan	1968	2011
Norway	1962	2011	Kazakhstan	1997	2011
Portugal	1968	2011	Latvia	1995	2011
Singapore	1974	2011	Lebanon	1966	2011
Slovak Republic	1996	2011	Lithuania	2002	2011
Slovenia	1995	2011	Macedonia	1996	2011
Spain	1968	2011	Malaysia	1973	2011
Sweden	1962	2011	Mexico	1984	2011
Switzerland	1962	2011	Morocco	1966	2011
Taiwan	1964	2011	Pakistan	1966	2011
United Kingdom	1963	2011	Panama	2004	2011
United States	1962	2011	Peru	1993	2011
			Philippines	1979	2011
			Poland	1993	2011
			Romania	1997	2011
			Russia	1997	2011
			Serbia	2003	2011
			South Africa	1966	2011
			Sri Lanka	1966	2011
			Thailand	1979	2011
			Tunisia	1983	2011
			Turkey	1966	2011
			Ukraine	1997	2011
			Uruguay	1983	2011
			Venezuela	1966	2011
			Vietnam	1998	2011

Source: IMF staff calculations

Table 5. Taylor Rule results: Entire Sample Period

Country	Simple correlation between real interest and output gap	Simple Taylor rule	Generalized Taylor rule	Generalized Taylor rule with FX
Panama	0.71	-0.35	-1.39	-1.39
Albania	0.57	-1.17	-0.03	-0.01
Dominican Republic	0.57	0.06	1.87	0.20
El Salvador	0.56	0.96	0.76	0.76
Poland	0.54	0.85	1.40	0.80
Jordan	0.51	0.01	0.11	0.13
Tunisia	0.43	-0.18	0.71	0.41
Croatia	0.34	0.13	0.57	0.37
South Africa	0.34	0.31	3.41	3.67
Costa Rica	0.31	0.07	1.39	1.56
Colombia	0.29	0.55	1.93	1.94
Ecuador	0.24	0.52	1.78	1.65
Chile	0.22	0.36	0.23	0.13
Macedonia	0.21	-0.40	-0.16	0.00
India	0.21	-0.04	-0.32	-0.35
Serbia	0.20	0.55	0.23	0.13
Venezuela	0.17	0.22	0.52	0.51
Peru	0.13	0.10	1.49	1.60
Bulgaria	0.13	-1.91	-1.06	-0.62
Philippines	0.13	-0.02	0.54	0.22
Lithuania	0.12	0.10	0.30	0.17
Guatemala	0.11	0.11	0.52	0.48
Indonesia	0.10	-0.02	0.45	0.48
Sri Lanka	0.10	0.07	1.24	0.94
Vietnam	0.10	1.41	-0.26	0.21
Thailand	0.08	0.14	1.20	0.46
Pakistan	0.07	0.11	0.99	0.98
Jamaica	-0.04	-0.13	-1.44	-0.16
Egypt	-0.04	-0.12	0.28	0.32
Brazil	-0.05	0.02	-1.63	-2.49
Hungary	-0.06	-0.16	0.17	0.13
Russia	-0.07	-0.61	-1.17	-0.67
Turkey	-0.08	-0.53	-0.30	-0.34
Bosnia and Herzegovina	-0.12	-0.04	0.20	0.22
Belarus	-0.13	0.10	-0.12	-0.42
Algeria	-0.15	-0.33	-0.34	-0.29
Malaysia	-0.19	0.14	0.38	0.28
Mexico	-0.22	-0.80	-0.83	-1.32
Morocco	-0.23	0.00	-0.38	-2.08
Georgia	-0.26	-0.71	-0.66	-2.08
Latvia	-0.27	-0.13	-0.18	-0.18
Romania	-0.28	-0.68	2.06	-0.52
Lebanon	-0.31	0.00	0.39	0.47
Uruguay	-0.34	-1.06	-0.88	-2.65
Armenia	-0.38	-0.77	-0.12	-0.38
Argentina	-0.39	-0.37	-0.52	-0.56
China	-0.41	-0.12	-0.30	-0.22
Ukraine	-0.66	-0.95	-1.03	-0.92
Kazakhstan	-0.70	-0.67	-0.49	-0.43

Source: IMF staff caculations

Table 6. Explaining CoMP in AMs

Dependent Variables	(1) CoMP	(2) CoMP	(3) CoMP	(4) CoMP	(5) CoMP	(6) CoMP
IT dummy	0.214				0.226	0.318
	(0.211)				(0.214)	(0.306)
FX regime		0.174				-1.387
		(0.364)				(3.480)
Institution			0.050		0.056	0.008
(Government stability in ICRG)			(0.054)		(0.055)	(0.096)
Financial deepening				-0.906		-1.938
(Financial reform index)				(0.824)		(1.844)
FX regime*financial deepening						1.304
						(3.539)
Number of samples	547	514	532	446	532	422
Adjusted R^2	0.059	0.043	0.051	0.057	0.062	0.074
Model	FE	FE	FE	FE	FE	FE

