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Do Monetary Policy Frameworks Matter in Low Income Countries?

by Alina Carare, Carlos de Resende, Andrew T. Levin, and Chelsea Zhang

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Do Monetary Policy Frameworks Matter in Low Income Countries?

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Abstract

In recent years, many Low-Income Countries (LICs) have implemented substantial reforms to their monetary policy frameworks, but existing economic research has not provided a clear rationale to guide those efforts. In this paper we analyze the role of monetary policy frameworks in the propagation of aggregate shocks, using a large panel dataset of 79 LICs over the period 1990-2015 as well as event study analysis for a group of 28 sub-Saharan African LICs. We find highly significant differences in the propagation of external shocks between the LICs that target monetary aggregates or inflation compared to those that maintain rigid nominal exchange rates as a nominal anchor. We also find that the large surprise devaluation of the Central African Franc (CFA) in January 1994 had highly significant effects on the GDP growth of 10 CFA countries compared to 18 similar countries that were outside the CFA zone. Our empirical analysis provides strong support for the role of monetary policy frameworks in facilitating macroeconomic stability in LICs—a conclusion that is particularly relevant as LICs now face a multitude of similar shocks associated with the global COVID-19 pandemic.

JEL Classification Numbers: E42, E52, F41, O23, O55

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Contents Page

I. Introduction 3
II. Literature 5
III. Panel Study Analysis 7
A. Strategy 7
B. Results 9
External demand 9
Terms of trade 13
Oil price 15
IV. Event Study: The 1994 Devaluation Effect on Growth in the CFA Zone .... **Error! Bookmark not defined.**
V. Conclusions .... **Error! Bookmark not defined.**

Figures

1. Monthly Frequency of Price Changes and Per Capita GDP Relative to the U.S. (percentages) 6
2. Event Study: Real GDP Growth, Before and After 1994 (two-year window) 20
3. Event Study: Distribution of GDP Growth, Before and After 1994 (two-year window) 21

Tables

1. Effect of a One-Percent Shock to World GDP on Domestic Output Growth (1990−2015) 11
2. Sensitivity Analisis: Effect of a One-Percent Shock in World GDP on Domestic Output Growth; Difference in Monetary Policy Framework Coefficients (1990−2015) 12
3. Effect of a Ten-Percent Shock to Terms of Trade on Domestic Output Growth (1990−2015) 15
4. Effect of a Ten-Percent Shock to Global Oil Price on Domestic Output Growth (1990−2015) 17
5. Event Study: Comparison of Key Indicators in CFA Zone and Control Group Countries 19
6. Event Study: Difference in Real GDP Growth, Before and After 1994 (two-year window) 21

Appendices

I. Estimation 23
II. List of Countries in the Sample 25
III. Data: Monetary Policy Frameworks 26
IV. Data: Sources 27
V. Data: Stylized Facts 28

References.....29

I. INTRODUCTION

Many Low-Income Countries (LICs) are engaged in substantial reforms to strengthen their monetary policy frameworks, and that progress is being supported by the International Monetary Fund and other policy institutions in higher-income economies. [2] In particular, LICs are moving towards frameworks that foster price stability while allowing for greater exchange rate flexibility. Nonetheless, the analytical and empirical basis underpinning these efforts has remained relatively unclear.

Indeed, one plausible view is that LICs could be characterized by monetary neutrality, because most transactions in these economies are conducted in spot markets with flexible prices.[3] According to that viewpoint, aggregate shocks would be swiftly and fully transmitted to prices, and hence monetary policy would not have any effect on the real economy. Consequently, the monetary policy framework would be irrelevant for the propagation of aggregate shocks in LICs. In this paper, we conduct empirical analysis to test that hypothesis. As a general strategy, we focus on estimating and testing reduced-form relationships, without making any assumptions about the type and degree of nominal rigidities in LICs.

First, we analyze a cross-country panel dataset of 79 LICs over the period of 1990–2015, and use a reduced-form approach à la Jorda (2005), to determine how the effects of several external shocks on real output growth vary according to the monetary policy framework—with different choices of the nominal anchor used to achieve price stability. We consider shocks that are highly relevant for LICs and arguably exogenous to policy in these countries, namely unanticipated changes in world GDP, shifts in the terms of trade, and fluctuations in the price of oil.[4] We use the estimated coefficients in the reduced-form regressions to test whether the impact of those shocks differs according to the monetary policy framework. In particular, we interact the impact of the shock with a dummy constructed based on the classification based on the IMF's AREAER database, to reflect the difference in impact in economies that *de facto* targeting monetary aggregates or inflation with the ones targeting exchange rate (in different degrees) to ensure price stability. Failure to find a statistically different impact across alternative monetary policy frameworks would be consistent with the money neutrality hypothesis.

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[2] International Monetary Fund (2015).

[3] Risk cannot be properly insured and hedged widely due to the underdevelopment of financial markets in LICs.

[4] IMF (2005) shows that country specific shock contributed the most to output growth volatility until 2000, and that output growth volatility declined over time in developing countries. IMF (2011) emphasizes that there is mixed evidence on the relative importance of external versus idiosyncratic shocks in explaining output volatility in LICs, and that external shocks contribute to large output losses and protracted growth slowdowns in LICs.

Second, we rely on an event study analysis involving 28 Sub-Saharan African (SSA) LICs, around the time of a large surprise devaluation of the CFA franc in early 1994, to study the impact of that event—which can be interpreted as an unanticipated monetary policy shock—on output growth. We use a difference-in-difference approach to test whether the shock had a significant effect on real GDP growth of 10 SSA LICs within the CFA zone compared to an otherwise similar control group of 18 other SSA LICs, which did not devalue their currency at that time. Again, failure to identify differences in real output growth outcomes before and after the shock within the CFA zone relative to the control group would be consistent with the money neutrality hypothesis and with the notion that the choice of monetary policy frameworks in LICs is irrelevant.

Based on results from both empirical strategies, we overwhelmingly reject the hypothesis that monetary policy frameworks do not matter in LICs, as would be in the case of money neutrality. Surprises in the world GDP, shifts in the terms of trade, and fluctuations in the price of oil all have a distinct real output effect in countries with monetary policy frameworks based on some targeting of the exchange rate to achieve price stability; for those countries, we document a statistically larger response in real domestic output growth to the selected shocks relative to the group of money- and inflation-targeting countries. These results are robust to various specifications, control variables, and subsamples of countries used. For instance, they hold even for the poorest LICs, suggesting that money non-neutrality is present in these economies as well. Consistently with that finding in our event study the real GDP growth rates in the CFA zone were statistically higher than the ones in the control group during the two-year period after the devaluation of the CFA franc.

These findings, which point unambiguously to money non-neutrality in LICs, were obtained without imposing any particular structure of the economy, or price and information setting. This flexibility of the empirical methodology and the lack of any *à priori* theoretical model comes at the cost of identifying the underlying structural reason for money non-neutrality.

The micro evidence presented in the next session points to a relatively high frequency of price adjustment in LICs, which indeed increases for lower levels of per capita income. Hence monetary non-neutrality may not be due to staggered price setting of the sort that is typically embedded in New Keynesian models for more advanced economies.[5] Other potential explanations might be informational frictions, including incomplete knowledge about the underlying structure of the economy as well as misperceptions of the central bank's monetary policy goals, strategies, and operations.[6] Clarifying the sources of these rigidities in LICs, as well as their magnitude should be a priority for future research.

