

**The Transformation and Performance of Emerging Market Economies Across the
Great Divide of the Global Financial Crisis**

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The Transformation and Performance of Emerging Market Economies Across the Great Divide of the Global Financial Crisis of 2007-2008¹

1. Introduction

Before the Global Financial Crisis (GFC)², a drive towards greater central bank autonomy (CBI) and transparency (CBT), as part of the achievement of greater central bank credibility that began in the advanced economies (AE), spread to the emerging market economies (EME). This process was greatly enhanced by the adoption of inflation targeting (IT; Bordo and Siklos 2014). The adoption of IT and other best practice CB technologies was viewed as a way for EME countries especially to “tie their hands” to deliver lower and more stable inflation rates without undue fiscal and /or political influence.

The process of CB evolution was interrupted by the GFC, a largely advanced economy (trans-Atlantic) event (Tooze 2018, McCauley 2018). The fallout from the GFC in the AE elevated the objective of financial stability, which, unlike monetary policy, was less well-defined, and in the search for reliable instruments to achieve it. Many of the EMEs were affected by the fallout of the GFC but most were largely insulated from it. Many continued on the trajectory of convergence to best practice central banking and maintenance of the hard-won benefits in the fight against inflation.³

In this paper we compare the performance of a representative set of EMEs with a group of AEs before and after the GFC. We focus on institutional developments (changes in CBI, changes in CBT, changes in CB governance indicators and a new measure of resilience). We then develop a new measure of CB

¹ For excellent research assistance we thank Humberto Martinez Beltran.

² There is no official chronology but the ones published by the Federal Reserve Bank of St. Louis (<https://www.stlouisfed.org/financial-crisis/full-timeline>), and the Federal Reserve Bank of New York (https://www.newyorkfed.org/research/global_economy/policyresponses.html) provide useful and comprehensive timelines. Some prefer to call the period from 2007 on the ‘Great Financial Crisis’ (e.g., see Carstens 2018) but we retain the, arguably, more popular GFC expression.

³ See Jasova, Moessner and Takats (2018) which provides evidence on exchange rate pass through to inflation for advanced and emerging economies since the GFC. They find that pass through for EMEs has declined since the GFC and converged on that of the AEs. This is perceived as a reflection of improved CB credibility.

credibility which extends our earlier work (Bordo and Siklos 2015, 2016, 2017). The improved measure combines deviations of inflation from a CB's objective, monetary policy uncertainty, and a global factor that can impact CB credibility.

With these building blocks we then use econometric methods (panel VARs based on both factor models and observed data) to ascertain the impact of global shocks, financial shocks, credibility shocks and trade shocks on the EMEs versus the AEs.

Section 2 provides a brief historical overview of the evolution of CB credibility and its correlates (CBI and CBT) in both AE and EME in the post Bretton Woods era. Section 3 outlines the data. Section 4 presents our institutional measures. Section 5 contains our econometric estimates. Section 6 concludes with some policy lessons.

2. Historical Background

The Great Inflation 1965 to 1983 was a defining moment for the central banks of the AE in the post-World War II era.⁴ The post-war Bretton Woods period was one of relative macro stability seen in low inflation and inflation variability and high real growth and low real output variability for the advanced countries (Bordo 1993, and Bordo and Siklos 2015). The collapse of Bretton Woods between 1971 and 1973 was followed by accelerating inflation and increased inflation volatility along with declining real activity and rising unemployment (stagflation; Bordo and Orphanides 2013). This performance was driven by the termination of the disciplining force of the Bretton Woods nominal anchor, the Keynesian emphasis on full employment and the belief by central banks that the benefits of full employment outweighed the costs of rising inflation. A key factor in this period across countries was the absence de facto and in some cases de jure of CBI. The story differed across countries. In the UK , the Bank of

⁴ For a discussion of the history of central banks see Bordo and Siklos 2018.

England was a de facto part of the Treasury. In the U.S., although the Federal Reserve was de jure independent, and de facto had regained its independence from the Treasury in the 1951 Accord, under the tutelage of Chairman William McChesney Martin it was “independent within the government” and it increasingly coordinated monetary policy with the Treasury (Meltzer 2010). Through a process called “even keel” the Fed indirectly monetized the fiscal deficits generated by the Johnson administration to finance the Vietnam war and the Great Society and later by the Nixon administration (Humpage 2019, Bordo 2018).⁵ The Fed’s unwillingness to tighten monetary policy sufficiently to kill inflationary expectations led to a ratcheting up in inflation in the 1970s (Bordo and Orphanides).⁶ This was also a period when CB credibility, defined as the deviation of realized inflation from the stated objective, was at a low point (Bordo and Siklos 2015).

As is well known, the Volcker shock of 1979 and subsequent tight monetary policies and similar strategies in the UK, Canada and other countries led to the Great Moderation period from the mid-1980s to before the GFC and the restoration of CB credibility (Bordo and Siklos 2015). In that period both CBI and CBT increased dramatically (Bordo and Siklos 2014).

Along with the evolution described above of the CBs of the AEs, the EMEs followed a similar trajectory but with generally worse economic performance. These countries had a long history of high and volatile inflation and of frequent currency crises. The political economy in the EMEs combined with less developed financial institutions and markets made it difficult to establish an institutional framework for monetary and fiscal stability. (For Latin America see Edwards 2012). Despite this, the Bretton Woods regime did serve as a nominal anchor for these countries and macro performance was better than after its collapse (Edwards and Santaella 1983, Bordo and Schwartz 1998). The Great Inflation period for the EMEs was characterized by even worse macro performance than the AEs and the instability was not fully

⁵ For the UK, see Bordo, Bush and Thomas (2019). For France see Monnet (2019)

⁶ Another important factor was accommodation of the oil price shocks. See Blinder and Rudd (2013)

alleviated until the 1990s when many countries began adopting best practice central bank and economic policy technology.⁷ Bordo and Siklos (2014, 2017) present evidence that those countries that adopted IT converged more rapidly to the inflation levels of the AE countries than EMEs that did not. Moreover, their performance on measures of CBI and CBT also improved greatly relative to countries that did not adopt IT (e.g., see Siklos 2017).

The GFC changed the plot considerably. It was primarily an advanced country /transatlantic event (Tooze 2018, McCauley 2018), triggered by the collapse of the U.S. housing market. Its causes included: US government policies to encourage home ownership (Rajan 2011); lax financial regulation and oversight (Calomiris 2017); financial innovation, especially in the unregulated shadow banking sector (Tooze 2018) and loose monetary policy (Taylor 2007). Although the GFC was an AE event, some EMEs were hard hit, especially those in Eastern Europe with financial ties to Western Europe, and others were hit by the collapse of international trade and the spillovers from the AE credit crunch. But there were a number of countries which had developed the resilience to largely withstand the crisis (e.g., Chile).

Since the GFC, CBs in the advanced countries have been heavily focused on financial stability and in developing the tools of macroeconomic policy and leaning against the wind policies to withstand future global imbalances. This strategic shift was manifest in the U.S. in the Dodd Frank bill of 2010 and in the international financial system with Basel III in 2011 (<https://www.bis.org/bcbs/basel3.htm>). Many EMEs have been developing similar policy strategies as in the advanced countries but their financial architecture and exposure through international trade and capital flows have prevented them from advancing to the level of the AEs so that their circumstances and vulnerabilities are different (BIS 2019).

In this paper we examine evidence on the performance of a panel of EME central banks from Latin America, Asia, and Europe to ascertain how the GFC affected the trajectories that they had been

⁷ Chile was one of the first following New Zealand to adopt IT.

following before the GFC in comparison to the experience of a panel of AEs. Our evidence suggests that a number of EMEs, but not all, have developed the institutional resilience to keep them on track.

In Appendix I, we present brief case studies for six countries; 3 AEs (US, Canada , Sweden) and 3 EMEs (Chile, Colombia and Mexico) These studies examine in more detail their monetary policy performance and credibility from the Great Moderation through the GFC.

3. Data

Most of the data for this study are from publicly available databases (e.g., national central banks, OECD Main economic Indicators, International Monetary Fund, Bank for International Settlements, Federal Reserve Economic Database (or FRED), and the World Bank. We have prepared a separate appendix available on request with detailed data sources. Some forward-looking variables (e.g., inflation and real GDP growth forecasts) are also publicly available (i.e., IMF's World Economic Outlook). Only Consensus Economics forecasts are not available for distribution. Some institutional data are from databases made available by other researchers. These include data on central bank independence (Dincer and Eichengreen 2014), and central bank transparency (Dincer, Eichengreen, and Geraats 2019). Other institutional data used include the World Bank's Governance indicators (<https://info.worldbank.org/governance/wgi/#home>), the KOF Swiss Economic Institute Globalisation indices (<https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html>), exchange rate and crisis data from Reinhart and Rogoff (2009), and Ilzetzki, Reinhart and Rogoff (2019; <http://www.carmenreinhart.com/>), with other crisis data from Bordo and Meissner (2016), and the Chinn-Ito index of financial openness (http://web.pdx.edu/~ito/Chinn-Ito_website.htm; Chinn and Ito 2006). As discussed below we also propose an indicator of institutional resilience that partially depends on two other series, namely Baker, Bloom and Davis's (2016) economic policy uncertainty index (EPU;

<http://www.policyuncertainty.com/index.html>), and Caldara and Iacoviello's (2018) geopolitical risk index (GPR; <https://www2.bc.edu/matteo-iacoviello/gpr.htm>).⁸

The sampling frequency of the raw data collected for this study ranges from monthly to annual with most of the key time series usually obtained at the quarterly frequency. Typically, institutional variables are available at the annual frequency while macroeconomic and financial data are generally available at the monthly and quarterly frequencies. Where required we convert all data used in the subsequent econometric estimation to the quarterly frequency. Conversion of monthly data is done via arithmetic averaging while, in a few cases (e.g., some forecasts), semi-annual data are converted to the quarterly frequency via interpolation.⁹ Most of the time series are in annualized growth rate form to ease interpretation. Some series, such as interest rates are already in percent.¹⁰ We collected data for the 1980-2018 period though, because of missing or incomplete data, the actual sample used in some of the econometric exercises typically begins during the 1990s before any transformations are applied. However, for reasons explained below, panel VAR estimates shown are for samples that begin in 2000 (before any differencing or lags are applied). In the case of institutional variables, we also collected data since the 1980s but, since many of the institutional developments discussed in the paper begin during the 1990s we limit the analysis to data over the past two decades or so.

⁸ Country-specific EPU indices are available for all countries except AR, CZ, HU, ID, IL, MY, NO, NZ, PE, PH, PL, YH, TR, and ZA. For these cases the global version of EPU is used. Turning to GPR, data are available for AR, BR, CN, CO, IL, IN, KR, MY, NO, PH, SE, TH, TR, and ZA. For the remaining economies the overall GPR indicator is used. See Table 1 for the country acronyms used.

⁹ The basic idea is to fill the gap due to missing observations by fitting a hypothetical function that links observations at both ends of the gap. Many algorithms to do so are available including the so-called Chow-Lin method (Chow and Lin 1971) that is used here.

¹⁰ Economists continue to debate the form in which macroeconomic and financial time series ought to be analyzed. The fact that this is an ongoing area of research indicates that a consensus has not yet been reached. Part of the difficulty is that some shocks are transmitted through the economy at a faster rate than others (e.g., monetary versus financial). We have generated series using other methods (e.g., Hamilton and Hodrick- Prescott) but these are not used in the econometric estimates presented in section 5. See, inter alia, Hamilton (2018), and Schüler (2019).

Our data set consists of 29 economies. They are shown in Table 1. By today's standards (i.e., in 2019) 12 are classified by the International Monetary Fund as advanced economies (AE) while the remaining 17 belong to the emerging market group of economies (EME). By 2019, 23 economies explicitly target inflation, of which 9 are advanced economies while 14 are emerging market economies. The starting date for the adoption of inflation targets varies considerably (see Appendix II) and so we also define a group of so-called 'established' inflation targeting countries due to the longevity of the policy regime. They are: Australia, Canada, Great Britain, New Zealand, and Sweden. Three of the economies are considered systemically important and advanced, that is, the US, Japan, and the Eurozone. Conceivably one might add China to the list, the lone emerging market economy in this category, but we elect not to for the present exercise in part because the last 'global' financial crisis originated in AE.¹¹

4. Institutional Developments: Some Stylized Facts

4.1 CBI, CBT, Inflation and Inflation Expectations

In this section, we document a number of measures of institutional performance in our panel of central banks.

Figure 1 plots average changes in the Dincer and Eichengreen (2014) overall index of central bank independence (CBI) for the available sample period, that is, 1998-2017.¹² The AE in our sample are shown to the right of the vertical dashed line while the EMEs are shown on the left. Only 3 EME experience a noticeable increase in CBI and that is almost the same number as among the group of AE. However, over the 1998-2017 period, CBI in the vast majority of economies in our sample is unchanged.

¹¹ See, however, Chen and Siklos (2019) for such an exercise.

¹² Dincer and Eichengreen's data begins in 1998 and ends in 2010. For convenience we extended the data by estimating a fixed effects panel model for the 29 economies using the overall indicator of the quality of the polity in each economy as a proxy for how CBI might have changed over time. We also considered an index of state fragility together with interactions effects (i.e., with the type of exchange rate regime, central bank transparency) to extend the sample from 2011 to 2017. The regression results are available on request. The policy data are from the Polity IV data set obtained from <http://www.systemicpeace.org/inscrdata.html>.