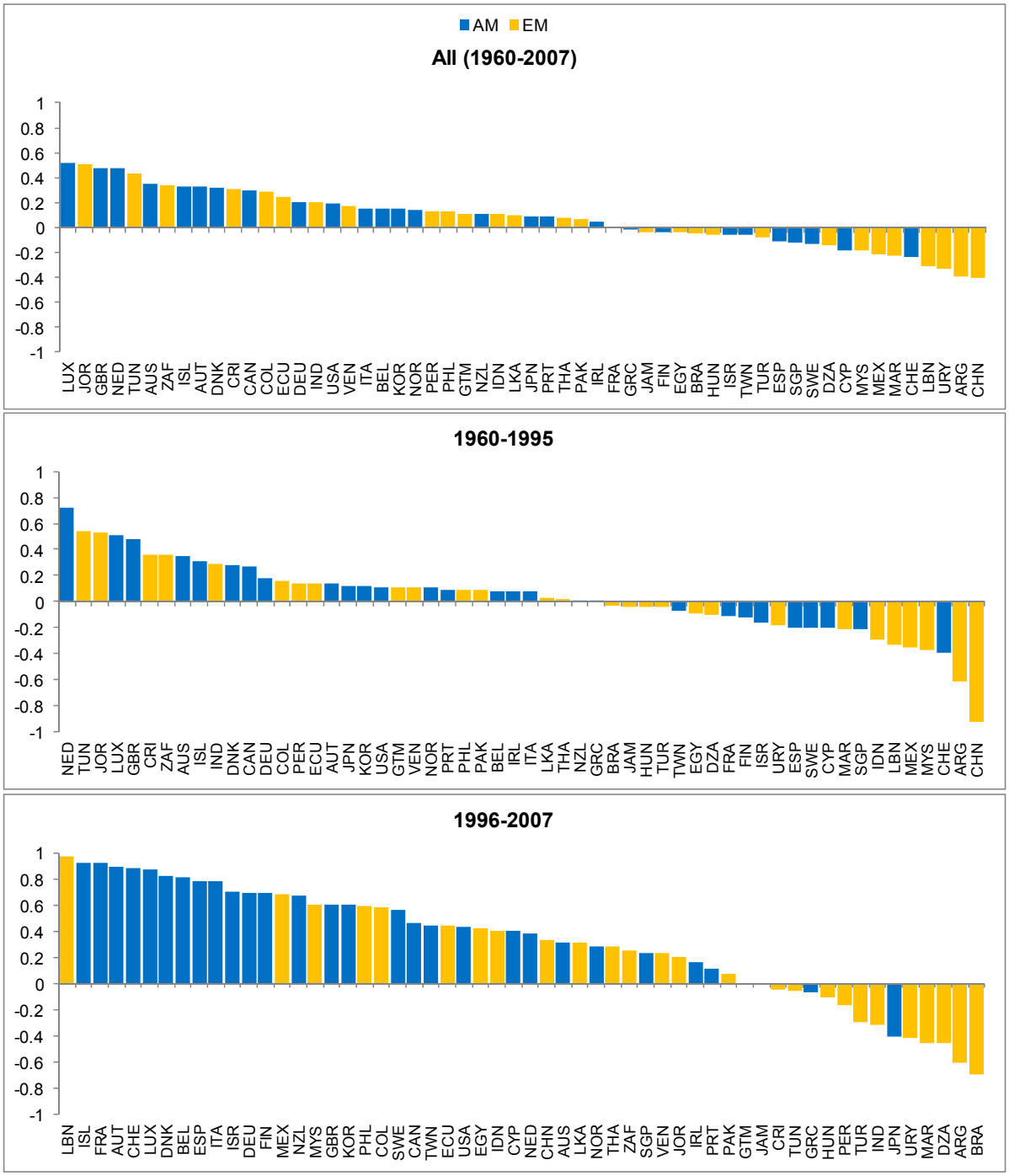
Number in parentheses indicate standard errors. *** p<0.01, ** p<0.05, * p<0.1
All variables in the right hand side are 10-year moving averages, consistent with the rolling correlations.
Source: IMF staff calculations