[5] See Walsh 2017 for a discussion of staggered wage and price setting and other forms of nominal rigidity in New Keynesian models.

[6] See Mankiw and Reiss (2002), Erceg and Levin (2003), Mackowiak and Wiederholt (2009).

Our analysis clearly indicates that the monetary policy framework—and the corresponding different choices of nominal anchor—does affect the propagation of external shocks on growth. Our results also underscore the structural reform agenda in LICs by strongly suggesting that the ongoing reforms in many LICs to strengthen monetary policy frameworks, while allowing for more exchange rate flexibility, will matter for macroeconomic management. Indeed, a well-designed framework (not just the choice of an anchor) can help insulate the domestic economy from the effects of external shocks.

Our findings also shed light on the effects of major exogenous shocks that impacted LICs over recent years—the large contraction in external demand during the global financial crisis and the plunge in oil and commodity prices during 2014–16, for example. These experiences brought to the forefront the importance of understanding how LICs could adjust to alleviate the impact of such shocks when the nominal exchange rate plays the role of nominal anchor and is not allowed to fully respond to these shocks. This issue assumes critical relevance and is coming to the forefront once again in the context of the COVID-19 pandemic, which is spawning shocks—historically low global demand and commodity prices, especially oil—that are hitting LICs in a very similar way as the selected shocks analyzed in this paper.

The plan of the paper is as follows. After briefly surveying the relevant literature, we present the research strategy based on panel data analysis, and the evidence of the impact of external shocks on real GDP (section III). Section IV presents the results of the event study. The conclusions and policy implications are laid out in section V.

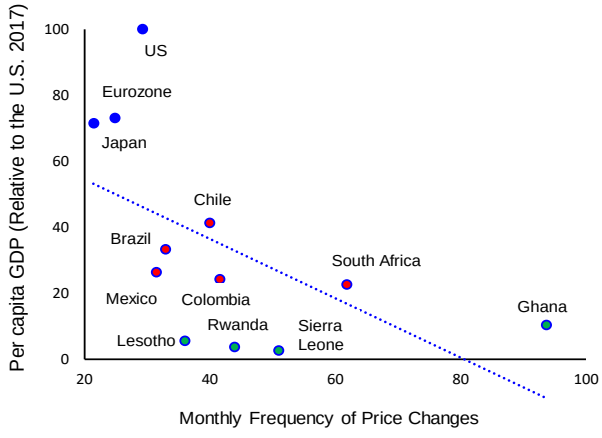
II. LITERATURE

Looking at estimates of price stickiness plotted in Figure 1 below, based on studies listed in the references section, we observe that in general countries with lower per capita income change prices more frequently in a given month.[7] Price stickiness is the highest in advanced economies (blue dots), and some middle-income countries (South Africa and Ghana[8]) show a much higher monthly price change frequency (over 60 percent). However, the estimates vary widely for LICs (light blue dots); the monthly frequency of price changes in Lesotho and Rwanda are similar to the ones in emerging markets (pink dots).

[7] While the estimates were obtained using different samples and there are differences in the consumption basket and the weights of items in the basket, the results are illustrative as they use similar methodologies.

[8] The estimation for Ghana uses data between 1997–2003, when inflation was over 22 percent (it peaked in 1995 around 60 percent). The share of informal employment in the total non-agricultural employment is 80 percent; with widespread informality contracts are hard to enforce, and wages and prices adjust frequently.

Figure 1. Monthly Frequency of Price Changes and Per Capita GDP Relative to the U.S. (Percentages)



Sources: Various studies; see text of the paper for references

The literature also finds that the standard real business cycle models assuming no price stickiness do a poor job explaining developments in emerging countries as opposed to advanced economies (see Aguiar and Gopinath, 2007, and Garcia-Cicco and others, 2010). For LICs the same rigorous exercise is not undertaken. Moreover, the models used in LICs to describe the impact of shocks on the economy and the policy needed, tend to be New Keynesian and are calibrated with a low frequency of price changes (25 percent; see Portillo and others, 2016, Berg and Portillo, 2018). Therefore understanding what type of models one needs to use for LICs needs to remain a research priority. [9]

The studies estimating reduced-form equations to assess the impact of shocks on output growth in LICs also assume sticky prices (hence imposing *a priori* a certain price setting) and differentiate the impact according to the exchange rate regime used, and not the monetary policy framework. Moreover, these studies tend to look primarily at the impact of one type of shock (terms of trade, or the global financial crisis), and do not focus entirely on LICs. For example, Broda (2004) uses a sample of 75 developing countries, including some LICs[10] and finds that the impact of a ten percent terms of trade shock on output growth is statistically significant (at 10 percent, in the year when the shock occurs) only in fixed exchange rate regimes.

[9] See Stiglitz and others (2006) "Macroeconomics was developed in and for industrialized countries. […] Developing countries often use this corpus of knowledge, with its competing schools of thought, without any significant modification. It is by no means clear that applying these theories is either justified or appropriate.", and Blanchard (2009) "...models are more similar in their structure than would seem desirable: Roughly the same models are used in rich and emerging economies, despite their different structures and shocks."

[10] Broda (2004) uses data between 1973 and 1996 for non-oil countries with population over 1 million people; about 40 percent of the countries in his sample are LICs (out of 75 developing economies). Edwards and Levy Yeyati (2005) use 186 countries and do not have separate results for LICs. Terrones (2020) and Rose (2014) look at the impact of the global financial crisis in a sample of countries not exclusively devoted to LICs, and do not explaining differences in growth according to the level of development.

Studies estimating the impact of changes in money or interest rates on real output in LICs rely mostly on estimating structural VARs (Mishra and Montiel, 2012). They require making strong assumptions about the nominal rigidities and price setting in LICs and look mostly at frameworks employing a flexible exchange rate. Moreover, the results tend to be weak given the non-trivial data challenges in LICs (frequency of data and quality of statistics, see Berg and Portillo, 2018).

Our contribution to the literature is to offer, for the first time, a comprehensive and robust array of evidence for the response of output growth to various shocks stemming from abroad varies, and to ask if it varies with the monetary policy framework employed in LICs.

III. PANEL STUDY ANALYSIS

A. Strategy

Given the wide variation in the frequency of monthly price changes in LICs, we set up a research strategy allowing us to be agnostic about the degree of price stickiness in LICs. The hypothesis we are testing is that the impact of various external shocks would be the same on domestic output growth in all LICs, regardless of their monetary policy framework. This hypothesis is consistent with an absence of, or much smaller, nominal rigidities (price stickiness, information setting, incomplete knowledge).

Concretely, we regress output growth, at various horizons, on a monetary policy framework dummy interacted with a shock. The shock is constructed as the unanticipated change in the selected "driver-variables". The model is described in more detail in Appendix I, and more details about these variables follow below.

The monetary policy framework indicator is a binary variable for the type of framework in a given year. We divide the sample in two meaningful groups for our analysis: (a) countries that follow a monetary policy framework that relies primarily on the exchange rate as the nominal anchor and (b) countries that use money- or inflation-targeting frameworks to foster price stability.[11]

The first group includes countries defined in the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER, an IMF database) as following a monetary policy framework where the exchange rate serves as the nominal anchor. This classification focuses on the classification of monetary policy framework, rather than the exchange rate regime per

[11] Ideally, we would like to have more differentiations in the monetary policy frameworks but LICs started to implement inflation targeting only in 2000s. In fact, only one country, Ghana, has a longer experience with IT, for consistency of robust results we report the results for monetary and inflation targeting together.

se (Appendices II and III).[12] For about one-third of the observations in our sample the monetary policy framework is focused on targeting money or inflation; for the remaining two-thirds of our sample, the monetary policy framework is focused on exchange rate stability.