CBI alone is unlikely to explain much of the great divide in the title of the paper. Criticisms of de jure style indicators of central bank independence are well known. However, it remains true that most observers regard a form of statutory autonomy of the central bank as a critical ingredient in good governance. Therefore, one should not under-estimate the importance of this kind of institutional feature.¹³

Arguably, one of the most important institutional developments over the past two decades has been the rise in overall central bank transparency (CBT). Figure 2A displays average changes in central bank transparency over the 1998-2015 period.¹⁴ Once again the vertical dashed line separates the AE from the EME economies in our dataset. Unlike CBI we observe progress in CBT in all economies although this is unevenly distributed. Indeed, improvements are greater in several EME (e.g., Thailand, Poland) than in some of the best performers of among the AE (e.g., New Zealand, Czech Republic).

Figures 2B and 2C provide two other perspectives on CBT since 1998. Figure 2B highlights the steady rise in CBT in both AE and EME but there is little indication that the gap in CBT between AE and EME is narrowing substantially. Figure 2C, however, shows that whereas CBT in small open AE economies exceeded levels in large AE, the latter have caught up and overtaken the former group of economies since the GFC. Whether the financial crisis pushed central banks in some AE that were most affected by the GFC to become even more transparent is open to debate but it is notable that the small open

¹³ Indeed, the current Chair of the FOMC, Jerome Powell, has felt it necessary to remind the public of the importance of CBI. "The Fed is insulated from short-term political pressures—what is often referred to as our "independence." Congress chose to insulate the Fed this way because it had seen the damage that often arises when policy bends to short-term political interests. Central banks in major democracies around the world have similar independence." (Powell 2019).

¹⁴ The data from Dincer, Eichengreen and Geraats (2019) ends in 2015 and we made no attempt to extend their data set. The index is an update and improvement over the original Dincer and Eichengreen (2014) index of CBT. The indicator of CBT ranges from a minimum of 0 to a maximum of 15. CBT is an aggregation of scores based on 5 sets of characteristics. They are: political transparency, economic transparency, procedural transparency, policy transparency and operational transparency. See Dincer, Eichengreen and Geraats (2019, pp. 329-332).

economies all explicitly target inflation while only Great Britain is considered an inflation targeting (IT) in the group of large economies.

Although we cannot be certain, of course, there is a risk that the steady rise in CBT, together with the occasional increase in CBI, may come into conflict with an overall deterioration in institutional quality threatening the resilience of central banks in the face of political pressure and, thereby, resilience in the face of shocks. We return to this point below.

The preceding two indicators suffer from at least two drawbacks. First, as noted already, they tend to rely on de jure indicators¹⁵ and they also ignore the wider pressures on monetary policy from overall governance in the countries and economies concerned. Figures 3A and 3B, respectively, display average levels of CBT in the AE and EME against an average of the World Bank's indicator of governance indicators (WBGi).¹⁶ To generate the results shown in Figures 3A and 3B we estimated, for each group of economies, the first principal component (using the principal factors method) of the overall governance indexes to obtain the scores shown. Although one cannot assign weights to the components of governance the following economies show a trend deterioration in at least half of the characteristics defined by the World Bank. They are: The Eurozone, the US, Hungary, Thailand, South Africa, Australia, Canada, and Brazil.¹⁷ When the governance indicators are combined as described above 7 of the 17 EMEs experience an overall decline in governance. They are: Argentina, Brazil, Hungary, Mexico,

¹⁵ This is a far more accurate description of the CBI index than the CBT indicator which is largely based on information made public by central banks.

¹⁶ The WBGi consist of 6 characteristics of governance. They are: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. We summed the scores of the 6 characteristics and took the mean as our overall indicator of governance. A rise in the indicator signals improved governance.

¹⁷ This inference is based on a simple regression of the time series of various components of governance on a time trend. Hungary has the distinction of a decline in all categories of governance. The Eurozone indicator is proxied here by the average governance indicators for Germany, France, and Italy.

Philippines, Thailand, and South Africa. In the case of the AE the Eurozone, The UK and the US contribute to reducing the AE's level of governance quality.

Turning to the data aggregated for the AE versus the EME, following a drop in the quality of governance from 1998 to 2004 the indicator remains relatively stable although a small additional drop is observed following the GFC. This stands in contrast with the continued rise in CBT over time although there is a levelling off after the GFC. Turning to the EME there is a steady drop in the overall quality of governance beginning in 2005 that continues until the end of the sample while the steady rise in CBT shows no signs of abating by 2015.¹⁸

A few other institutional indicators are worthy of mention although we relegate to the appendix the details. First, despite the GFC, financial globalization continues to rise. This is not a phenomenon restricted to the AE but is global in nature. In contrast, the message is far more mixed when it comes to trade globalization with signs of retreat in several EMEs (e.g., Indonesia, Turkey, China and Malaysia) and even in a few AE (e.g., Canada, Norway, and New Zealand).¹⁹ The Chinn-Ito indicator, over the 1998-2016 period, provides a similar interpretation at least as regards capital account openness with progress in several AE and EME although the message is again mixed for the EMEs with several countries becoming less open to capital flows (e.g., Argentina, Indonesia, Thailand, and Malaysia).²⁰ Finally, average changes in monthly indicators of the degree of exchange rate flexibility over the 1998-2019 period obtained from Ilzetzki, Reinhart and Rogoff's (2019) exchange rate regime classification also provide a mixed message with roughly half of the economies in our sample showing no regime changes

¹⁸ The WBI data are available until 2017 and the downward trend in governance in EME continues. Since the CBT data end in 2015 the governance indicators for 2016 and 2017 are not shown.

¹⁹ The indexes are based on an aggregation, via principal components analysis, of several indicators of trade and financial openness (both de jure and de facto; e.g., export and imports to GDP, tariffs, capital account openness). See Gygli, Haelg, Potrafke, and Sturm (2019). Our calculations are based on an average of index values over the 1996-2017 period.

²⁰ The Chinn-Ito index codifies the restrictions reported in the International Monetary Fund's Annual Report on Exchange Arrangements and Restrictions.

while 5 EME economies' regimes are less flexible (e.g., Thailand, Colombia) while 3 demonstrate greater flexibility (Chile, Brazil, Turkey). Among the AE the tendency is in the direction of greater flexibility but half are unchanged since 1998.

Next, we turn to some evidence on inflation and inflation expectations in AE versus EME since the late 1990s. Figure 4 plots the 'distance' between inflation in each economy over the 2000-2018 period vis-à-vis US inflation. One must take some care in drawing too strong conclusions from these calculations since it is not immediately evident that US inflation is always the benchmark for best practice in monetary policy.²¹ Moreover, the distance estimates are unconditional. Nevertheless, it is generally the case that distance remains highest between US inflation and inflation in EMEs though there are a few exceptions among AE such as, not surprisingly, Japan. A concern for policy makers is how to think about best practice when it comes to monetary policy regimes and inflation when AE suffer from inflation rates persistently below their stated targets while several EME suffer from the opposite challenge. We return to this issue below.

Figure 5 plots the gap between observed CPI inflation and an average of expected inflation rates in selected groups of economies. Expected inflation is the mean of one year ahead inflation rates for Consensus forecasts and forecasts from the IMF's World Economic Outlook (WEO).²² A large gap signals the possibility that expectations have become unanchored. Of course, the precise source of the unanchoring remains to be determined. The left-hand side plot compares the evidence for all 29 economies (ALL) against established IT economies (ITEST; defined previously), all AE that explicitly target

²¹ Among the 29 economies in our sample, Japan (0.1%), Sweden (1.2%), and the Eurozone (1.7%) achieved substantially lower inflation rates over the period considered. Canada, China, Great Britain, Israel, Norway and New Zealand achieved very similar average CPI inflation rates, again over the same period.

²² The former are monthly, the latter are semi-annual. See above for a discussion of conversion to the quarterly frequency. In addition, both forecasts are fixed event forecasts, that is, calendar-year forecasts. These were converted to fixed horizon forecasts (i.e., one year ahead) using a simple transformation that is commonly used although it is, admittedly, somewhat *ad hoc*. See Siklos (2013) for more details.

inflation (ITAE; see Table 1), and AE that are not considered IT economies (NITAE). The right-hand side plot distinguishes between EME that target inflation (ITEME) and ones that do not (NITEME) as well as the 'global' record (ALL).

During the early 1990s even the ITEST economies were in the early days of operating under such a regime and the gap between observed and one-year ahead inflation is larger than for all remaining IT central banks, many of which had not yet formally adopted the regime. Similarly, the gap for the NITAE economies also appears smaller during this period. By the mid-2000s there is little to distinguish the record of all economies, regardless of whether they formally target inflation or not. However, there is also apparently greater volatility in the gap, at least among the NITAE while volatility in the same measure for the ITEST is largely unchanged.

In contrast, differences in the gap are more noticeable for the EME economies in our dataset. They remain more volatile for the NITEME group of economies relative to ones that target inflation (ITEME). Nevertheless, what is striking is the improvement in the gap for the ITEME beginning in the mid-2000s, that is, once the economies in the dataset had formally adopted the regime. Gaps not only hover around zero after approximately 2005 but they are also much lower than in the 1993-2004 period. While this does not prove that IT is the cause of the improvement since, as we shall see, global factors are also likely to have played a role, it is hard to think of other explanations. Indeed, global factors are shown in Figure 6 for observed and expected inflation.²³

To obtain an estimate of global inflation we estimate the first principal component for AE only (via maximum likelihood) since this is arguably a benchmark that can be used to evaluate inflation performance of EMEs. A sharp decline in global inflation expectations is noticeable in the early 2000s

²³ We have a shorter sample for expected inflation because Consensus data were not available before the late 1990s for most EMEs. WEO data are available for a longer sample.

and there is, subsequently, relative stability although our estimates are persistently just below the 2% goal of central banks in the AE following the GFC. There is greater volatility in the global inflation factor based on observed CPI inflation especially after the GFC. Notice that the global gap between observed and expected inflation is positive in the immediate aftermath of the GFC and turns negative after 2014 (i.e., observed inflation is below expected inflation).

Finally, to further illustrate differences in inflationary developments in AE versus EME we present some evidence relying on two examples, namely Sweden and South Africa. Both target inflation and Figure 7A displays the target band in both countries as shaded areas. The mid-point of the target, that is, the inflation target is also highlighted by a dashed line. Both observed and average inflation expectations are shown. These two examples illustrate one of the features of the inflation record in several EME and AE that we wish to highlight, namely that while central banks in the former group of economies struggle with inflation rates at the top of the target the opposite is often the case for AE.²⁴ This phenomenon is particularly noticeable after the GFC but is also a feature of the years leading up to the end of the Great Moderation. The impact of the GFC on observed inflation relative to expected inflation is also striking with the latter seemingly not overly sensitive to changes in observed inflation. However, post-GFC we observe inflation expectations remaining persistently above the target in South Africa while the opposite is true in Sweden's case. The picture is not entirely different in the US as shown in Figure 7B. Indeed, the US experience resembles that of Sweden except at the end of the sample.²⁵

²⁴ The South African Reserve Bank (SARB) has admitted to allowing inflation to drift to the upper limit of the band. See, for example, Reid, du Plessis and Siklos (2018), and references therein.

²⁵ The sample ends with 2018Q3. CPI inflation has since dipped below 2%, the Fed's medium-term objective, in 2019 (not shown but see <https://www.bls.gov/charts/consumer-price-index/consumer-price-index-by-category-line-chart.htm>).

4.2 Resilience

The tension between rising central bank independence and transparency and weak political institutions may well threaten the ability of an economy to remain resilient to shocks. There exists a rich literature linking economic performance (e.g., economic growth) to the quality of governance and the latter is often thought to be a function of the strength of democratic institutions (inter alia, Acemoglu, Naidu, Restrepo, and Robinson (2019), Eichengreen and Leblang (2008), Rivera-Batiz (2002), and references therein).

We exploit the fact that a rich and growing number of datasets have become available over the years to explore how developments in central banking combine with other institutional developments to provide resilience to economic shocks. We leave it to subsequent research to determine whether there are any statistical links between the proposed indicator of resilience and economic performance (e.g., inflation or growth) though we suspect, based on other evidence to be provided below, that greater institutional resilience is likely to contribute to ensuring that a monetary policy regime adheres to best practices.

Our approach is straightforward. We aggregate 10 institutional indicators where each one is normalized first to generate values that range between 0 and 1.²⁶ We then aggregate the scores to obtain our resilience indicator. Out of the 10 institutional characteristics 7 are defined such that an increase in their value raises resilience; the remaining three serve to reduce resilience. The elements that improve resilience are: CBI, CBT, the flexibility of the exchange rate regime (greater flexibility improves resilience), governance quality, capital account openness, financial and trade globalization. Three factors contribute to reduce resilience. They are: greater economic policy uncertainty, higher geopolitical risks,

²⁶ Each indicator for each country or economy is normalized as follows: $(X_t - \min(X_t)) / (\max(X_t) - \min(X_t))$ where X is the value of an indicator, \min is its minimum value in the sample and \max the maximum value in the sample.

and the incidence of financial crises.²⁷ As a result, the resilience index ranges from a minimum of -3 to a maximum of +7. We did not apply any weights to the individual components of the indicator as there is no theoretical guidance that would permit us to implement a weighting scheme.