Table 7. Cross Country Regressions for EMs in 1995 and 2007

Dependent Variables	(1) CoMP	(2) CoMP	(3) CoMP	(4) CoMP	(5) CoMP
IT dummy	0.491 ***				0.526 ***
	(0.140)				(0.163)
FX regime		-0.085			
		(0.274)			
Institution			-0.044		-0.001
(Government stability in ICRG)			(0.075)		(0.074)
Financial deepening				0.110	
(Financial reform index)				(0.516)	
Number of samples	80	79	75	71	75
Adjusted R^2	0.059	-0.020	-0.023	-0.025	0.040
Model	FE	FE	FE	FE	FE

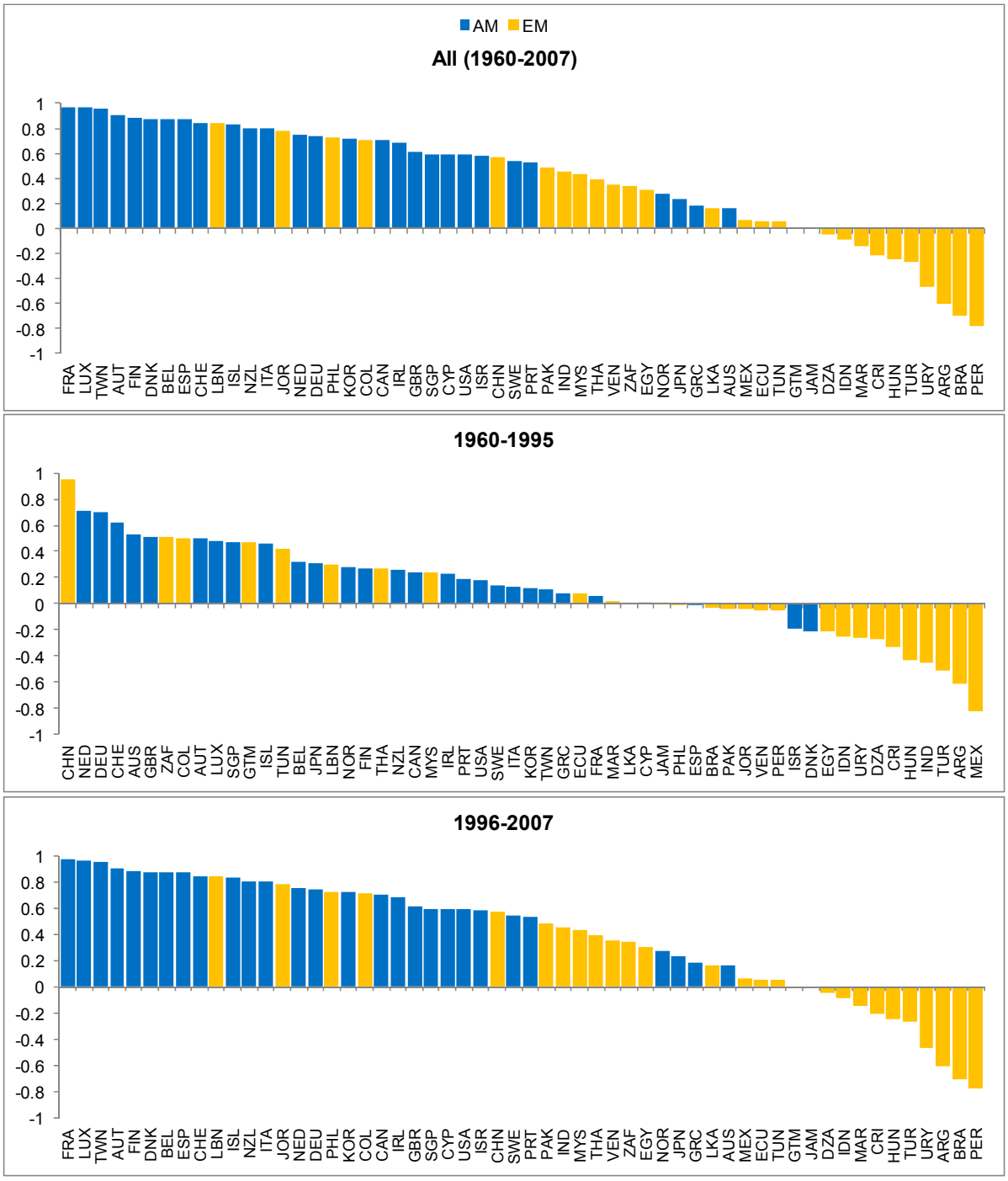
Number in parentheses indicate standard errors. *** p<0.01, ** p<0.05, * p<0.1
All variables in the right hand side are 10-year moving averages, consistent with the rolling correlations.
Source: IMF staff calculations