We verified that our key conclusions are robust to alternative classifications, and more granular results, varying for inflation versus monetary versus exchange rate targeting are available on request from the authors. As customary in the literature one observation is constituted by the framework of a country for a given year, as listed in the AREAER.

The AREAER classification of monetary policy frameworks uses a transparent and consistent methodology that incorporates judgments of the national authorities as well as Fund country teams. Of course, occasional misclassifications could occur; for example, Nigeria has been classified as a monetary targeting regime even though it was regularly intervening in the foreign exchange market. Such misclassifications would add noise to the data and tend to reduce the statistical significance of the results. Consequently, our results may be reasonably viewed as providing a lower bound for the true importance of monetary policy frameworks in LICs.

To construct the shock series, we use forecast errors for different horizons for selected "driver" variables. We use the forecast published in the *World Economic Outlook*. We calculate it with the forecast at time *t*, a year ahead. Details on all other sources of data are described in Appendix IV. We employ this methodology because, by definition, unanticipated shocks are a type of forecast error.

Our analysis is focused on *reduced-form shocks*, which are a composite of the underlying *structural shocks* and don't require any identifying assumptions, and as opposed to most of the literature we do not rely on any specific economic theory or macro model. By construct, an approach that focused on *structural shocks* would require a set of identifying assumptions, which might be particularly problematic for LICs where the existing set of macro models may not be very suitable.

To test our hypothesis, we use some shocks (and therefore compute the forecast errors) that are highly relevant for LICs: a change in global demand (world GDP shock), terms of trade, and oil prices shocks.[13] If there is a significant response in the impact (coefficient of the

[12] These include Hard Pegs (no separate legal tender, currency boards and conventional pegged arrangements), Soft Pegs (stabilized arrangements, crawling pegs, craw-like arrangements, pegged exchange rates within horizontal bands, and other managed arrangements), and a few countries where a flexible exchange rate serves as the intermediate monetary policy anchor. Appendix III shows that if we would splice the data in "fixed ER regimes" (the Hard and Soft Pegs), vs "Flexible", the difference in the sample would be of 62 observations (4 percent of sample).

[13] We ensure that we capture in each estimation a country that has the same framework at year *t*, and *t+1*.

monetary policy framework dummy interacted with the shock), for certain type of frameworks, and if the difference in impact is statistically significant according to the monetary policy framework used, then the design of the monetary policy framework matters in LICs. Moreover, the evidence is consistent with the existence of stronger nominal rigidities in LICs causing prices to adjust more slowly.

Control variables are also taken into account (introduced in the regression). First, we control for the impact of wars, because output growth volatility in LICs, especially sub-Saharan African LICs, depends a lot of internal or external conflicts, and we want to ensure that the results do not reflect this causality rather than a different growth impact due to the monetary policy framework employed. Second, when we test for terms of trade and oil price shocks, we control for the role of the external demand, to ensure we identify only the impact of these shocks on output growth, and not of a change in external demand. Third, to ensure that certain characteristic of the countries do not determine endogenously the choice of a certain monetary policy regime, and therefore alter the impact of the shocks on output growth, we also control for these characteristics (see Appendix IV for data sources and Appendix V for stylized facts). Moreover, we control for outliers, and in the case of the world GDP shock we also show the results for the poorest LICs.

For estimation purposes, we used observations from countries which have been LICs at some point over the sample (1990–2015). Therefore, the group changes over time; in 1990 we have 79 LICs in our sample (Appendix II), while by 2015 we have only 60 countries.

Some stylized facts regarding the LICs in our sample, according to various control variables (trade openness, capital account openness, financial depth and fiscal policy), are displayed in Appendix V. As the theory would predict, we observe that countries using exchange rate as an intermediate target to achieve price stability tend to be more open to trade. We also observe that we have roughly an equal amount of countries in both groups, over time, and no other characteristic that could be interpreted as driving the results is strongly statistically significant.

B. Results

External demand

For many developing countries that embrace an export-led growth strategy, external demand is crucial. Indeed, Rand and Tarp (2002) find that shocks originating from OECD economies are critically important drivers of short-run output fluctuations in developing economies.

To compute our measure of external demand shocks, we compare actual and forecast data from country-specific world GDP growth, which is weighted by trade flows from all trading partners. The difference between actual data, measured at year *t*, and the WEO forecast of the same variable made at year *t-1* for realization at year t, (i.e., the one-year and two-year ahead

forecast error realized at year *t*) is interpreted as the unanticipated shock to world GDP growth. We test to see if the effect of 1 percent shock to the world GDP[14] on domestic output growth rate would be the same regardless of the monetary policy framework employed.

The intuition is that a positive unanticipated external demand shock increases aggregate demand, pushing up money demand and prices. Since the shock was unanticipated, and money supply was set up ex ante, interest rates rise. In frameworks where the nominal exchange rate should remain unchanged, the central bank offsets this decline in real money balances and lowers interest rates to maintain the exchange rate parity. Aggregate demand increases further, but interest rates remain unchanged. In countries where the exchange rate is not kept fixed to achieve price stability, the change in real money balances can be offset, and the nominal exchange rate would adjust to bring aggregate demand back in equilibrium. As a result, interest rates change (especially if inflation forecast deviated from target), but aggregate demand may not change.[15]

This is indeed what we observe in Table 1 where we present the results. In response to an unanticipated positive one-percent shock to the world GDP, there is a:

- positive effect on domestic output growth (by about 0.5 percentage points) only in frameworks maintaining price stability through fixed exchange rates;
- this effect is highly statistically significant (mostly at 1 percent level) in the year when the shock occurs (horizon 0), and, also in the subsequent year;
- statistically significant difference between the effects in frameworks based on countries targeting the exchange rates versus monetary or inflation targeting frameworks.

For the inflation or monetary targeting economies to respond in the way we described above, prices would need to adjust relatively slowly. Otherwise the response to the shock would occur relatively fast through prices.[16]

[14] This is a reasonable normalization, as commonly used in the literature. The forecast errors of the world GDP vary from -3.6 to +1.9 percent, and the standard deviation is 1.1 percent.

[15] Standard case of perfect capital mobility and no impediments to transmission mechanism like dollarization.

[16] Anand and others (2015) show that in a small open developing economy with incomplete markets and food expenditures representing a high share of total consumption expenditures; a central bank, can maximize welfare by replicating the flexible price equilibrium, under certain conditions (e.g. targeting core inflation).

Table 1. Effect of a One-Percent Shock to World GDP on Domestic Output Growth (1990-2015)

MP Framework	*k* (horizon in years)	
	0	1
Sample: All LICs *(79 countries, 1578 observations)*		
Exchange Rate	0.49***	0.54***
Inflation or Monetary Targeting	0.16	-0.09
Difference	0.33*	0.63***
Sample: LICs with GDP Per Capita below US$800 *(62 countries, 870 observations)*		
Exchange Rate	0.43**	0.86***
Inflation or Monetary Targeting	-0.18	-0.03
Difference	0.62**	0.88***

Note: The regression is estimated using Panel Least Squares. The asterisks ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively. The regression variables are specified as follows:

Dependent : domestic real GDP growth rate at time *t+k,* (100*(log GDPt+k - log GDPt+k-1))

Independent: (i) country fixed effects, (ii) forecast error world GDP at time t, interacted with monetary policy framework dummy coefficients (exchange rate versus inflation or money targeting), and (iii) battle-related deaths (war)

These results could be different according to the countries' income level. For example, one could presume that in countries with preponderant agricultural sectors and small manufacturing sectors (lowest income countries) prices and wages are not sticky at all, since contracts have a short duration. As such, there is a higher opportunity to adjust prices in the next round, should a shock occur.