Figure 8 provides three different views of our resilience indicator. The top portion of the figure shows the range of estimates for AE; the middle portion for the EME in our data set while the bottom offers a direct comparison of resilience between AE and EME. Perhaps unsurprisingly there is considerable variation in resilience between the two country groups. Nevertheless, while resilience declined temporarily in AE in the aftermath of the GFC the opposite took place in EME. Unfortunately, the temporary rise in resilience after 2008 in EME did not last although the gap between the best and worst performers has narrowed since the GFC relative to the period between 1998 and 2008. In the case of the AE the impact of the GFC is most clearly seen in the rising gap between the best (i.e., “MAX”) and worst performers (i.e., “MIN”) that lasts until 2013 when the gap narrows substantially. It is somewhat comforting that resilience in EME is higher at the end of the sample relative to the period before the GFC. However, as shown in the bottom of Figure 8, there is no evidence of a narrowing of the mean values of the resilience indicator after 2008. If anything, there is a slight widening of differences in resilience between the AE and EME and, while we cannot assign any statistical significance to the results, one would hope that institutional resilience in EME can catch-up to levels reached in AE as is the case with some key indicators of central bank institutional quality (e.g., CBI, CBT, the adoption of IT).

²⁷ The incidence of financial crises is the sum of the average annual number of banking, currency, domestic and external sovereign debt crises based on the Reinhart and Rogoff (2009) and Bordo and Meissner (2016) chronologies of financial crises. The maximum value this indicator can take is, therefore, 4. The original data end in 2013. The following financial crises were added to extend the sample to 2018 although other data limitations mean that the resilience indicator is fully calculated only until 2015. They are: Russia (currency, 2014); 2011-15 (Eurozone, domestic sovereign debt); Argentina (currency and external sovereign debt, 2017-18); a table in the appendix provides additional details.

In sum, the resilience of institutions, including the central banks in EMEs, has not caught up with their counterparts in the AEs. This suggests that these countries remain more vulnerable to shocks.

4.3 Credibility

Next, we return to a central feature used to identify the success of monetary policy, namely its credibility. As noted earlier, there is no unique definition of credibility. However, all versions have, at their core, the notion that best practice implies that central banks ought to be able to control inflation in the medium-term (e.g., over a 2 to 5 year horizon), that policy surprises should only be used as a tool of last resort or only when necessary, and, in order to anchor expectations, that the gap between observed and expected inflation ought to be as close to zero as practical. Since, as former and current prominent central bankers have frequently observed, we do not yet have a complete understanding of the formation of expectations perhaps the best that can be expected is that the aforementioned gap ought to be small.²⁸ Moreover, one might add, in view of growing evidence that macroeconomic uncertainty in general also has negative economic consequences, that it is plausible that this can translate into less monetary policy credibility. Finally, there is also a body of evidence that global factors also play a role in explaining inflation dynamics.

We build and improve on our earlier estimates of monetary policy credibility (Bordo and Siklos 2015, 2017) by combining three elements of credibility, two of which are new. We, therefore, write:

²⁸ One could add a lack of persistence in deviations between observed and expected inflation but there is already a voluminous literature that rejects this view. Indeed, AR(1) regressions of the gap referred to in Figure 5 suggests considerable persistence. Notably, the period since the GFC only affects persistence in the Eurozone and New Zealand. Both experience a significant drop in persistence since 2008Q4 (results not shown).

$$\begin{aligned}
& (\bar{\pi}_{t+1}^f - \pi_t^*), \text{ if } \pi_t^* - \theta \leq \bar{\pi}_{t+1}^e \leq \pi_t^* + \theta \\
& (\bar{\pi}_{t+1}^f - \pi_t^*)^2, \text{ if } \pi_t^* - \theta > \bar{\pi}_{t+1}^e > \pi_t^* + \theta \\
& \theta^{AE} = 1; \theta^{EME} = 2 \\
& MPU = (\pi_{t+1}^{f1} - \pi_{t+1}^{f2})^2 + (\dot{y}_{t+1}^{f1} - \dot{y}_{t+1}^{f2})^2 \\
& GLOBAL = \pi_{t-1} - \bar{\pi}_{t-1}^G
\end{aligned} \tag{1}$$

The first two equations define the credibility ‘penalty’ central banks suffer when they miss their targets.

Since IT is typically defined somewhat more loosely in many EME via a more liberal tolerance band around an inflation target, our measure of credibility also takes this into account. Hence, the tolerance level around the target is set at 1% for AE and 2% for EME. Once inflation expectations exceed the tolerance band the penalty becomes a quadratic in line with most definitions of central bank loss functions. We treat positive and negative misses symmetrically so that credibility is defined in terms of the absolute value of the level of misses when these are inside the tolerance range. Finally, we consider three variants of the gap between inflation and the target. One proxy uses average one year ahead inflation expectations; another uses last year’s observed inflation; finally, we also use a two year moving average of inflation. So far, the definition follows our earlier work although previously we were more conservative in some of our estimates for EMEs where the tolerance range was set at 1% for some estimates and we try three different proxies for the gap between inflation and the target instead of just two.

In our earlier work we proxied each economy’s IT using a moving average of inflation (e.g., 5 years). For IT economies, replacing the moving average estimates with the mid-point of the IT, once the regime is adopted, did not impact the conclusions. In the present study we allow for the possibility that de facto targets are, to some extent, unobserved.²⁹ We do so by estimating the target as the mean from 3 different filters applied to observed inflation. They are: a 5-year moving average of inflation, the

²⁹ In IT economies the mid-point of the target is not expected to be met every quarter. Elsewhere it is likely that the target, even if one is announced, is expected to be met over the medium-term.

inflation obtained by a band pass filter for frequencies ranging from 2 to 8 quarters, and estimates from a one-sided Hodrick-Prescott filter.³⁰ These are applied to the full available span of the data.

The next two elements of our estimates of credibility represent the impact of monetary policy uncertainty and the global factor. Given the wide range of economies considered we were only able to rely on two sets of comparable estimates of expected inflation, that is, Consensus Economics and WEO forecasts. To proxy monetary policy uncertainty (MPU) we sum the squared differences between the two forecasts of inflation and real GDP growth. This effectively amounts to capturing a form of disagreement between forecasters. It is plausible to assume that greater monetary policy uncertainty translates into larger differences in the future outlook for the economy. There are, of course, other proxies for forecast disagreement (e.g., see Siklos 2013, 2019, and references therein) and forecast uncertainty. However, absent a greater variety of available comparable forecasts across 29 economies we cannot generate a useful estimate of, say, the kurtosis or some other indicator of forecast uncertainty. Our information set is sufficiently limited that we are not able to generate reliable estimates of the distribution of inflation forecasts or forecast disagreement.

The global factor in credibility is captured by deviations of observed inflation from an estimate of global inflation. We chose to use the levels of the respective series because higher inflation relative to some global estimate likely translates into currency depreciation, among other economic consequences.³¹ However, it is also questionable whether deviations from global inflation are seen to penalize central bank credibility in the same manner as misses in domestic inflation vis-à-vis an inflation target. Part of the reason is that global inflation is not as readily observed as domestic headline inflation. Moreover, it

³⁰ We use a smoothing parameter of 1600 for the HP filter.

³¹ The addition of this element is partially inspired by Clarida (2018) who argues, to the extent global inflation has declined (see Figure 6), this might yield substantial benefits and may reflect a form of international monetary policy coordination. Nevertheless, alongside any benefits there are challenges that depend on the differences between domestic observed and targeted inflation and the same differential for the foreign benchmark inflation rate.

is difficult to know how much weight a central bank might attach to the global component especially since, as noted earlier, pass-through effects vary considerably across the economies in our sample. We proxy the global inflation target, π_t^* , using the two estimates shown in Figure 6 and described earlier. Other proxies, such as a moving average of observed or expected inflation, or the mid-point of IT target bands in countries that target inflation do not appreciably impact the results (results not shown). Note that in estimating the deviation from global inflation, $\bar{\pi}_{t-1}^G$ is lagged one period to allow for a delay in collecting the data.³²

Once the individual components of credibility are estimated they are summed up to obtain the estimates of credibility. We calculate both raw estimates as well as normalized estimates. Therefore, our proxy for credibility is defined as:

$$\text{CRED}_{it} = \left\{ \begin{array}{l} (\bar{\pi}_{i,t+1}^f - \pi_{it}^*), \text{ if } \pi_{it}^* - \theta \leq \bar{\pi}_{i,t+1}^e \leq \pi_{it}^* + \theta \\ (\bar{\pi}_{i,t+1}^f - \pi_{it}^*)^2, \text{ if } \pi_{it}^* - \theta > \bar{\pi}_{i,t+1}^e > \pi_{it}^* + \theta \end{array} \right\} + \text{MPU}_{it} + \text{GLOBAL}_{it} \quad (2)$$

where CRED is the estimate of monetary policy credibility for economy i at time t and all other terms were previously defined. Positive values for each component are seen as contributing to reduce credibility since the gap between observed and expected inflation widens, there is more monetary policy uncertainty, and domestic inflation is higher than a measure of global inflation. Estimates of CRED are unweighted since it is not obvious, in theory, how much relative importance ought to be attached to any one of the three components.

We also estimate and focus on a normalized estimate of CRED (see n. 25) since this transforms the raw estimates into ones that range from 0 (perfect credibility) to 1 (no credibility) based on the historical credibility of an individual's economy's monetary policy. It is useful to compare the two different estimates. As an illustration, consider Figure 9 which plots CRED in both raw and normalized forms for

³² Using the contemporaneous measures of inflation and global inflation has little effect on the results.

Argentina and Chile. The left-hand side shows the normalized estimates while raw estimates are plotted in the right-hand side figure. Both convey essentially the same message. However, the scale of the raw CRED estimates indicates that credibility losses in Argentina, when they occur, are as much as 20 times larger than in Chile. Credibility falls sharply during the GFC but is volatile. Credibility recovers quickly but begins to decline once again toward the end of the sample. Indeed, Argentina suffers large losses as the currency board collapses in early 2002 and large losses reappear once again after 2014 when sovereign debt problems and rising inflation return. However, the credibility loss is less noticeable in Argentina during the GFC than in Chile.

Our estimates of credibility (equation (2)) are normalized to range between [0,1]. Several estimates are shown in Figures 10A through 10F. Figure 10A provides the most general picture since it pits mean credibility for the AE versus the EME in the data. For the available sample the GFC stands out, not surprisingly, as signalling a large but temporary loss of credibility. Credibility in both groups of economies does not recover until 2011. That said, there were also large losses in central bank credibility around the time of the Asian Financial Crisis of 1997-1998 among EME and some of this spilled over into the group of advanced economies. Central banks in EME, as a whole, also suffered credibility losses in the early to mid-1990s while credibility in the AE group actually improved perhaps due to the increasing number of countries that adopted the IT monetary policy strategy.

The remaining figures (Figure 10B through 10F) show credibility estimates for other economies or regions of the globe. Figure 10B, for example, shows two different estimates of credibility for four 'large' economies that depend on whether lagged observed inflation (CREDN4) or the one-year ahead mean inflation forecast is used (CREDN2). While the two sets of estimates are comparable there are the occasional differences. At least three of the four were at the centre of the GFC while Japan has long been mired in a low growth – low inflation environment. Clearly, the GFC stands out in the US, GB and the EZ, as well as Japan. However, Japan experiences more bouts of credibility losses than any of the

other three economies shown. Indeed, based on our indicator, it appears that the latest attempts by the BoJ to raise inflation³³ have led to substantial increases in credibility losses. Figure 10C focuses on the so-called BRICS, essentially the largest EME in our dataset. There are two aspects to note for these economies. First, unlike their AE counterparts there tend to be more frequent credibility losses. Brazil, India, China and South Africa stand out. Second, differences between the two credibility proxies are more apparent for some of these EMEs, most notably India where credibility losses tend to be larger when the forward-looking inflation data are used.

Next, we examine in Figure 10D credibility in AE countries that adopted IT earliest, namely, AU, CA, NZ, SE, and NO. While the GFC led to a reduction of credibility everywhere the size of the loss is historically smaller in AU and NO than in SE, NZ, and CA. indeed, NZ and SE were hit twice, once in 2008-9 and again in 2011. In NZ's case the earthquake in Canterbury and the increase in the Goods and Services tax that year likely provide the explanation. Figure 10E plots our credibility measures for Asian economies while Figure 10F shows the results for the LATAM countries in the dataset. In the former group of economies, the Asian Financial Crisis stands out in at least three of the 5 countries shown (i.e., ID, KR, and MY). Even in PH 1998 stands out and is not far from levels reached in 2008-9. Data for TH are available for the CREDN4 indicator and it also reveals that the crisis of 1997-1998 leads to a loss of credibility as large as in 2009-2010 (not shown). A similar story is repeated for many of the LATAM economies with more than one episode of large losses of credibility. Chile stands out because, while credibility levels do not match the ones in the AE with IT only the GFC really stands out in the data shown since the late 1990s.

³³ Since 2012 the BoJ has raised the inflation target, introduced additional quantitative and qualitative easing measures. See, for example, Iwasaki and Sudo (2017).

In sum, credibility issues at EME central banks did not suffer as much as in AE (with the exception of the BRICS). However, a gap remains as the EME central banks, on average, are less credible than their AE counterparts.

5. The Impact of Selected Shocks

5.1 Econometric Model

The principal aim of this study is to examine the impact of selected shocks, namely financial, trade, and credibility shocks, as well as the impact of shocks emanating from systemically important economies.

We choose a technique where cross-border effects are at the centre since this seems like the most fruitful way to understand differences between AE and EME in how they respond to a variety of economic shocks. Consider first the case of an individual economy j . We assume that economic shocks can be decomposed into a maximum of five factors. Although factors, as such, are not observed (we return to this issue below) they have the advantage that this approach can deal with the ‘curse of dimensionality’ when one is seeking to model dynamic relationships.