Figure 14. Correlations between Real Interest Rates and Output Gaps



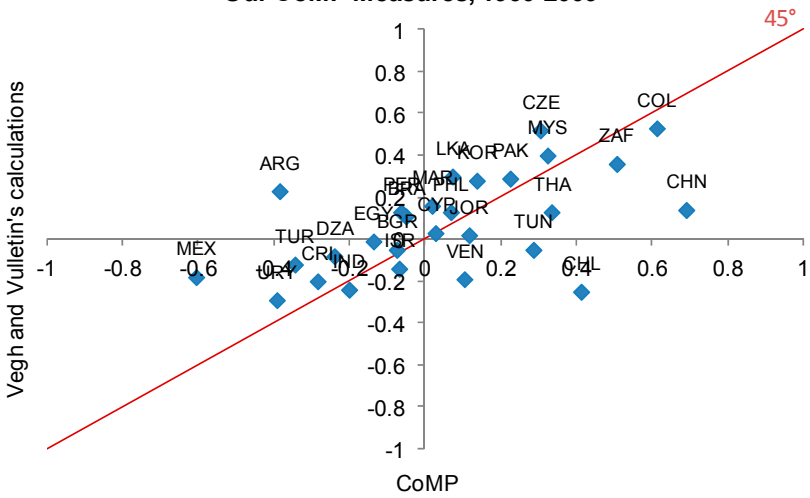
Source: IMF staff calculations

Figure 15. Correlations between Nominal Interest Rates and Output Gaps



Source: IMF staff calculations

Figure 16. Comparison of Vegh-Vuletin and Our CoMP Measures, 1960-2009



APPENDIX II. DATA AND SOURCES

1. Stage one regressions

Data sources. All data are annual. Real GDP and inflation data are taken from the World Economic Outlook database, where inflation is defined as the first difference of the natural logarithm of CPI (average). The nominal interest rate is the discount rate of central banks in each country, taken from IFS. For countries where the discount rate is not available, money market rates are used, also taken from IFS. The real interest rate is the "ex post" rate, i.e., nominal interest rates minus actual inflation.

Treatment of outliers. Observations of very large inflation and nominal interest rates during hyperinflation episodes—above the 99th percentile of overall observations—are dropped from the data. This operation has excluded several hyperinflation episodes in Latin America in the 1980s and transition countries in the 1990s. However, even including outliers did not change the main storyline of the rolling correlations presented in Section 3, while it has critical impact on the estimated Taylor coefficients.

Derivation of cyclical components. The cyclical component is defined as the difference between the natural logarithm of headline variables and their trend, where the trend is derived from the HP filter[32]. To avoid the usual end point problem associated with HP filters, the filter is applied to data spanning from 1950 to 2030, where the same growth rate as in 2017 is assumed for inflation and real GDP beyond 2017 while a constant value is assumed for nominal interest rates beyond 2017 in each country.

Construction of CoMP. This is derived as the 10-year window of rolling correlations between the real interest rate and the output gap (i.e., cyclical component of real GDP), where the real interest rate and the output gap are defined above.

2. Stage Two Regressions

Monetary policy regime (inflation targeting or not). The adoption date of inflation targeting follows Table 1 in Roger (2009). The variable takes a value of one for the year and the year after the adoption of inflation targeting, and zero otherwise.

Exchange rate regime. This follows the classification in Reinhart and Rogoff (2004), spanning from 1940 to 2007, where the fixed exchange regime is defined as the fine grid value less than 5 in Table V[33] in the paper. After 2007, the classification in the AREAER database is used, where the fixed exchange rate regime in the paper is defined as no separate legal tender, currency

[32] Other filters (Christiano-Fitzgerald filter and Baxter-King filter) were also applied. But the results did not change the main storyline in the paper.

[33] This definition includes no separate legal tender, preannounced peg or currency board arrangement, preannounced horizontal band that is narrower than or equal to ± 2 percent, and de facto peg.

board, conventional peg to a single currency, conventional peg to a composite, and stabilized arrangement thereafter (i.e., crawling peg is not included in fixed exchange arrangement in the paper). A higher number indicates a more flexible and more reformed exchange rate regime.

Financial markets reforms. The financial reform index aggregates scores of seven components—credit controls, interest rate controls, banking sector entry barriers, bank supervision, privatization, capital account transactions (capital account openness), and securities markets from Abiad et al. (2008), spanning from 1973 to 2005—which is used as a proxy for the extent of financial sector reforms. The paper uses the normalized index, spanning from zero to one. A higher number indicates better (more flexible and more reformed) financial market reforms.

Institutional strength. This is proxied using the International Country Risk Guide (ICRG) rating spanning from 1985 to 2011. The paper uses government stability component as a proxy for institution potentially affecting counter/pro-cyclicality of monetary policy.

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