One way to check the robustness of the results would be to test this hypothesis even for a sub-sample of the poorest countries. The intuition is that those are the countries that have the largest share of the economy operating as a self-subsistence economy, and if there is employment outside the house it will be largely informal. In these cases intertemporal contracts will be non-existent, and prices for the basic goods in the consumer basket will adjust faster.

To undertake this analysis, we select the observations below the median GDP per capita. To ensure robustness, we calculate the median using two different statistics, and report the results for both subsamples as follows. First, with a subsample containing countries that in 1990 were below the median GDP per capita calculated across the sample (US$800), and second, with a subsample containing countries that in 1990 were below the cross-country median for 1990 (US$540.7). The country has to remain in this category for at least a year. About sixty percent of our sample are in the first subsample.

We show the results in the first case in Table 1 and observe that the results are stronger than the average for the sample. For example, the impact of the shock in frameworks centered around more rigid exchange rates, is stronger by up to sixty percent in the year following the shock (horizon 1) than in the case of our entire sample of LICs, and the difference in impact among the two types of frameworks almost doubles in the year of the shock.[17]

The results are also robust according to a variety of methods and controls used. Table 2 reports the difference in coefficients for various monetary policy frameworks when controlling for various factors (outliers, and one control variable at a time, as follows).

First, the difference in coefficients associated with the monetary policy framework remains significant at 1 percent when we use different ways to eliminate outliers. Second, the control variables are statistically significant and introducing these controls weaken the results somewhat: (i) the results at the impact of the shock (horizon 0) are now insignificant (they remain significant at 1-year horizon), and (ii) introducing the controls lower the impact of shocks at horizon 1 for financial depth. This is in line with other results found in the literature.[18]

Table 2. Sensitivity Analysis: Effect of a One-Percent Shock to World GDP on Domestic Output Growth Difference in Monetary Policy Framework Coefficients (1990-2015)

Sample: All LICs; *(79 countries 1552 observations)*		
Horizon	*k* (horizon in years)	
	0	1
Baseline, controling for outliers	0.19	0.66***
Additional Controls:		
Trade Openness	0.20	0.60***
Capital Openness (Inflows + Outflows / GDP)	0.19	0.62***
Capital Openness (Ito's index)	0.20	0.48***
Financial Depth (Bank assests / GDP)	0.17	0.52***
Financial Depth (Credit to private sector / GDP)	0.14	0.59***
Fiscal Policy	0.15	0.34**

Note: In each regression, outliers are excluded using the studentized residual method. The regressions are estimated using Panel Least Squares. The asterisks ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively. The regression variables are specified as follows:

Dependent: domestic real GDP growth rate at time *t+k,* (100*(log GDPt+k - log GDPt+k-1))

Independent: (i) country fixed effects, (ii) forecast error world GDP at time *t*, interacted with monetary policy framework dummy coefficients (exchange rate versus inflation or money targeting), (iii) battle-related deaths (*war*) and (iv) one control variable at a time, listed above

[17] The results hold including for the poorest LICs (with income below US$540.7), especially in the year following the shock. For countries above the median the results still hold, and the impact is stronger in the year of the shock; results available by request.

[18] Broda (2004) finds that trade openness is the only systematically significant control, and that introducing such a control makes the difference among regimes less significant.

The introduction of such control variables prevents that correlations between the monetary policy framework and other characteristics of that country are not captured by the monetary policy framework variable, a number of control variables are also included in the regressions, as commonly used in the literature. These variables are: trade openness (the share of trade in the country's output, defined as the sum of nominal exports and imports divided by the nominal GDP), capital account openness (measured as the sum of capital inflows and outflows as a share of GDP), financial depth (measured as deposit money bank assets as a percent of GDP), and the overall fiscal balance for central government (also as a percent of GDP). The stylized facts for these variables are listed in Appendix V.

To summarize, we find strong and robust evidence the effect on domestic output growth of unanticipated surprises to external demand depends on the monetary policy framework used. This implies that even in monetary policy frameworks targeting inflation and money, prices adjust relatively slowly to allow for the exchange rate to act as a shock absorber.[19] The results hold even for the poorest LICs. The source and size of this nominal rigidity (price stickiness, informational friction, etc.) needs to be further studied to properly assess impacts of shocks on LICs, and the appropriate policy response, especially as many of these LICs are modernizing their monetary policy frameworks.

Terms of trade

Developing countries (which include LICs) tend to have growth strategies centered on integrating their economies into the global supply chain and developing through exports growth. Understanding the effects of a terms of trade shock[20] on domestic growth and how it varies with the monetary policy framework used is also very important.

To the extent that LICs are price takers in the commodity markets, the monetary policy framework affects the impact of a change in terms of trade on domestic output growth.[21] A rise in the value of a country's currency lowers the domestic prices of its imports but may not directly affect the prices of the commodities it exports. As some countries could be price makers, we expect weaker results than in the previous case of an external demand shock.

[19] In frameworks with fixed exchange rates, liquidity management becomes crucial. In such a case an exogenous external shock induces fluctuations in foreign exchange reserves that may generate greater volatility in the liquidity of the banking system, and the central banks' effective use of various tools—including the policy rate, reserve requirements and other sterilization instruments— can dampen the transmission of exogenous shocks to the real economy (see El Hamiani and Veyrun, 2019).

[20] The terms of trade are the relative price of imports in terms of exports in domestic currency. An improvement of a nation's terms of trade benefits that country; it can buy more imports for any given level of exports.

[21] There are some cases where a particular country has a dominant role in the production of a specific commodity. For example, in 2012 Cote d'Ivoire produced about one-third of the world's supply of cocoa and Madagascar accounted for about one-fifth of the global supply of bourbon vanilla.

The shock is defined as before, the difference between the actual variable (here a country's terms of trade) and its forecast at horizon *k*. As commonly used in the literature for this shock the size is 10 percent, rather than 1 percent.[22] An unanticipated ten percent improvement in the nation's terms of trade should increase aggregate demand, as the net exports rise. The intuition is similar as before. In the monetary policy framework centered around a fixed exchange rate, the rise in aggregate demand puts pressure on interest and exchange rates.

Since the value of the exchange rate should remain fixed, the central bank would offset this effect. If we observe a distinct response of this shock in a monetary policy framework targeting money or inflation, it would be because the exchange rate would be able to adjust, *and* other prices do not adjust instantaneously.

The top panel of Table 3 confirms this intuition. In response to an unanticipated ten-percent shock to the terms of trade, there is a:

- positive effect on domestic output growth (about 0.20 percentage points) mainly in frameworks maintaining price stability through rigid exchange rates;
- statistically significant effect at 5 percent level in the year when the shock occurs (horizon 0), and at 10 percent in the subsequent year;
- highly statistically significant difference between the effects in frameworks with rigid exchange rate versus monetary or inflation targeting frameworks (1 percent at 1-year horizon).