We define the factors of interest as follows. They are: a real economic factor, a financial factor, a trade factor, a monetary factor, and a global factor. The global factor is either a shock from the US or a combined shock from three systemically important advanced economies, namely the US, the Eurozone and Japan. Each factor is labelled i . Each economy is identified by j . If X denotes the vector of variables used to estimate each one of these factors i we can write

$$\mathbf{X}_{ijt} = \boldsymbol{\alpha}_i \mathbf{F}_{ijt} + \boldsymbol{\varepsilon}_{it} \quad (3)$$

where X are vectors of observable time series from which factors F are estimated, α are the factor loadings, and $i = R, F, T, M, G$ denote respectively the Real, Financial, Trade, Monetary, and Global factors. We extract the first principal component which then serves as the proxy for each factor for R, T, G but

not M.³⁴ For the monetary factor we use the policy rate since this remains the principal instrument of monetary policy throughout for the vast majority of economies in our dataset. Nevertheless, this is arguably not the case for the major economies directly impacted by the financial crisis (i.e., US, GB, and EZ) as well as Japan. For these four economies we replace the observed policy rate with a shadow rate once the policy rate reaches the zero lower bound.³⁵ In a separate version we add our estimates of central bank credibility. This results in $I = \text{CRED, R,F,T,M,G}$ where CRED was defined above. This permits us to explore the potential effects of credibility shocks on the group of economies considered.

Since it is unlikely over the sample period considered that the factors loadings are constant we allow these to vary with time in a manner described below. All series in X are assumed to be stationary.³⁶ After extensive testing we ended up using the annualized (log) first difference for many series, the first difference, or the levels for others in the results to be reported in the following section. Other filters were considered (see above), including a one-sided HP filter, a band pass filter, and Hamilton's (2018) filter but some experimentation led us to conclude that our main results would remain unchanged.³⁷

In estimating (3) we collect series that are typically thought to be representative of each one of the factors listed. Table 2 presents a listing of series that are available for all economies in the study. We

³⁴ Owing to the short sample we elected not to include more than one principal component although the first component explains the majority of the variation in the series included (results not shown). A disadvantage of this approach is that we are unable to identify whether the estimated shocks are primarily driven, say, by supply or demand factors. This is left for future research.

³⁵ We use Krippner's dataset (<https://www.rbnz.govt.nz/research-and-publications/research-programme/additional-research/measures-of-the-stance-of-united-states-monetary-policy/comparison-of-international-monetary-policy-measures>) since these are constructed in a similar manner for all four economies. Other methodologies to estimate have, of course, also been proposed. See, for example, Howorth, Lombardi, and Siklos (2019), and references therein.

³⁶ We conduct a series of panel unit root test. The series, as described below, were found to be stationary (results not shown).

³⁷ See Chen and Siklos (2019), and references therein, for a more extensive discussion of the specification and impact of various filters for a data set that consists of four systemically important economies (i.e., including China).

proceed in this manner in part because it is a more intuitive way to generate factor loadings as well as ones that are consistent with economic theory.³⁸

Many in the literature have proxied a global component by assuming that shocks emanating from the U.S. fulfills this role (e.g., Feldkircher and Huber 2016). We also follow this approach. However, others have also created large cross-country datasets to derive a common factor that is interpreted as the global factor (e.g., Kose, Otrok, and Prasad 2012). Therefore, we also proceed to identify the global component for R, T, F, and M, again via factor model estimation. This time we specify a panel consisting of the data from the US, the Eurozone and Japan as our second proxy for the source of global shocks. Since the conclusions (Pierre ?) the list of economies with a ‘global’ reach is extended are not affected we do not discuss this case further.³⁹

The modified factor model specification with the addition of the global factor can then be written as follows:

$$\mathbf{X}_{ijt} = \boldsymbol{\gamma}_{ijt} \mathbf{F}_{it}^G + \boldsymbol{\lambda}_{ikt} \mathbf{F}_{ikt}^D + \mathbf{v}_{ijkt} \quad (4)$$

where i is as previously defined, $k= US, EZ, JP$, $\boldsymbol{\gamma}$, $\boldsymbol{\lambda}$ are, respectively, the factor loadings for the global (i.e., \mathbf{F}^G ; the US or the systemic 3 (S3)), and domestic factors (\mathbf{F}^D ; real, financial, trade, and monetary),

³⁸ A criticism of our approach is that factor models often rely on a larger number of variables than are being used. Nevertheless, as discussed above (also see the appendix) once a dataset moves beyond the AE the number of available and comparable time series over a reasonable span of time becomes difficult to compile. Moreover, the total number of series used in our study does not differ much from, for example, Stock and Watson (2018), or Hatzius, Hooper, Mishkin, Schoenholtz, and Watson (2010). More importantly perhaps, many studies of this kind, regardless of the number of variables that enter the factor model, end up finding that only a small handful of variables dominate all others in terms of their explanatory power in the factor model.

³⁹ When the global factor consists of more than one economy the least unique component for each one of the four economies considered, that is, the variance of a factor that is least unique to the country-specific factor but is most common across all three economies serves as the global component. This is typically evaluated by the uniqueness statistical measure in principal component analysis. Typically, significance is determined by retaining the eigenvalues that exceed one (also known as the Kaiser-Guttman procedure). This approach has been criticized but, as far as we are aware, no clearly superior approach has been developed. Moreover, as noted earlier, the choice is also motivated by the factor loadings that must be economically meaningful.

and ν is the residual term. As before the factor loadings are time-varying in a manner described later. Equation (4), therefore, makes clear that there is a global component for each of the factors named earlier.

To exploit the cross-sectional dimension, we then estimate the dynamic relationship between the factors in a panel setting. This gives rise to the following (quasi) time-varying panel factor or factor-augmented vector autoregression model (PFVAR) written as⁴⁰

$$\mathbf{P}_{ijt} = \boldsymbol{\Omega}_{ijt}(\mathbf{L})\mathbf{P}_{ijt-1} + \boldsymbol{\Psi}_{jt}(\mathbf{L})\mathbf{F}_{jt}^G + \boldsymbol{\xi}_{jt} \quad (5)$$

where $\mathbf{P}_{ijt} = [R_{jt}, T_{jt}, F_{jt}, M_{jt}]'$ and \mathbf{F}_{jt}^G is exogenous. The latter, as we shall see, can include a set of observable variables or factors. As mentioned previously, the factors are time-varying which, in effect, implies that \mathbf{F}_{jt}^G is also a time-varying element.⁴¹

Recall that \mathbf{P} consists of five elements, namely the domestic Real, Trade (T), financial (F), and monetary (M) factors, and the global factor (\mathbf{F}^G). One issue that arises from (3) is the ordering of the variables. While ordering the real factor first is unlikely to be controversial, as almost all empirical work of this variety suggest that real economic factors are the ‘most’ endogenous in a recursive or Cholesky decomposition, the rest of the ordering is less clear cut with the possible exception of the monetary (M) factor which is traditionally seen as the ‘least’ endogenous since it is affected by all the other shocks while these same shocks only impact by M with a lag. This is also standard in almost all estimated macro-econometric models. Accordingly, we estimate versions of the panel VARs where the real factor

⁴⁰ Its is “quasi” time varying because the factors scores are time-varying not because the coefficients in the PVAR are time-varying.

⁴¹ In principle, while responses to a specific shock at time t can also be estimated we did not follow this approach. See, however, Lombardi, Siklos, and Xie (2018) who perform such an exercise in a time-varying VAR framework.

is placed first, followed by the financial and trade factors, with credibility and monetary factors last. In a separate exercise, we place credibility first and switch the order of the trade and financial factors.

Alternatively, one might also consider identifying more precisely the structural shocks either by imposing long-run or short-run restrictions, or even sign restrictions. Such extensions are feasible (e.g., see Canova and Ciccarelli (2013), and references therein) but create additional challenges with the net benefits unclear. In the present context the most important drawback is that the economic development of the various countries in our dataset is quite diverse. This makes it difficult to impose common structural restrictions across the four economies considered. The same difficulty arises when sign restrictions are considered.

Finally, we discuss how the time-varying factor scores are obtained. First, we estimate factor models using the core variables shown in Table 2 for the full available sample. Next, we estimate the same factor models for samples that range from 5 to 6 years in a rolling manner where the sample shifts ahead two years at a time. This creates estimates for overlapping samples.⁴² The estimated factor scores are then averaged to produce an estimate that is time-varying.

Specifications such as equation (5) are non-standard. Accordingly, we also consider a version of (5) relying on observable time series. Define $\mathbf{P}_{jt}^{d'} = [y_j, f_j, \varepsilon_j, pr_j]'$ where y is real GDP growth, ε is the rate of change in the real exchange rate, f is credit growth, and pr represents monetary policy. As before, we also consider a version where $\mathbf{P}_{jt}^{d'} = [y_j, f_j, \varepsilon_j, CRED_j, pr_j]'$ as well as another version where CRED is

⁴² The samples are 5 years long for the real and trade factors and 6 years for the financial factor. The slightly longer span for the financial factors is inspired by the finding that the phase length of the financial cycle is longer than for business cycle (e.g., see Borio 2012). Ideally, we would have liked to estimate the financial factor for an even longer sample (e.g., 7 to 10 years) but data limitations prevented us from doing so.

placed first and the ordering of y and ε is reversed.⁴³ Hence, a more conventional alternative specification, is written

$$\mathbf{P}_{jt}^d = \mathbf{\Omega}_j(L)\mathbf{P}_{jt-1}^d + \mathbf{\Psi}_j(L)\mathbf{P}_{jt}^{US} + \boldsymbol{\xi}_{jt} \quad (6)$$

Where all terms were defined previously. Note that \mathbf{P}^d , \mathbf{P}^{US} are time invariant. We also assume that the global factor consists of US shocks alone.

We now turn to the data and estimation results.

5.2 Shocks to AE and EME

We estimate a variety of panel VARs but only 2 variants are discussed below as they seem representative of the variety of panel VAR estimates that broadly reach similar conclusions. The panel VARs are estimated via GMM instrumented using 1 or 2 lags of the endogenous variables (i.e., as in Holz-Eakin, Newey, and Rosen (1988); also see Abrigo and Love (2005)). The results presented below rely on 1 lag. Panel-specific fixed effects are removed via a Helmert transformation to reduce dimensionality.⁴⁴ All panel VARs are estimated for a balanced sample that can vary depending on how the factor scores are estimated and the economies considered. Nevertheless, when all economies are considered, the sample is 2001Q4-2018Q3 before lags. For the AE, where 11 cross-sections are included, this yields 649 observations or 68 observations per cross-section. For the EME, there are 16 cross-sections yielding 1088 observations.⁴⁵ Confidence intervals are also estimated via Monte Carlo and 68% significance levels (i.e., equivalent to ± 1 s.e.) are used, which is fairly typical in the relevant literature, although none of the highlighted results are greatly affected when, say, an 80% confidence interval is used. In all the panel

⁴³ Technically, CRED is not observed but it seems important nevertheless to examine the role and impact of credibility when the shocks are to observable variables.

⁴⁴ It is a transformation used in instrumental variable estimation even if the label itself is not always used. See, for example, Arellano and Bover (1995).

⁴⁵ Data from PH were omitted because we could not obtain a long enough sample for enough of the series in the factor model version of the panel VAR.

VARs, the ordering is as follows: real or real GDP growth, financial conditions or the change in the ratio of private non-bank financial assets to GDP, the trade factor or real effective exchange rate growth, central bank credibility⁴⁶ and the monetary factor which is represented by the policy rate in both versions of the model. US shocks are deemed exogenous.⁴⁷ Where the results are affected by the ordering of some of the variables this is noted below.

Results are shown in Figures 11 and 12. Figures 11A and 12A plot the impulse responses (IR) to shocks in the endogenous variables while Figures 11B and 12B show the dynamic multipliers of exogenous shocks from the US on the remaining AE and EME. As one can imagine, a large number of results are generated and space limitations prevent us from displaying all of them let alone discussing every single impulse response function. Hence, our discussion is in line with our prior that we wish to focus on the differential impact of central bank credibility, monetary policy, trade and financial conditions in AE versus EME.

We first examine the results for the AE. These are shown in Figure 11A. A positive credit shock fuels a rise in real GDP growth. Similarly, real exchange rate appreciations⁴⁸ improves central bank credibility and raise policy rates. Increases in the policy rate are seen as reducing central bank credibility and reduce the real exchange rate thereby offsetting the previously reported link between the real exchange rate and the stance of monetary policy. Policy rate increases also have a negative impact on real GDP growth. Finally, a reduction in central bank credibility⁴⁹ reduces credit growth but has a positive impact on real GDP growth.

Dynamic multipliers in Figure 11B reveal that US shocks, in the form of a higher policy rate (fed funds) have spillover effects by raising credit growth and improves central bank credibility and real GDP growth

⁴⁶ We use the CREDN4 versions in part because it is available for a longer sample. Results using CREDN2 are relegated to the appendix although our principal findings are unaffected.

⁴⁷ We omit a discussion of the case where factor models were used to generate exogenous shocks from the S3 economies. Some of the results are relegated to the appendix but our conclusions are unaffected.

⁴⁸ The real exchange is defined here such that a rise signals an improvement in competitiveness.

⁴⁹ Recall that CRED is defined in a such a way so that a rise implies a fall in central bank credibility.

in AE, at least at first but this this reversed in future quarters. A rise in US competitiveness is seen as reducing real GDP growth in other AE, the policy rate, and central bank credibility. However, higher US real GDP growth improves central bank credibility in AE.

We also examined the variance decompositions and performed Granger causality tests (results not shown). Not surprisingly, all models suggest that own shocks matter most. This is a common finding in the literature and captures the strong persistence property found in macroeconomic and financial time series. Nevertheless, it is worth noting that central bank credibility stands out as a variable that explains up to 16% of variation in real GDP growth, 18% of real exchange rate fluctuations as well as about 15% of variation in policy rates. Granger causality tests confirm the chosen ordering in the sense that whereas the policy rate Granger-causes the other variables in the system it is only Granger-caused by central bank credibility. Nevertheless, when the ordering is changed as discussed earlier only the size, not the sign, of the IR from the real exchange rate and credit growth to central bank credibility are affected. All other IR are unchanged.

Turning to the same model now estimated using factor scores for the real, trade, and financial variables, IR are shown in Figure 11C. Although the interpretation of many of the IR are compatible with the version that relies on observables there are some noteworthy differences. First, tighter monetary policy no longer impacts central bank credibility. Next, reductions in credibility are now associated with looser monetary policy and reduced real economic activity. The latter result is the opposite of that found using only observable time series. Finally, trade shocks have less overall impact on the remaining variables than when observable time series are used. The dynamic multipliers shown in Figure 11D reveal that spillovers from US shocks impact all the variables in the model. A couple of results, however, are worth highlighting. First, tighter US monetary policy tightens monetary conditions in the remaining AE and improves central bank credibility in these economies. Second, a positive US real shock improves trade and real economic conditions in the other AE. When the ordering of some of the variables is changed

the link between credibility, trade, and financial conditions becomes insignificant. Other IR are unaffected.

The only noteworthy results from the variance decompositions (not shown) when factors are used is the finding that almost 20% of the variation on monetary conditions is explained by changes in financial conditions. Hence, the nexus between financial markets and monetary policy is significant and cannot be ignored in AE. As we shall see below, the same result is not obtained for the EME.

We now turn to the results for EME shown in Figures 12A through 12D when the variables are observable. Three results are worth highlighting. First, policy rate increases improve central bank credibility but reduce real GDP growth. The former result stands in contrast with the one shown in Figure 11A for AE. Unlike the experience in AE, credit growth does not fuel real GDP growth. Otherwise, the results are broadly similar with the ones reported for AE. Changing the ordering of the variables renders insignificant the links between credit growth and credibility and real GDP growth and central bank credibility.

Interestingly, the variance decompositions (not shown) reveal that credibility shocks explain around 25% of variation in credit growth and 11% of the policy rate in EME after 10 quarters. Policy rate changes explain a large portion of the real exchange rate variable (38%). Overall, these results stand in contrast to the ones reported for AE. Granger causality results (not shown) are comparable to ones discussed above.

Turning to spillovers from US shocks these also reveal a few differences vis-à-vis the case shown in Figure 11B. although a tightening of US monetary policy also leads to higher policy rates in EME, central bank credibility in these economies deteriorates and there is no impact on EME real GDP growth. However, as was found for AE, rising US real GDP growth improves trade competitiveness and leads to a small rise, after 5 quarters, in policy rates in EME.

Finally, Figures 12C and 12D plot the IR for the factor-based model applied to the EME. Tighter financial conditions lower real economic outcomes but improves central bank credibility. These results are consistent with the ones reported based on observable variables. An improved trade factor, which is akin to an improvement in trade competitiveness, also improves central bank credibility. Finally, a loss of central bank credibility implies a tightening of monetary policy, looser financial conditions and poorer real economic outcomes. Changing the ordering of some of the variables (see above) in the model has no impact on the IR.

Variance decompositions (not shown) suggest that around 9% of credibility shocks explain monetary conditions which is considerably higher than in the case of AE but monetary shocks explain less of the variation in financial, real and trade factors than in AE (around 6 to 10%). Granger causality testing (not shown) also finds that, unlike AE, monetary policy shocks in EME are more responsive to the other variables in the model. Finally, dynamic multipliers (Figure 12D) suggest that US monetary policy shocks deliver a central bank credibility dividend in EME but at the expense of looser financial conditions. Moreover, greater US competitiveness also leads to looser financial conditions in EME, as well as improved central bank credibility and improvements in the trade factor.

Overall, we reach a few conclusions. First, regardless of the specification, many global shocks (i.e., here U.S. shocks) impact AE and EME in a similar manner. For example, a tightening of US monetary policy leads to higher policy rates in both AE and EME but at the expense of lower real economic growth. Higher U.S. economic growth or better U.S. real economic conditions improve central bank credibility in both groups of economies as well as higher policy rates. In line with the greater integration of EME in the global financial system, tighter monetary conditions also result in tighter financial conditions. Finally, a positive US policy rate shock makes both groups of economies more competitive. As mentioned below this may capture some of the flavor of the financial dimension of the resulting exchange rate

appreciation which may be blunted because so much of trade is invoiced in US dollars (e.g., see BIS 2019).

Nevertheless, important differences between AE and EME also remain. First, whereas higher policy rates appear to worsen central bank credibility the reverse is true for the EME as a group. Also, higher policy rates, on balance, result in less competitiveness so that the conventional trade channel may well continue to operate. Moreover, while credit growth fuels real economic activity in AE there is no such impact in the EME. Finally, EME are relatively more sensitive to credibility shocks than their counterparts in AE.

6. Conclusions and Policy Lessons

In this paper we present some empirical evidence based on a panel of 29 countries (with the euro area treated as a country) on the performance of central banks in both advanced (AE) and emerging (EME) countries. Our focus is on the post Bretton Woods era. We document the progress made by the AE countries since the end of the Great Inflation in the early 1980s. Most of these countries achieved credibility for low inflation by adopting the major institutional changes of central bank independence (CBI), central bank transparency (CBT), and the adoption of inflation targeting. The epogee of this evolution was the Great Moderation from circa 1985 to 2006.

The EMEs started with a less favorable track record. For them the 1980s into the 1990s was characterized by macroeconomic and financial instability exhibited in frequent currency, banking and twin crises (Bordo, Eichengreen et al 2001). Many of these countries had fiscally dominant regimes and problems establishing constitutional representative democracies, rule of law and sound governance of

fiscal, monetary and financial institutions. They also had limited financial development and financial repression.

Beginning in the 1980s a number of EMEs (e.g., Chile and Korea) began to learn from their crisis experience and began following the lead of the AEs in developing sound fiscal, monetary and financial institutions. By the 1990s several EMEs began to tame their inflation problems and their inflation rates converged to those of the AE. Those adopting IT were at the vanguard of this process (Bordo and Siklos 2014).

The GFC of 2007-2008 was a major global shock which had serious consequences for the AEs. Their central banks began to attach greater importance to financial stability while still following flexible IT policies. Many of the EMEs fared well but some with exchange rates pegged to the AEs were hard hit.(e.g., Hungary). Also, many were hit by the collapse of global trade and commodity markets in 2009-2011 and by the spillover effects of the credit crunches in the AE, especially those with original sin (foreign currency denominated debt (Bordo, Meissner and Stuckler (2012).

Given this background we document what has happened since the GFC to CB institutions and inflation performance in the EMEs relative to the AEs . We show that that some of the patterns observed before the GFC continued but some were significantly different. Our study shows that although some EMEs did maintain the levels of CBI and CBT that they had before the GFC, they experienced a decline in our measure of institutional resilience to shocks as well as a reduction in the quality of their governance. They also exhibited a reduction in our measures of CB credibility. Indeed, it appears that CB credibility in EMEs is more fragile than in the AEs. Although the EMEs, as a group, avoided the worst of the direct effects of the credit shocks of the GFC a number are still struggling.

This we believe reflects both the impact of the global shock that was the GFC but also deep structural flaws that made them vulnerable such as less developed financial institutions and markets and exposure to original sin For example, it is noteworthy that credibility shocks reverberate through the economies

of the EME to a greater degree than in the AE. Stated differently, credibility shocks appear to have more temporary effects in AE than in EME.

Two main policy lessons follow from our study.

First, that the EMEs should “carry on” to paraphrase a British World War II slogan and to continue improving their financial institutions, financial markets, and governance so that they can grow up to the AEs as some earlier EMEs (e.g., Israel and Korea) have done.

Second, the problem of the post-GFC era is not just of the EMEs making. AE central banks following best practice have been unable to hit their IT from below (Ehrmann 2015). This impinges on their credibility just as the EMEs not being able to hit their IT from above. In particular, one difficulty faced by EME but not the AE, at least over the past decade, is that explicit inflation targets and the permissible range of inflation rates, has changed on several occasions thereby giving the impression of a moving target. In contrast, among AE, there is a fairly strong consensus that 1-3% is the range of CPI inflation rates they ought to be targeting (Siklos 2017).

The reasons for this are complex and not fully understood. Some argue that the slow recoveries observed in the AEs after the GFC was because of the GFC – that all serious recessions with financial crises have slow recoveries (Reinhart and Rogoff 2009). But actually not all serious recessions accompanied by financial crises have slow recoveries. Research suggests that, following Friedman’s plucking model, recessions with financial crises recover faster (Bordo and Haubrich 2017). Some argue it is because of the Zero Lower Bound and the use of quantitative easing and forward guidance by the Fed and other major CBs and the fact that the Fed and the other CBs did not follow an expansionary monetary policy but a credit (carry trade) policy because of the payment of interest on excess reserves. (Lombardi, Siklos, and St. Amand 2018, and references therein). Others focus on the supply side and see the deep fundamentals of globalization and TFP as keeping wages and prices down. Still others argue that CBs should raise their inflation targets to give them more cutting room for the next recession

(Blanchard, Dell’Ariccia, and Mauri 2010, Ball 2014). Although the fact that the CBs have up to now been unable to reach their two per cent targets casts doubts on this case. The implication of these issues is that it is difficult to urge the CBs of EMEs to follow the AEs best practice if our understanding of the concept it is in a state of flux.

. The ongoing debate in the Federal Reserve over the monetary strategy it should follow illustrates this conundrum. The issues under consideration include: continuing to follow IT, shifting to average IT or price level targeting; nominal GDP targeting; keeping the central bank’s balance sheet large along with forward guidance or returning back to a “bills only” doctrine; and central bank digital currency and negative policy rates (Bordo and Levin 2019). Until these issues are resolved it will be difficult for the CBs of the EMEs to develop their catching up to the AEs.

Table 1 Economies in the Data Set

Countries and ISO Codes	Name
ar	Argentina
au	Australia
br	Brazil
ca	Canada
cl	Chile
cn	China
co	Colombia
cz	Czech Republic
ez	Euro Area
gb	United Kingdom
hu	Hungary
id	Indonesia
il	Israel
in	India
jp	Japan
kr	Korea
mx	Mexico
my	Malaysia
no	Norway
nz	New Zealand
pe	Peru
ph	Phillipines
pl	Poland
ru	Russia
se	Sweden
th	Thailand
tr	Turkey
us	United States of America
za	South Africa

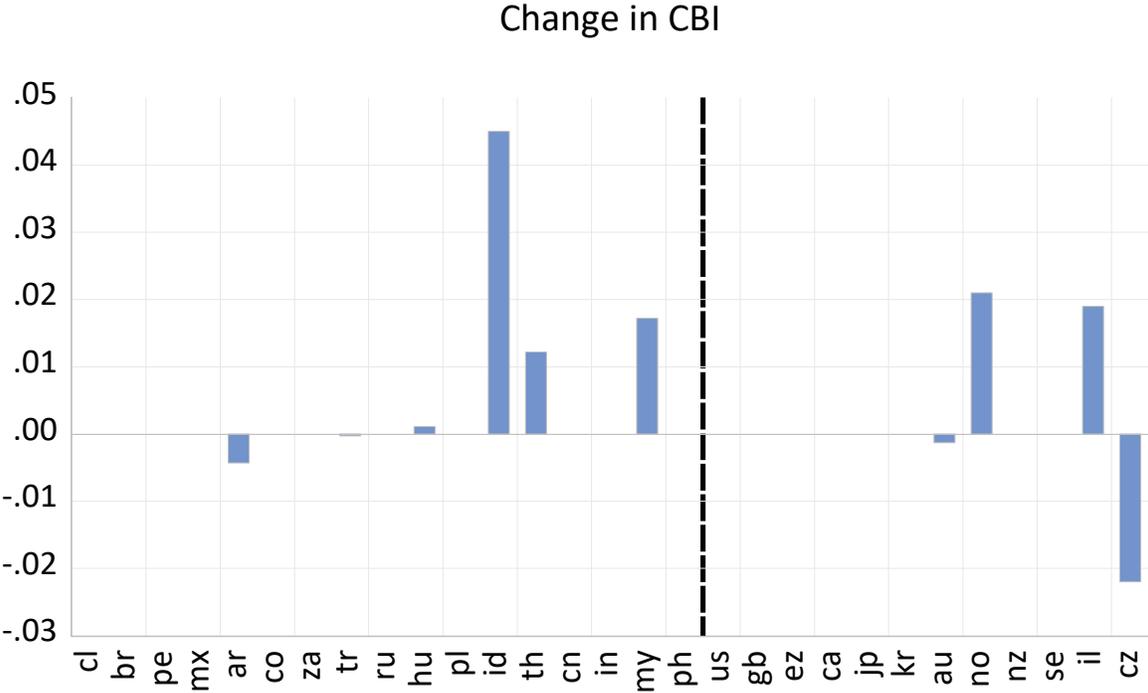
Note: Highlighted names belong to the Advanced Economies (AE) group while the remainder are Emerging market Economies (EME). The selections are based on the 2019 World Economic Outlook.