The lower panel of Table 3 examines the robustness of these results when we eliminate the influence of outliers and control for other characteristics of the countries studied. Indeed, the precision and statistical significance of our key results is generally strengthened by doing so.

Our sensitivity analysis also highlights potential interactions between monetary and fiscal policy in determining the propagation of shocks. In principle, accommodative fiscal policy could offset restrictive monetary policy, in which case the effects of monetary policy framework might not be readily apparent from the reduced-form impact on economic growth.

As shown in the final row of Table 2, such interactions are not strong enough to mask the difference in the growth impact of a global demand shock across monetary policy frameworks. By contrast, as shown in the final row of Table 3, inclusion of fiscal policy it does not allow us to pinpoint the role of the monetary policy framework in the propagation of terms of trade shocks on GDP growth.[23]

[22] The standard deviation of the forecast error of the terms of trade is about 15 percent.

[23] Broda (2014) finds that when including all control variables results weaken. Furthermore, Catao and Chang (2015) show that when imported food price shocks are substantial, in the presence of sticky prices and

Table 3. Effect of a Ten-Percent Shock to Terms of Trade on Domestic Output Growth (1990-2015)

MP Framework	*k* (horizon in years)	
	0	1
Sample: All LICs *(76 countries, 1504 observations)*		
Exchange Rate	0.28**	0.16*
Inflation or Monetary Targeting	-0.17	-0.16*
Difference	0.45***	0.32***
Sensitivity analysis: Difference in monetary policy framework coefficients		
Sample: All LICs *(76 countries, 1484 observations)*		
Baseline, controling for outliers	0.44**	0.29**
Additional Controls:		
Trade Openness	0.44**	0.29**
Capital Openness (Inflows + Outflows / GDP)	0.40**	0.27**
Capital Openness (Ito's index)	0.47**	0.37**
Financial Depth (Bank assests / GDP)	0.52***	0.37***
Financial Depth (Credit to private sector / GDP)	0.45***	0.37***
Fiscal Policy	0.13	0.04

Note: The regressions are estimated using Panel Least Squares. The asterisks ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively. In the sensitivity analysis regressions, outliers are excluded using the studentized residual method. The regression variables are specified as follows:

Dependent : domestic real GDP growth rate at time *t+k,* (100*(log GDPt+k - log GDPt+k-1))

Independent : (i) country fixed effects, (ii) forecast error world GDP at time *t* , interacted with monetary policy framework dummy coefficients (exchange rate versus inflation or money targeting), (iii) battle-related deaths (*war*), and (iv) country specific external demand (to control for world GDP). Results available by request for introducing one additional control variable at a time, as in Table 2

Oil price

An oil price shock is also relevant to analyze. In a monetary policy framework that targets inflation, a central bank would respond to such shock only to the extent that the second-round effects will push the expected inflation at the targeting horizon to deviate from the inflation target. As before, a difference in the impact on the domestic output growth according to the monetary policy framework used would be present only to the extent to which prices do not adjust immediately, and the exchange rate adjust to buffer the economy instead.

The papers that have analyzed the effects of oil price shocks in LICs find that the effect of the most recent oil price shock (starting in 2014) on the output growth of oil importing countries has been muted (see Cerdeiro and Plotnikov, 2017, Obstfeld and others, 2016). One explanation is that most countries, especially the LICs, use oil price subsidies. Since their economy was somewhat insulated when the prices were high, then the aggregate demand did not expand when the prices collapsed, if they were importers. That is the case regardless of the monetary policy framework used.

incomplete international risk sharing, the real exchange rate and terms of trade can move in opposite directions and there are trade-offs between (monetary) policy rules.

We also find that the impact of a ten percent oil price shock[24] (the shock defined as before, unanticipated surprises between the forecast of the prices at a year horizon and the actual price) does not differ across monetary policy frameworks for oil importing countries. The results are not reported here but are available on request from the authors.

For big oil exporters (countries that have crude oil production exceeding 5% of their nominal GDP in at least one year of our sample),[25] an unanticipated ten percent change in oil prices leads to an increase in net exports, and therefore aggregate demand. In the presence of rigidities and frictions, the exchange rate would adjust to buffer the economy from the shock, rather than the prices. As such, we expect a significantly different impact of such shock on domestic output growth across different monetary policy frameworks.

Table 4 supports this intuition. In response to an unanticipated ten-percent shock to global oil prices, there is a:

- positive effect on domestic output growth (by about 0.45 percentage points in the year of the shock and higher in the subsequent year) only in frameworks maintaining price stability through rigid exchange rates;
- statistically significant effect at 1 percent level, especially one year after the shock;
- statistically significant difference between the effects in frameworks with rigid exchange rate versus monetary or inflation targeting frameworks at 1 percent in the year after the shock.

The results are robust, at 1 and 5 percent level, even when controlling for outliers and other control variables, especially in the year following the shock. The results are in line with Grigoli and others (2017), who found that the 2014 oil price shock affected disproportionately the oil exporters targeting an exchange rate. This strong and robust statistical difference in the effect on domestic output growth of an oil price shocks for big oil exporters, implies that big oil exporters using a fixed exchange rate as a nominal anchor have a very volatile domestic output growth. They benefit tremendously when oil prices increase and suffer a lot when oil prices plunge.

Good demand management, as well as a consistent policy mix, adjustment strategies, and strong built-in automatic stabilizers and safety nets are needed to best take advantage of natural resources, if the LICs choose a monetary policy framework geared towards achieving

[24] This is a reasonable normalization, as commonly used in the literature. The forecast error of oil price varies in our sample between -60 and +40 percent, the median of the oil price forecast error is 12 percent.

[25] We converted the IEA measure (in metric ton) into barrels using the standard conversion factor of 7.33 bbl/ton, then we computed the US$ value of crude oil production by multiplying oil price, and then computed the ratio to nominal GDP. While this is a relatively low threshold, given the size of the sample, it is useful.

price stability by maintaining a rigid exchange rate. Nominal wage flexibility also becomes very important as part of the needed adjustment to restore competitiveness.

Table 4. Effect of a Ten-Percent Shock to Global Oil Price on Domestic Output Growth (1990-2015)

Sample: LICs big oil exporting *(9 countries, 183 observations)*		
MP Framework	*k* (horizon in years)	
	0	1
Exchange Rate	0.46**	0.69***
Inflation or Monetary Targeting	0.62*	-0.03
Difference	-0.16	0.66***

Sensitivity analysis: Difference in monetary policy framework coefficients

Sample: LICs big oil exporting *(9 countries, 183 observations)*		
Baseline, controling for outliers	0.30	0.71***
Additional Controls:		
Trade Openness	0.32	0.71***
Capital Openness (Inflows + Outflows / GDP)	0.24	0.66***
Capital Openness (Ito's index)	0.27	0.87***
Financial Depth (Bank assests / GDP)	0.28	0.62***
Financial Depth (Credit to private sector / GDP)	0.29	0.68***
Fiscal Policy	0.10	0.43*

Note: The regressions are estimated using Panel Least Squares. The asterisks ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively. In the sensitivity analysis regressions, outliers are excluded using the studentized residual method. The regression variables are specified as follows:

Dependent: domestic real GDP growth rate at time *t+k,* (100*(log GDPt+k - log GDPt+k-1))

Independent: (i) country fixed effects, (ii) forecast error world GDP at time *t*, interacted with monetary policy framework dummy coefficients (exchange rate versus inflation or money targeting), (iii) battle-related deaths (*war*), (iv) country specific external demand (to control for world GDP)

Big oil exporters: Angola, Cameroon, Chad, Rep. of Congo, Ghana, Mauritania, Nigeria, Sudan, Yemen

IV. EVENT STUDY: 1994 CFA DEVALUATION

The CFA zone consists of fourteen countries, belonging to two currency unions, the West African Economic and Monetary Union (WAEMU), and Central African Economic and Monetary community (CEMAC). The common currency used in each union is the Central African Franc (CFA), fixed to the French franc since 1980, and to the euro since 1999. A lot of these countries are big commodity exporters: cocoa and coffee (Cote d'lvoire), petroleum (Congo, Gabon, Cameroon), cotton (Chad, Burkina Faso, Mali), and phosphate (Togo).