Table 2 Factor Estimation

CRED	REAL	TRADE	FINANCIAL	MONETARY	GLOBAL
CRED is the credibility indicator	Real GDP	Real exchange rate	Equity prices	Policy rate	US
	Inflation	Current account/GDP	Private non-bank financial assets to GDP ¹		or
	Real GDP growth forecast	Forex reserves	Housing prices		S3 = US, EZ, JP
	Inflation forecast		Yield curve (i.e., short less long rate)		
			Interest rate differential (domestic less US short-term interest rate)		

Note: the text also provides some details about the form in which the series enter the various factor models. Real GDP, the current account/GDP, interest rate differential, the yield curve, and the policy rate are in levels; (1) enter in first difference form. The remaining series are in annualized growth rate form (i.e., 100 times $(\log(X(t))-\log(X(t-4)))$).

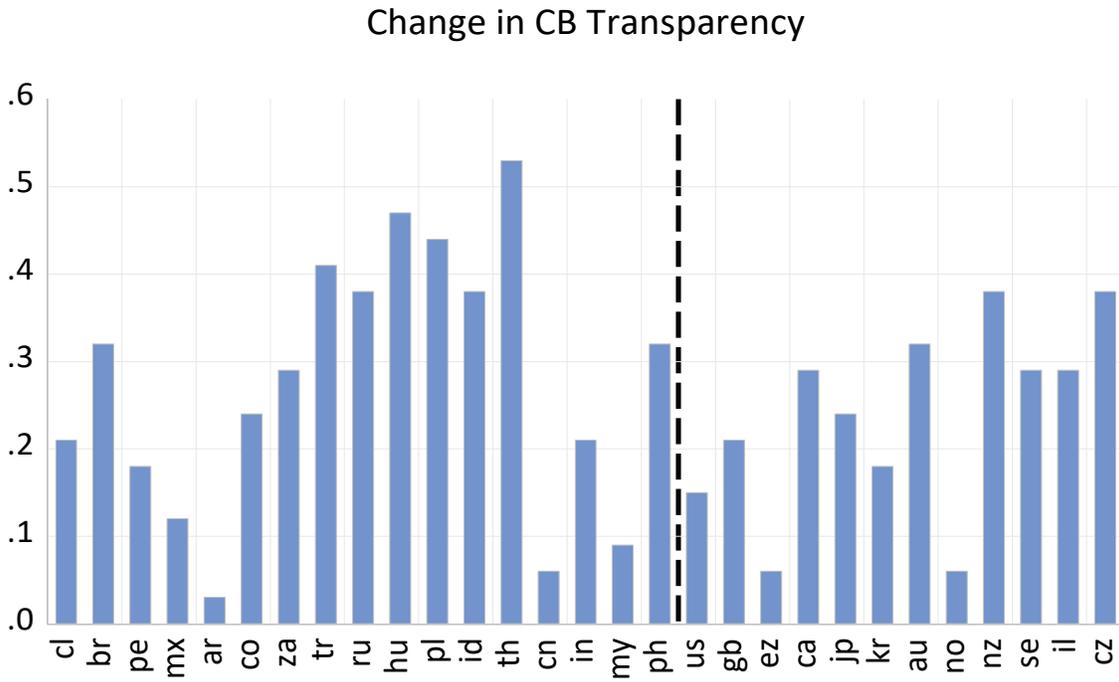
Figure 1 Changes in Central Bank Independence, 1998-2017



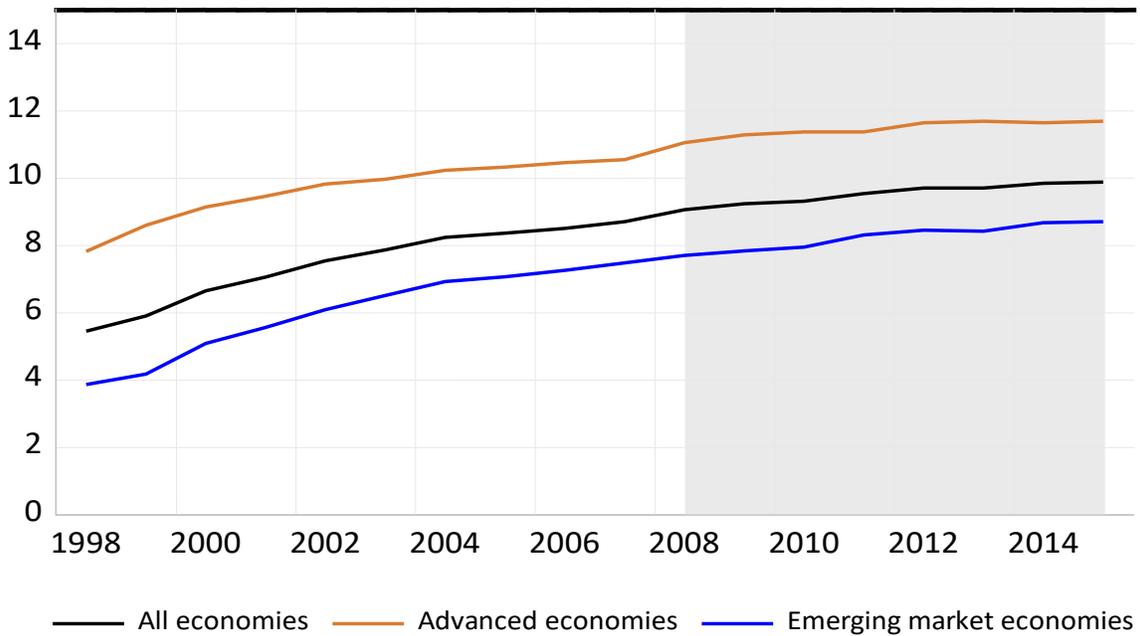
Note: See Table 1 for the ISO codes. The vertical dashed line divides the AE from the EME in the sample. See Table 1 for the list. The overall measure of central bank independence from Dincer and Eichengreen (2014) up to 2010 is used updated to 2017 as explained in the main body of the text. A positive value means an improvement in central bank independence.

Figure 2 Two Views of Central Bank Transparency, 1998-2015

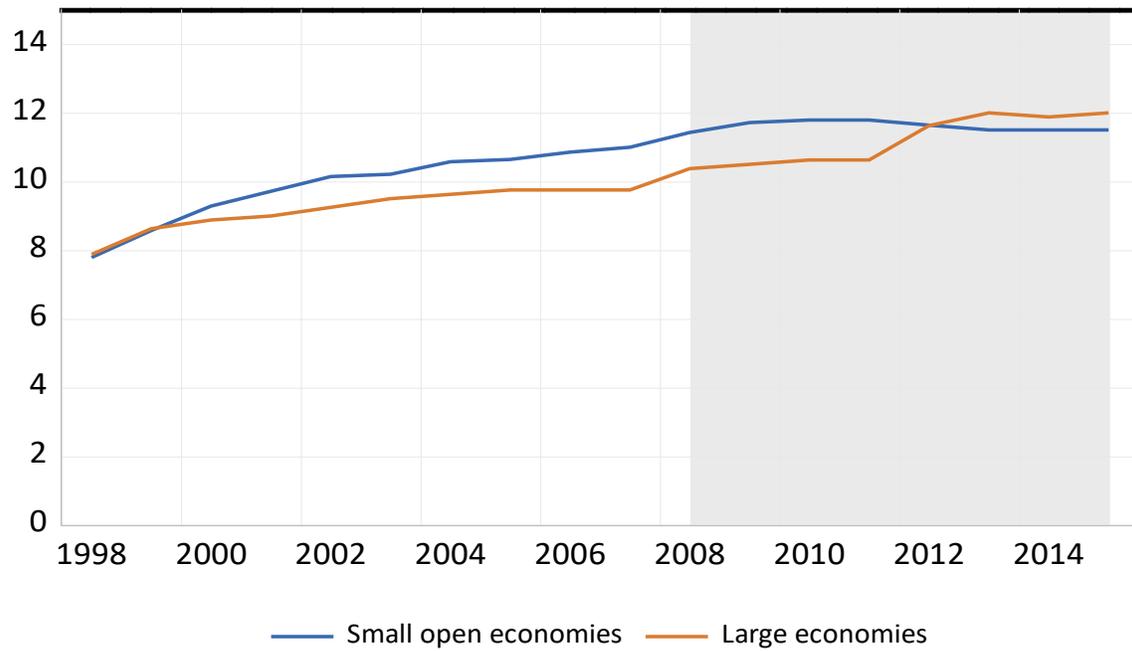
(A) Changes in Central Bank Transparency



(B) Levels of Central Bank Transparency Over Time



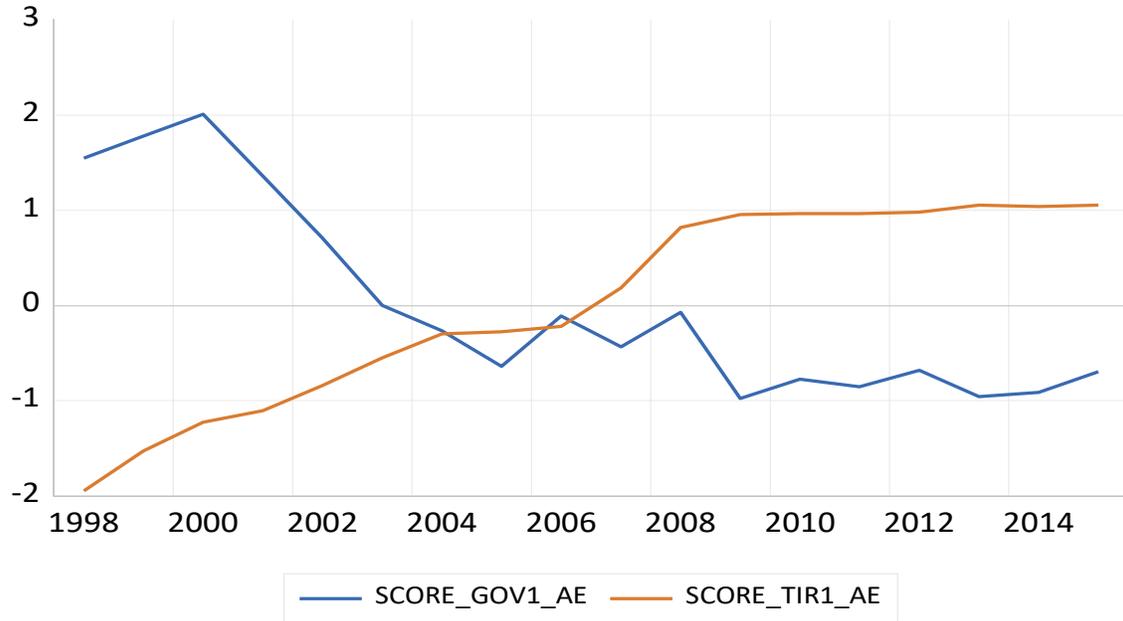
(C) Levels of Central Bank Transparency



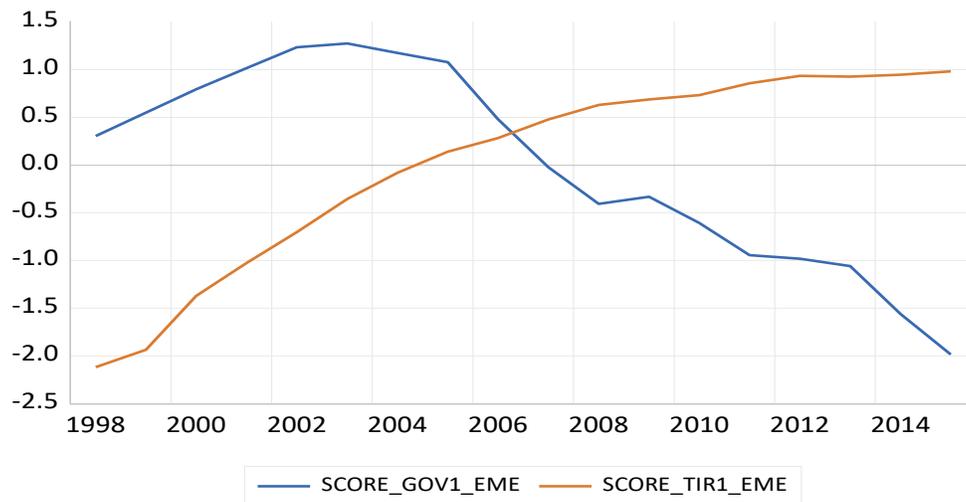
Note: Constructed from data in Dincer, Eichengreen, and Geraats (2019). Table 1 contains the ISO codes and the list of AE versus EME. Also, see Figure 1. CBT ranges from a minimum of 0 to a maximum of 15 as shown by the dashed line in part (B). Positive values signal more CBT or an improvement in CBT.