Heavy dependence on commodity exports created a problem between 1984 and 1989 when the commodity prices (denominated in U.S. dollar) declined—more than 60% for cocoa and petroleum US$ prices, with the cocoa price reaching a fourteen-year low. In addition, the variation of the U.S. dollar-French franc exchange introduced more volatility in the CFA prices, and worsened the countries' economic plight. The loss of income and purchasing power for exporters was accompanied by a loss of domestic demand as the imports became cheaper, such that these economies grew little or not at all for most of the late eighties, and the beginning of the nineties.

In response, most CFA countries implemented one austerity program after another to adjust their real exchange rate. However, by late 1993 the extent of the overvaluation was 30 percent on average. To address this situation, the CFA countries consulted with one another and with the IMF and France and devalued the CFA franc by 50 percent on January 1st, 1994.

The neighboring or competing African countries which opted out earlier from the currency unions (e.g. Nigeria, Ghana, Sierra Leone, and Gambia) had monetary policy frameworks that allowed them significant nominal depreciation. While a devaluation in the CFA zone was expected for some time, the magnitude and the one-shot nature was a surprise.

Our event study focusses on assessing the impact of this monetary policy shock on output growth. We test to see if the shock—the discrete event of the large surprise devaluation of the CFA franc in early 1994—had a highly significant effect on the real GDP growth of 10 African LICs within the CFA zone. We compare these effects with a control group of 18 other African LICs. As shown in Table 5 this control group is broadly similar to the CFA zone group as of 1993. In particular, both groups of countries have similar levels development (real GDP per capita), trade and capital account openness, financial depth and selected governance indicators.[26]

[26] We excluded the sub-Saharan African countries that were not LICs in 1993 (South Africa, Botswana Gabon, Guinea Bissau) and some countries for which data was not available (see Appendix II for a complete set).

Table 5. Event Study: Comparison of Key Indicators in CFA Zone and Control Group Countries

	CFA Zone			Control Group		
Indicator	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
Population (millions)	9	3	15	18	0	108
Real GDP Per Capita ($US)	409	197	777	489	148	1,342
Trade/GDP (Export + Imports / GDP, percentage)	24	17	36	28	10	81
Capital Flows/GDP (Inflows + Outflows / GDP, ooercentage)	2	-1	11	5	-1	18
Financial Depth (Bank Assets / GDP, percentage)	14	6	29	13	4	25
Corruption Index	3	2	4	3	2	4
Political Risk Rating	50	41	63	54	41	65
Composite Risk Rating	53	48	59	53	39	64

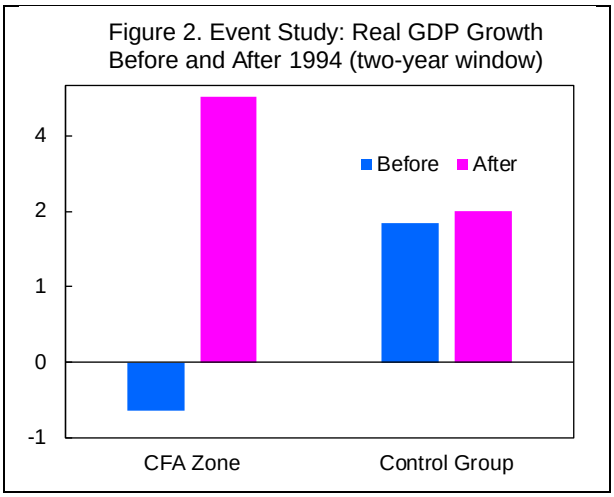
Source: WEO.

The mean for the real GDP per capita is very similar and while the range is wider in the control group, we account for this characteristic in the sensitivity analysis. Only one country in the control group has very high trade openness, and much higher than in the CFA zone, (Lesotho, 81 percent of GDP). However, because of its ties with South Africa, and a fixed exchange rate regime, that country had a decline in GDP in 1994–1995. Hence, given the similarities in the groups, this is a good natural experiment.

We use a difference-in-differences approach and compare the average real output growth outcomes before and after the shock within the CFA zone to that in the control group that did not devalue their currency at that time. Concretely, we measure the difference in average real GDP growth before and after 1994. We allow two-years after devaluation to capture all effects and compare the average growth rate over 1994–1995 with that during 1992–1993 (Figure 2), with the differences reported for the two groups in Table 6.[27] To ensure that the results are not driven by country specific events, we report in Figure 2 and Table 6 the de-meaned rates (over the 1990–2015 sample) for each group. In addition, we present in Figure 3 the distribution of the differences in these two-year growth rates (pre and post-1994). The latter and the methods of eliminating the outliers, presented in Table 6, is our sensitivity analysis for this method. [28]

[27] Results for a one-year window difference in growth before and after January 1994 are available by request and are similar with the ones presented for the two-year window. In an event study, the smaller the window, the higher the probability that the difference in growth performance is driven by the devaluation, and no other exogeneous shock. Moreover, a two-year window should be enough to capture all effects of a monetary policy shock on output, even for the countries with the highest nominal rigidities.

[28] Figure 3 shows a similar growth performance before devaluation, per group and as a distribution, but not after the 1994 devaluation.



Since we observe a statistically different growth performance post devaluation in the CFA zone, and not one in the control group, then we could infer that the devaluation had real effects: the nominal devaluation led to an instant and full adjustment in prices.
In particular, the results strongly reject the hypothesis of monetary neutrality. As follows:

- Real GDP growth on average has improved by 5 percent after the devaluation in the CFA zone, while the control group's growth performance is relatively unchanged before and after 1994 (Figures 2 and 3, and Table 6).
- This result is statistically significant and robust—at 5 percent (Table 6); the impact on real growth of the devaluation in the CFA zone is estimated between 2¾ and 5½ percent once we exclude different outliers.
- The distribution of the growth performance in the CFA zone and the control group, before and after 1994, shows similar results in Figure 3. The average growth in the CFA zone was about 4 percent after the devaluation, and the difference between before and after 1994 two-year windows was about 5 percent and statistically significant (at 10 percent, see Table 6).

Table 6. Event Study: Difference in Real GDP Growth, Before and After 1994 (two-year window)

Sample: 28 sub-Saharan African LICs 1/

Difference in Growth (1994-1995 versus 1992-1993)	CFA	Control group	Difference in difference
Baseline	5.21**	-0.23	5.44*
	(2.06)	(1.23)	p-value 0.07
Sensitivity Analysis: selected sub-Saharan African LICs			
Exclude CFA outlier with very high 1994 growth (Togo)	2.81**	-0.23	3.04*
	(1.13)	(1.23)	p-value 0.06
Exclude Highest Income LICs 2/	5.32**	-0.34	5.66*
	(2.18)	(1.35)	p-value 0.08
Exclude Lowest Income LICs 3/	5.52**	-0.54	6.06*
	(2.30)	(1.48)	p-value 0.08

Note: The regression is estimated using Panel Least Squares. The asterisks ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively. the standard deviation is reported under each coefficient. The p-value refers to the chi-squared test of equality between the coefficients for the CFA zone and the control group. The regression variables are specified as follows:

Dependent : Change in two year real GDP growth rate (1994-1995 versus 1992-1993), demeaned

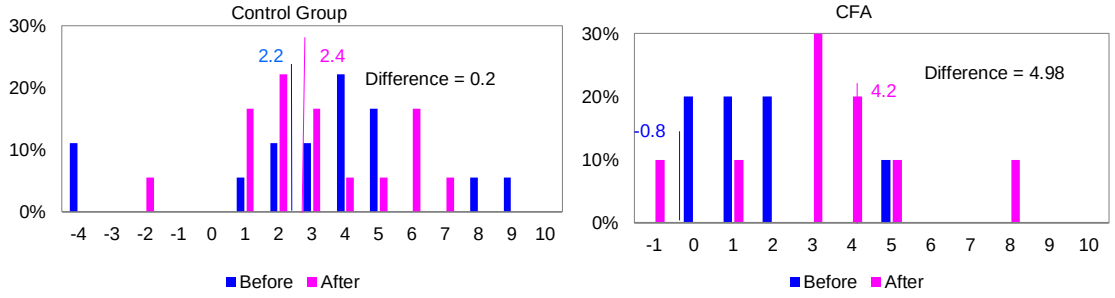
Independent : Constant, CFA zone dummy, and battle related deaths (to control for wars)

1/ 10 countries CFA (Benin, Burkina Faso, Cameroon, CAR, Chad, Cote d'Ivoire, Mali, Niger, Senegal, and Togo). 18 control group countries (Burundi, Cabo Verde, Comoros, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Nigeria, Sao Tome & Principe, Tanzania, Uganda, and Zambia).

2/ Exclude countries where GDP per capita exceeded US$ 800 in 1995 (Cabo Verde and Nigeria).

3/ Exclude countries where GDP per capita was below US$180 in 1995 (Burundi, Ethiopia, Mozambique, and Tanzania).

Figure 3. Event Study: Distribution of Real GDP Growth, Before and After 1994 (two-year window)



The results also show that the monetary policy framework in LICs does matter. To shine some further light on these results, we surveyed policy reports of the era. The Overseas Development Institute (ODI) 1990 report noted that highly publicized nominal wage cuts in the CFA zone countries had sparked political unrest and proved difficult to implement in the late eighties. By contrast, the experience of neighboring Ghana (1990) showed that a devaluation following a move to a free float could help reduce real wages and improve competitiveness (Beaudry and Sowa 1994).

V. CONCLUSIONS

In recent years many LICs have been modernizing their monetary policy frameworks. The results of our paper provide strong empirical support for the importance of that progress. We overwhelmingly reject the hypothesis that monetary policy frameworks do not matter in LICs. First, we analyze the response of output growth (real GDP) to shocks stemming from abroad (including surprises in the world GDP, shifts in the terms of trade, and fluctuations in the price of oil) using panel data for 79 LICs over the period 1990–2015. Second, we use event study analysis and find that a large surprise devaluation of the CFA franc in early 1994 had highly significant effects on the real GDP growth of 10 African LICs within the CFA zone compared to an otherwise broadly similar group of 18 other African LICs that had different monetary policy frameworks. The results are robust to various specifications—including shocks, control variables, and subsamples—and hold even for the poorest LICs, indicating that nominal rigidities are present in those economies as well.

In particular, we find highly significant differences in the response to shocks on real output growth between LICs with monetary policy frameworks implemented through rigid nominal exchange rates and LICs implementing monetary or inflation targeting. The countries that use exchange rate targeting to ensure price stability see a statistically larger response in real domestic output growth than countries targeting inflation or money.

Our empirical analysis reaches these conclusions without imposing a model or economic structure borrowed from advanced economies. While the paper does not shed light on the underlying causes of money non-neutrality, our findings have broader implications for identifying the fundamental sources of why monetary policy is relevant in LICs and for studying what type of nominal rigidities lead to this result and therefore what type of model one needs to employ in assessing economic performance in these economies (see Stiglitz, 2006, and Blanchard, 2009). The nature and degree of such rigidities need to be explored further, which will provide further insight into analyzing how LICs should respond to domestic and external shocks.

More broadly, the building blocks needed for a successful monetary policy framework in LICs are remarkably similar to the best practice for advanced economies and emerging markets (see IMF, 2015). Unsal and others (2020) emphasize the relevance of *de jure* and *de facto* characteristics of monetary policy frameworks. Indeed, having a systematic and transparent monetary policy framework may be even more important in LICs in the current context of the COVID-19 pandemic and its associated economic disruptions across the globe.

APPENDIX I—ESTIMATION

To estimate the dynamic response of GDP growth to specific shocks, we use a parsimonious, single equation model. This approach, like Jordà (2005), is a flexible alternative to VARs to estimating impulse-response functions without imposing the dynamic restrictions embedded in VAR specifications. It is particularly suited to capture nonlinearities in dynamic responses.

The estimation comes at a cost though, ignoring the interaction with other variables. This could obscure the true source of shocks, because it may have been left out of the regression.

Our strategy is to uncover the effect of innovations in the real GDP growth, according to the monetary policy framework, through the following equation:

$$y_{i,t+k} - y_{i,t} = \alpha_i^k + \gamma_t^k + \beta^k * \theta_1 * FE(x_{i,t}) * MP\_ER_{i,t} + \beta^k * \theta_2 * FE(x_{i,t}) * (1 - MP\_ER_{i,t}) + \varphi z_{i,t} + e_{i,t}^k \quad (1)$$

where:

- $y_{i,t+k} - y_{i,t}$ is the percent change in the real GDP growth, $y_{i,t}$ (measured in logs) observed between times *t* and *t+k*;
- α_i^k and γ_t^k are country and time fixed-effects, respectively;
- $FE(x_{i,t})$ is the forecast error (i.e., shock) in exogenous driver variable $x_{i,t}$;
- $MP\_ER_{i,t}$ is as vector of binary indicators of the monetary policy framework (equals 1, if exchange rate targeting, or 0, if money or inflation targeting);
- $z_{i,t}$ is a vector of controls.

Equation (1) is estimated using annual data from LICs for intervals k = 1, 2 years. The parameter β^k allow us to construct impulse responses (IRF) for the effect of a shock to $x_{i,t}$ on $y_{i,t}$ over horizon *k*.

Wald tests are used first to assess the statistical difference between the effect of $x_{i,t}$ on $y_{i,t}$ across different monetary policy frameworks. In other words, we test to see if $\theta_1 \neq \theta_2$.

Afterwards, we test our baseline hypothesis, that the monetary policy framework does not have a differentiated impact of the shock on growth. In other words, we test to see if $\theta_1 = 0$, $\theta_2 = 0$ and $\theta_1 - \theta_2 = 0$.