Figure 3 Central Bank Transparency and Governance, 1998-2015

(A) Advanced economies

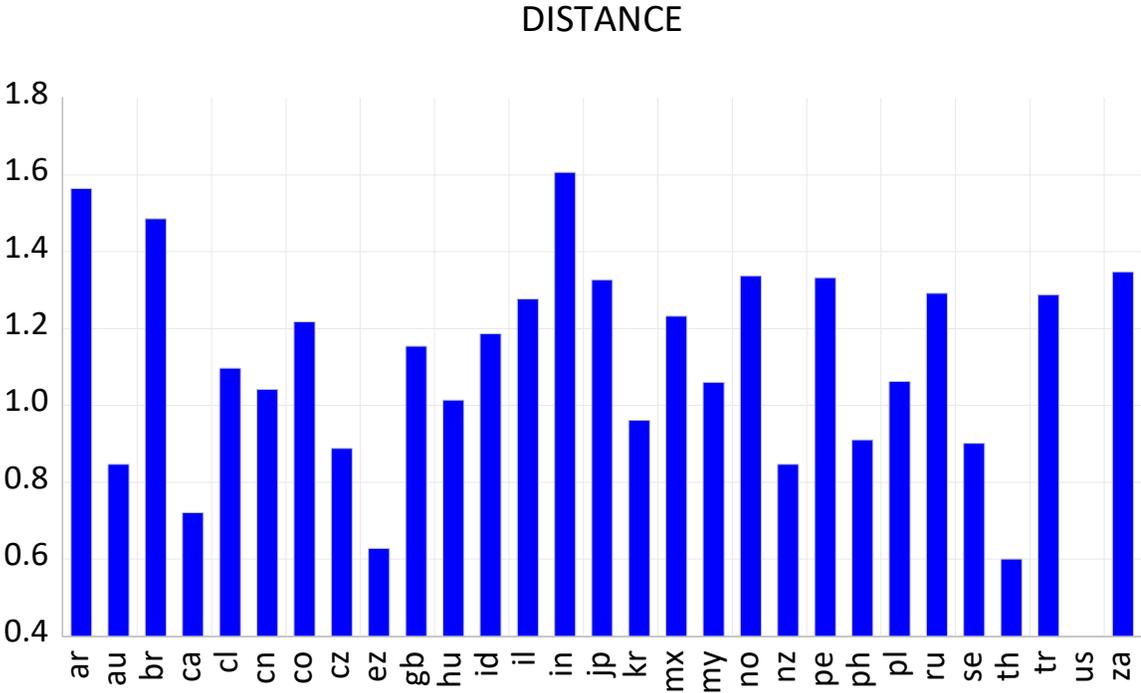


(B) Emerging Market Economies



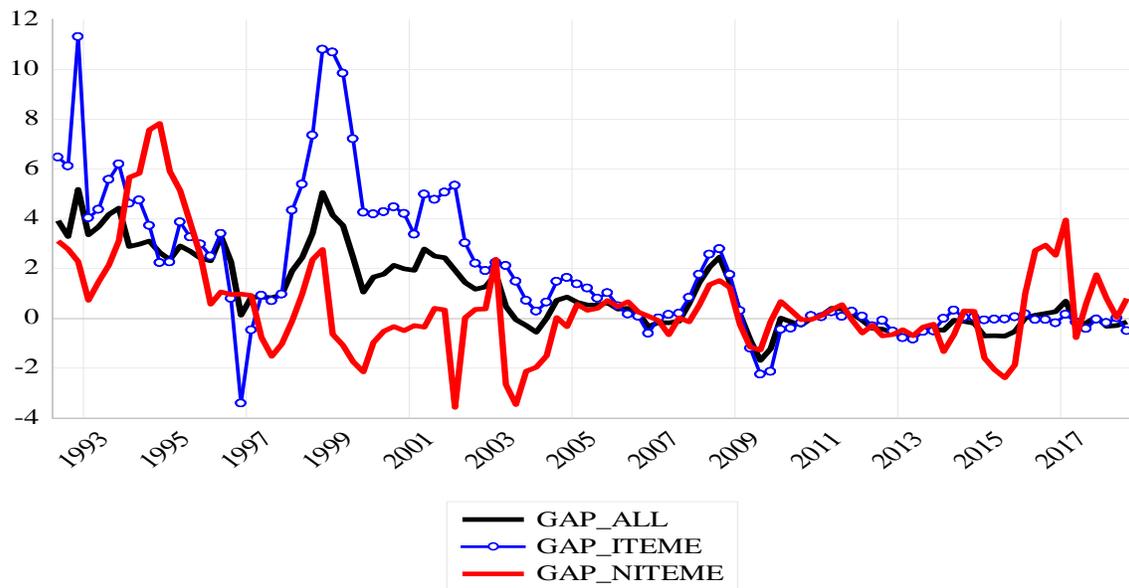
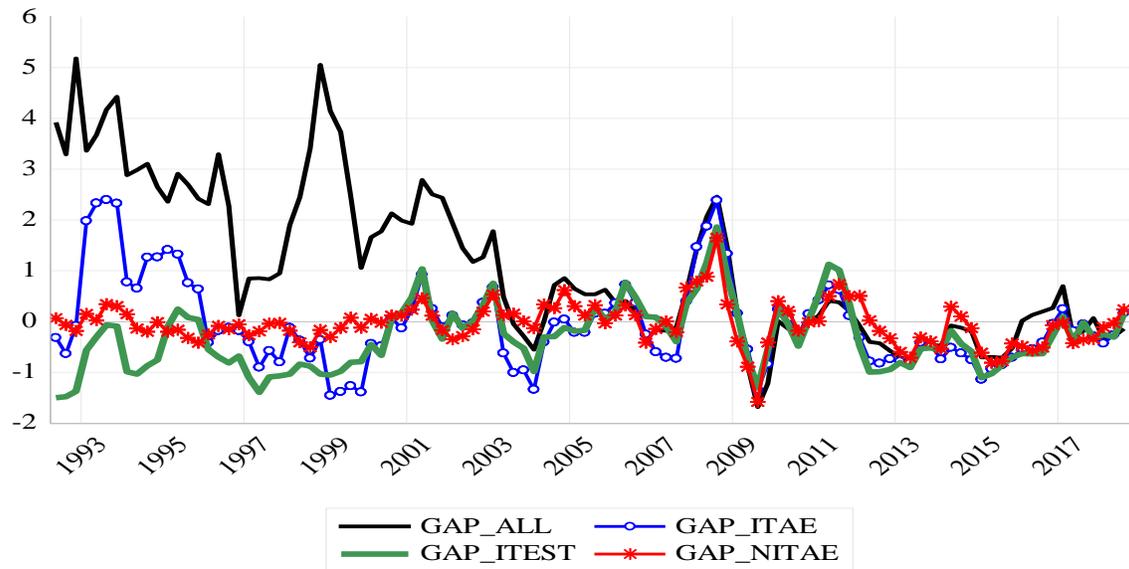
Note: GOV1 is the sum of the 6 components of governance: voice and accountability, rule of law, regulatory quality, government effectiveness, control of corruption and political stability. EME are emerging market economies, large economies are US, JP, EZ, GB, small open economies are CA, NO, SE, NZ, KR, IL, AU.

Figure 4 Inflation Distance from US Inflation



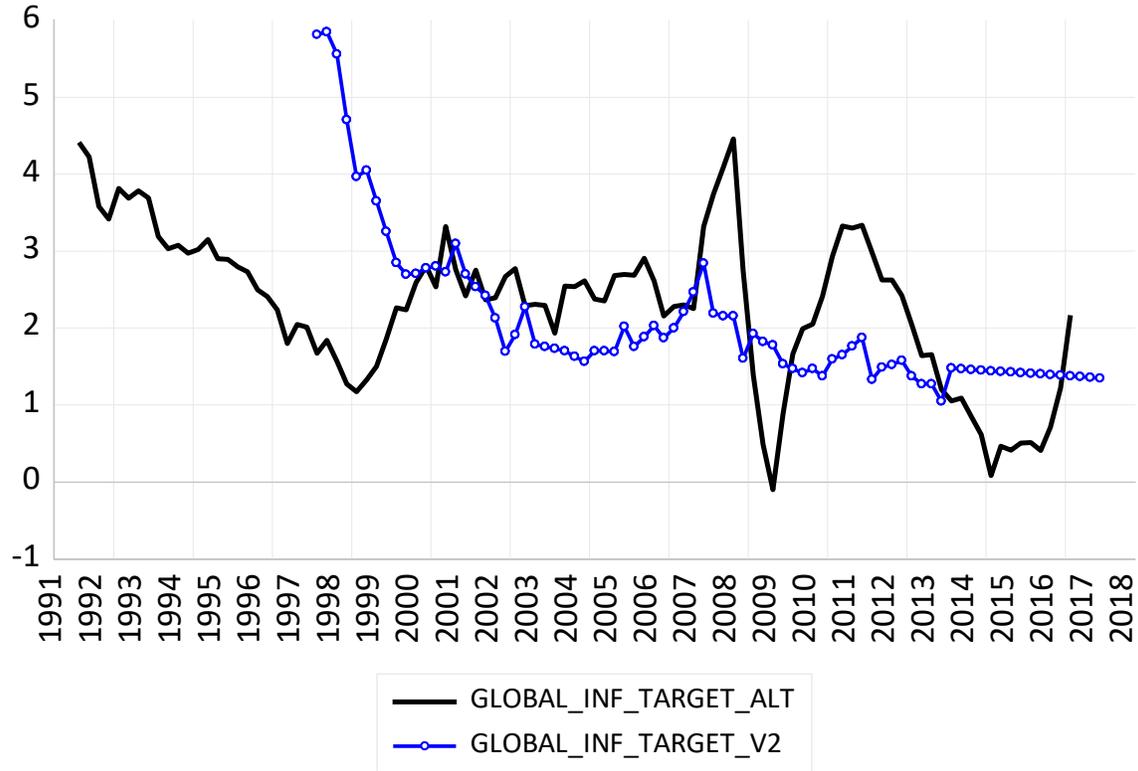
Note: Distance is $d_{ij} = \sqrt{2 * (1 - \rho_{ij})}$ where ρ_{ij} is the simple correlation between US inflation and inflation on the other economies considered. The sample is: 200Q1-2018Q3.

Figure 5 Gaps Between Inflation and Inflation Expectations, 1993-2018



Note: GAP is the difference between inflation (time t) and one-year ahead expected inflation (at time t). sources and methods of calculations are described in the main body of the text. ALL refers to the 29 economies in the dataset; IT refers to inflation targeting economies; NIT to non-inflation targeting economies; AE and EME are defined in Table 1.

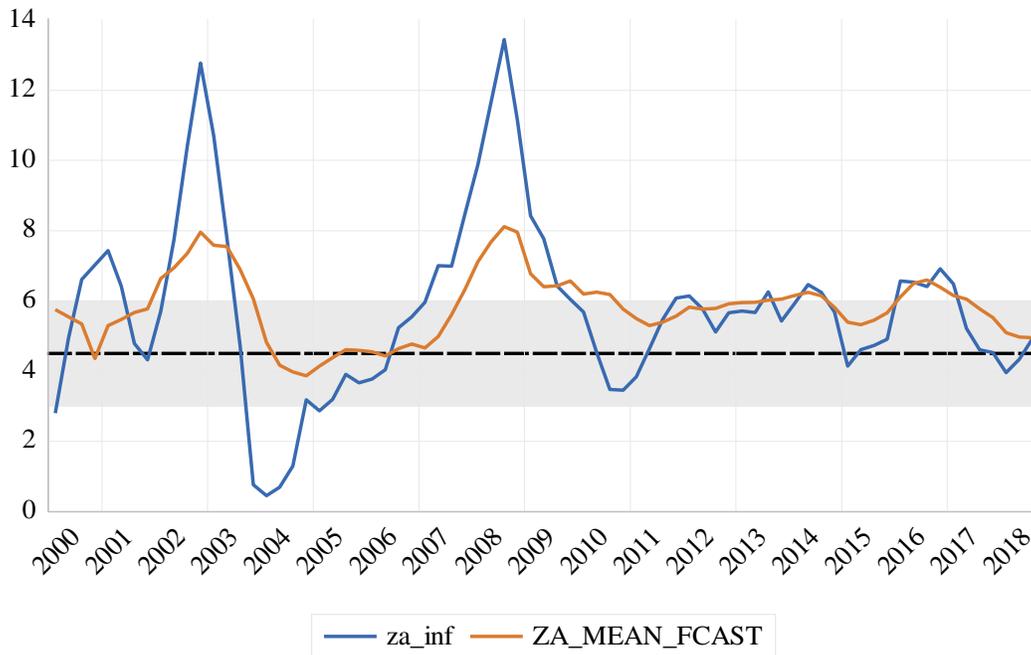
Figure 6 Estimates of Global Inflation



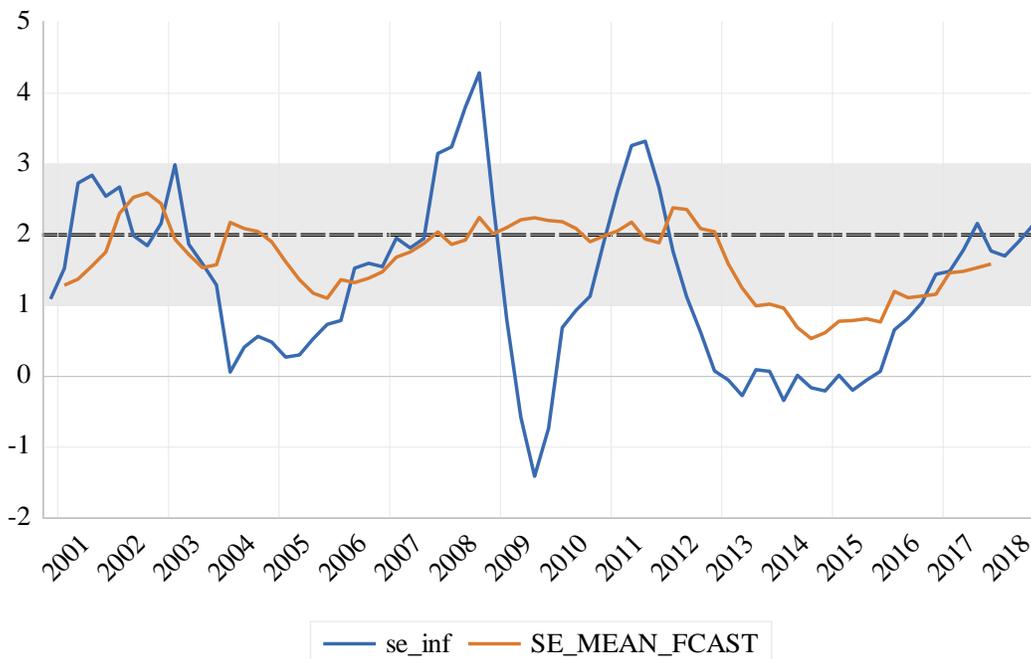
Note: Estimates of global inflation are used to proxy $\bar{\pi}^G$ in determining central bank credibility (CRED). V2 is obtained as the first principal component from average one year ahead expected inflation for AE. TARGET_ALT is obtained as the first principal component for AE for observed CPI inflation. Estimation of the first PC is via maximum likelihood. See also Table 1 for the list of AE.