The results reported in each line of the tables are: $\beta^k \theta_1$, $\beta^k \theta_2$ and $\beta^k \theta_1 - \beta^k \theta_2$, respectively, to be able to be interpreted them as the impact of a certain shock on domestic output growth, according to the monetary policy framework (e.g. $\beta^k \theta_1$ for exchange rate targeting).[29]

We use WEO forecasts, and hence compute forecast errors using WEO data because the WEO covers the entire global economy (unlike most professional forecasters) and reflects rigorous analysis as well as expert judgment of Fund staff. An alternative approach would be to use forecasts generated mechanically by a statistical model (such as a VAR), but such forecasts would necessarily rely on specific technical assumptions (e.g., linearity or stationarity).

Regarding the forecast horizon, the forecast error variance increases rapidly with the forecast horizon. Consequently, using a longer forecast horizon would add unnecessary noise to our explanatory variable and diminish the prospect of obtaining any statistically significant or economically meaningful results.

[29] Introducing lag domestic GDP growth as a control variable would reduce autocorrelation in the error term at the expense of making more difficult to disentangle the difference in the impact of the shock relative to the monetary policy framework. To account for the possibility of autocorrelation in residuals we used robust standard errors.

APPENDIX II—LIST OF COUNTRIES IN THE SAMPLE

LICs in the Analysis			
Afghanistan	Albania	Angola	Armenia
Azerbaijan	Bangladesh	Benin	Bhutan
Bolivia	Burkina Faso	Burundi	Cabo Verde
Cambodia	Cameroon	Central African Republic	Chad
Comoros	Congo, Democratic Republic of the	Congo, Republic of	Côte d'Ivoire
Djibouti	Dominica	Eritrea	Ethiopia
Gambia, The	Georgia	Ghana	Grenada
Guinea	Guinea-Bissau	Guyana	Haiti
Honduras	India	Kenya	Kiribati
Kyrgyz Republic	Lao P.D.R.	Lesotho	Liberia
Madagascar	Malawi	Maldives	Mali
Mauritania	Moldova	Mongolia	Mozambique
Myanmar	Nepal	Nicaragua	Niger
Nigeria	Pakistan	Papua New Guinea	Rwanda
Samoa	São Tomé and Príncipe	Senegal	Sierra Leone
Solomon Islands	Sri Lanka	St. Lucia	St. Vincent and the Grenadines
Sudan	Tajikistan	Tanzania	Timor-Leste
Togo	Tonga	Uganda	Uzbekistan
Vanuatu	Vietnam	Yemen	Zambia

Event Study

CFA 1/	Control Group 2/
Benin	Burundi
Burkina Faso	Cabo Verde
Cameroon	Comoros
CAR	Ethiopia
Chad	Gambia
Côte d'Ivoire	Ghana
Mali	Guinea
Niger	Guniea-Bissau
Senegal	Kenya
Togo	Lesotho
	Madagascar
	Malawi
	Mozambique
	Nigeria
	Sao Tome and Principe
	Tanzania
	Uganda
	Zambia

[1/] CFA excludes two high-income countries Gabon and Equatorial, and countries affected by military conflict Congo, Democratic Rep, Congo, and Rwanda.

[2/] The Control Group excludes countries with GDP data not available in 1992–95 Angola, Eritrea, Liberia, and Sierra Leone. This means the event study uses 28 countries, from a potential sample of 35 countries.

APPENDIX III—DATA: MONETARY POLICY FRAMEWORKS

LICs, 1990–2015

Exchange rate regimes					
	Hard Pegs	**Soft Pegs**	**Flexible**	**Total**	**Monetary Policy Frameworks**
ER targeting	845	195	24	1,064	
Money targeting	0	82	472	554	
Inflation targeting	0	4	29	33	
Total	**845**	**281**	**525**	**1,651**	

Source: IMF AREAR.

APPENDIX IV—DATA SOURCES

We consider $y_{i,t}$ = real GDP as the endogenous variable in (1) and look for the effect of shocks to the following variables:

Exogenous "drivers" ($x_{i,t}$)	Control variables ($z_{i,t}$)
World GDP	Wars, Trade Openness, Capital Account Openness, Financial Depth, Fiscal Policy
Terms of Trade, Oil Prices	Foreign Real GDP, Wars

The list of variables used in the estimations are represented (with sources) by the series in the table below.

Variable	Notation	Source	Transformation/Unit
Monetary policy indicator	*MP_ER*	AREAER	Dummy
Real GDP	*GDP*	WEO	In logs; 2005 = 100
World GDP	*WGDP*	WEO	In logs; 2005 = 100
Terms of trade	*ToT*	WEO / IFS	Unit value of exports / unit value of imports, in logs; 2005 = 100
Oil prices	*Oil*	WEO	In logs; 2005 = 100
Oil producing indicator	*OilExp*	IEA	Crude oil production exceeding 5% of NGDP
Wars	*War*	Uppsala Conflict Data / UN	Number of battle-related deaths / number of total population
Nominal GDP	*NGDP*	WEO	
Trade Openness	*TO*	WEO	Nominal exports + Nominal imports (US$) / Nominal GDP (US$)
Capital Account Openness	*FA*	WEO	Financial account inflows + outflows (US$) / Nominal GDP (US$)
Capital Account Openness: Ito index	*CAI*	Chinn-Ito	
Financial Depth: deposit money banks assets (percent of domestic currency GDP)	*BA*	Global Financial Development	
Financial Depth: credit to the private sector (percent of domestic currency GDP)	*CPS*	Global Financial Development	
Fiscal Policy: central government overall balance (domestic currency)	*CGBAL*	WEO	Percent of nominal GDP (domestic currency)
International Country Risk Guide index and main subcomponents	*ICRG*	PRS group	
Central bank independence index and subcomponents	*CBI*	Cukierman	

APPENDIX V—DATA: STYLIZED FACTS

Panel Study (79 countries, 1990-2015)

	Mean over sample		Significance
	Monetary and Inflation Targeting	Exchange Rate Targeting	Equality of Means
1. Trade openness			
Exports / GDP (X, in US$, percentage)	29	31	0.01
Imports / GDP (M, in US$, percentage)	42	47	0.00
(X + M) / GDP (in US$, percentage)	71	78	0.00
2. Capital account/financial openness			
Financial Account: Inflows / GDP (in US$, percentage)	6.1	5.3	0.20
Financial Account: Outflows / GDP (in US$, percentage)	2.3	2.7	0.33
Financial Account: Inflows + Outflows / GDP (in US$, percentage)	8.3	7.8	0.54
Financial Openness index	-0.3	-0.5	0.00
3. Financial depth			
Financial depth	14	25	0.00
4. Governance			
Corruption	2.1	2.3	0.00
Composite Risk rating	58.1	58.2	0.76
Economic Risk rating	29.8	31.0	0.00
Fincial Risk rating	31.5	31.1	0.44
Political Risk rating	54.8	54.3	0.39
5. GDP per capita US$			
All LICs *(79 countries)*	848	1498	0.00
LICs with GDP per capita below US$800	428	436	0.48
6. Central bank independence			
Component 1: CB CEO (0.20)	0.5	0.6	0.00
Component 2: CB objectives (0.15)	0.6	0.6	0.00
Component 3: Policy formulation (0.15)	0.6	0.6	0.03
Component 4: CB lending (0.50)	0.5	0.5	0.05
CBI Cukierman	0.5	0.4	0.00

Source: WEO.

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