Figure 7 Case Studies of Inflation and Expected Inflation: South Africa and Sweden

(A) South Africa

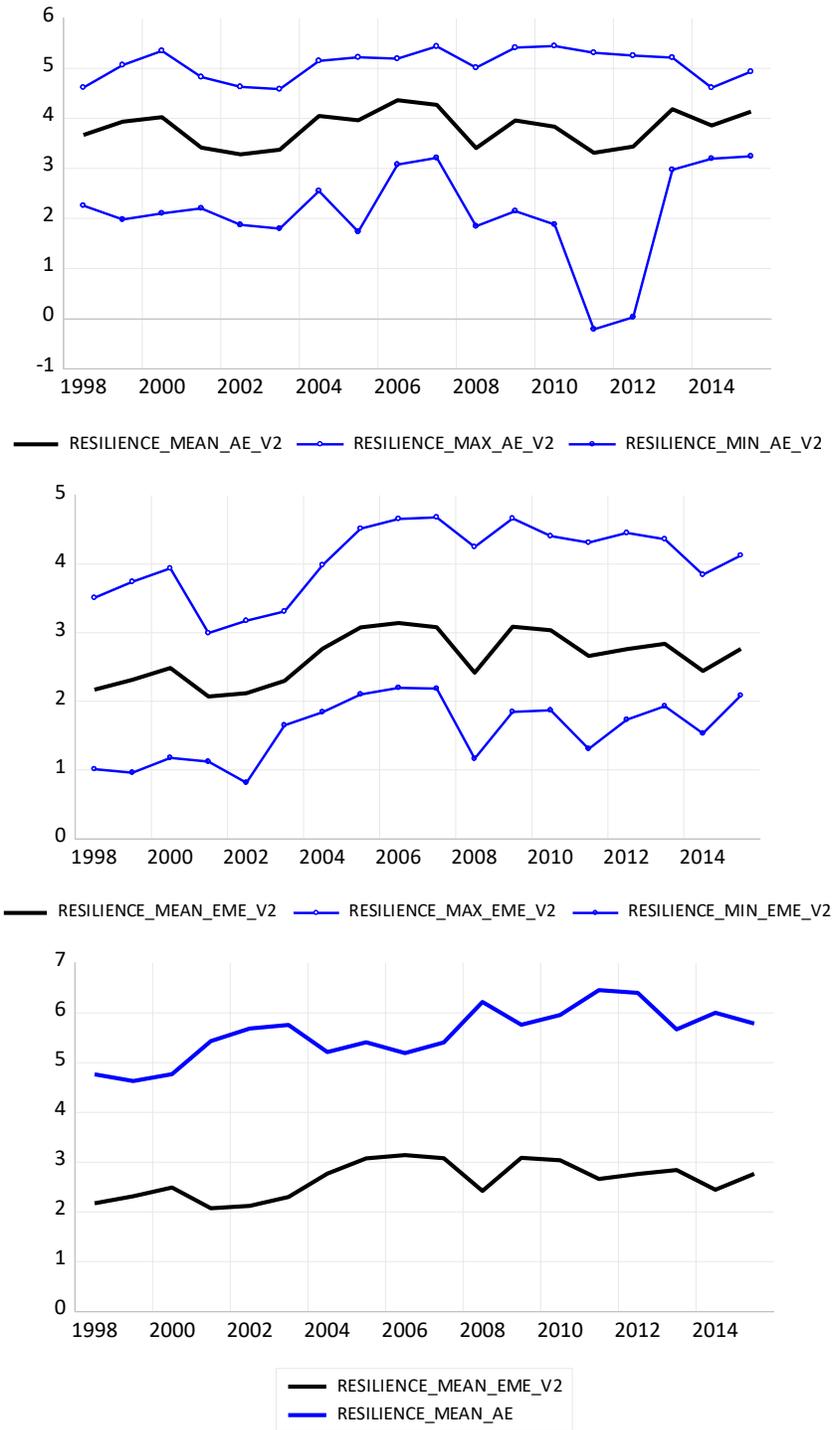


(B) Sweden



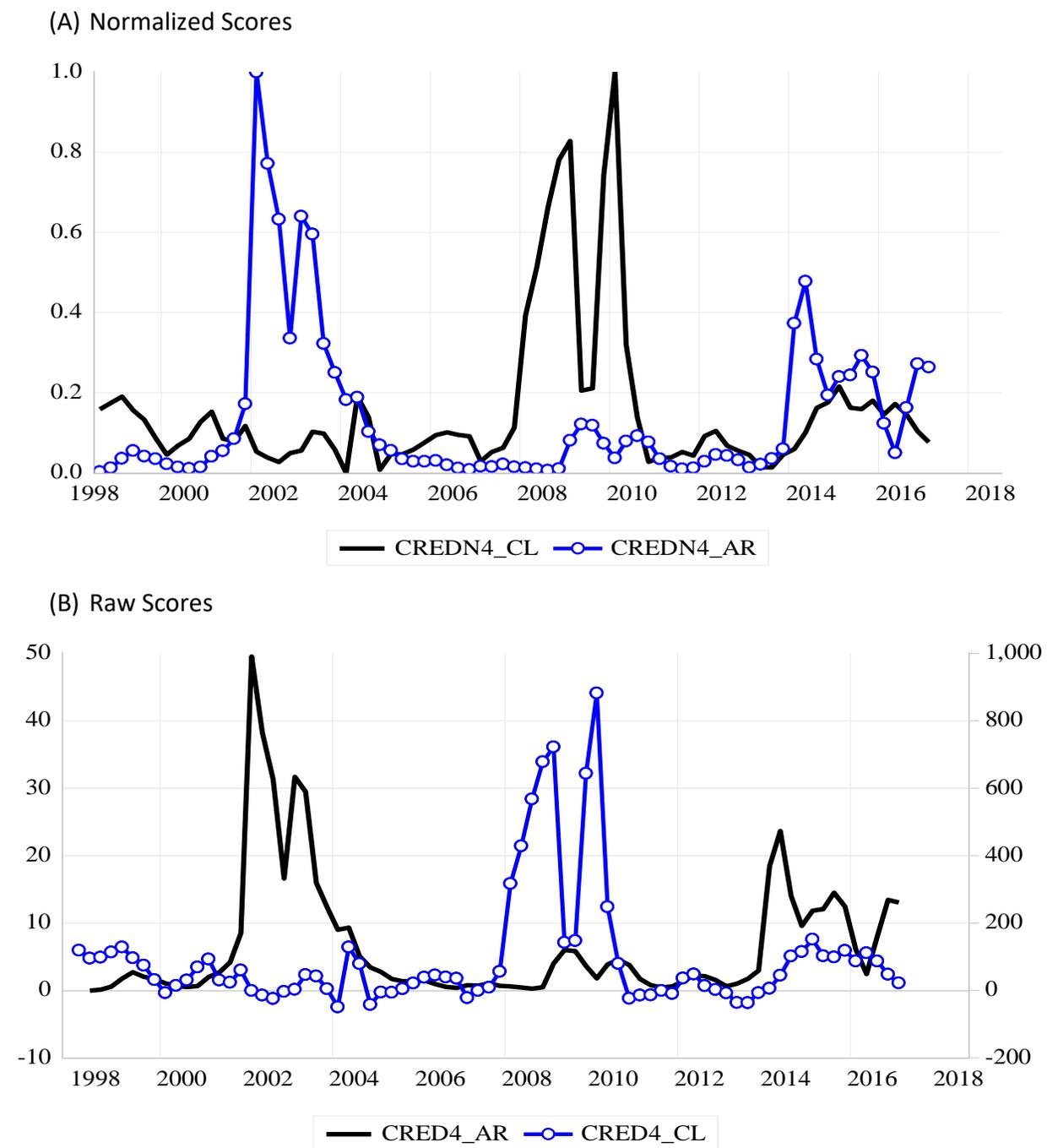
Note: inflation (inf) is the annualized quarterly CPI inflation rate. See the yexy for details. MEAN_FCAST is the average one year ahead expected inflation constructed from Consensus Economics and World Economic Outlook forecasts. See the text for other details.

Figure 8 Three Views of Institutional Resilience



Note: Resilience is defined in the main body of the text and consists of the aggregation of 10 institutional characteristics. The mean, maximum (most resilient) and minimum (least resilient) are shown for AE and EME. See Table 1 for the ISO codes and classifications.

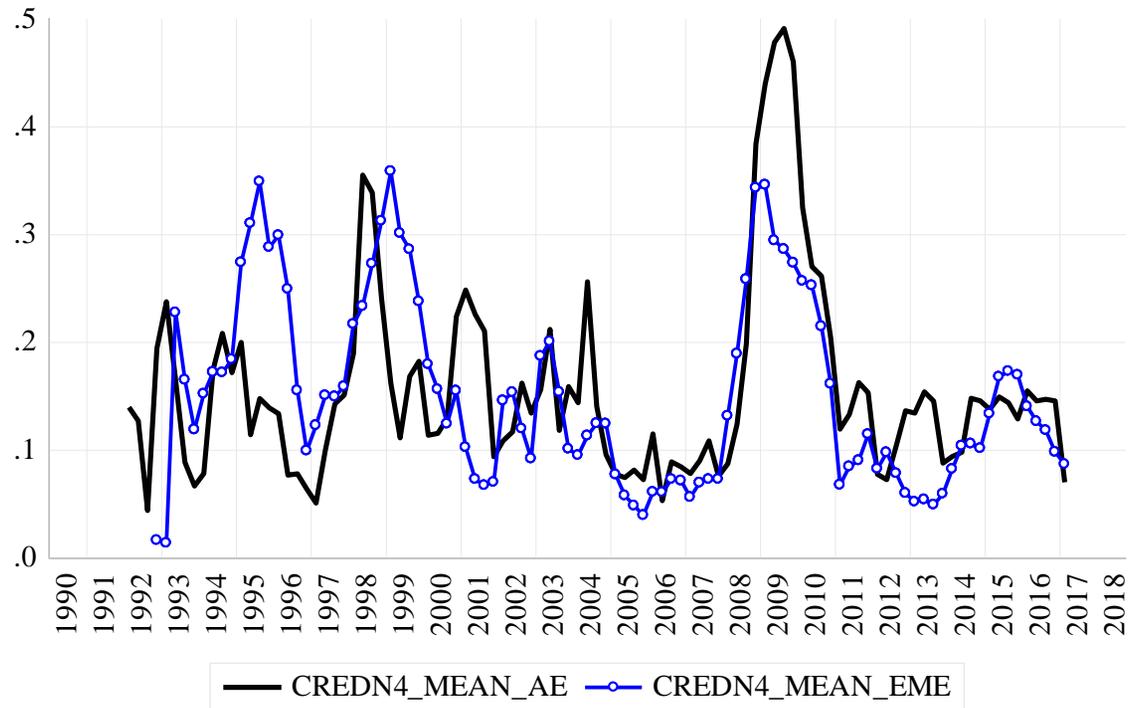
Figure 9 Illustrating Estimates of Central Bank Credibility: Chile Versus Argentina



Note: CRED is the credibility estimate in equation (2) estimated on a normalized scale (part (A)) and in raw form (as in equation (2); part (B)). AE and EME are found in Table 1. The global inflation target is TARGET_ALT (see Figure 6), while π_{t-1} proxies $\bar{\pi}_{t+1}^f$ in equation (1).

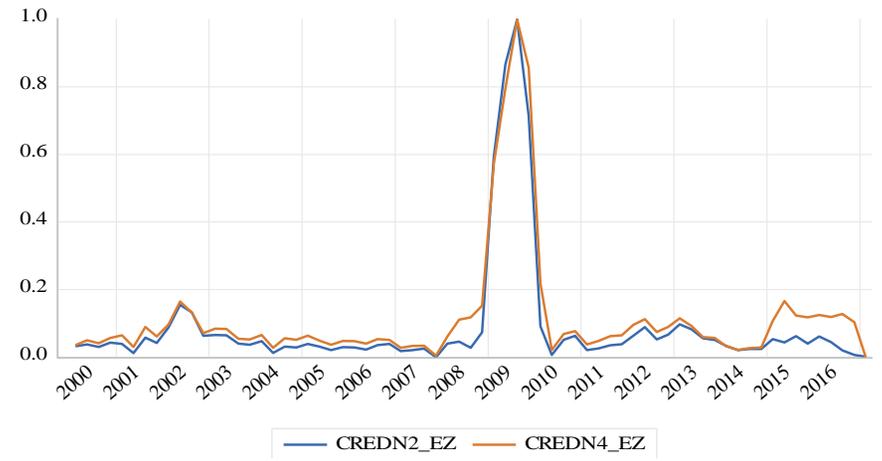
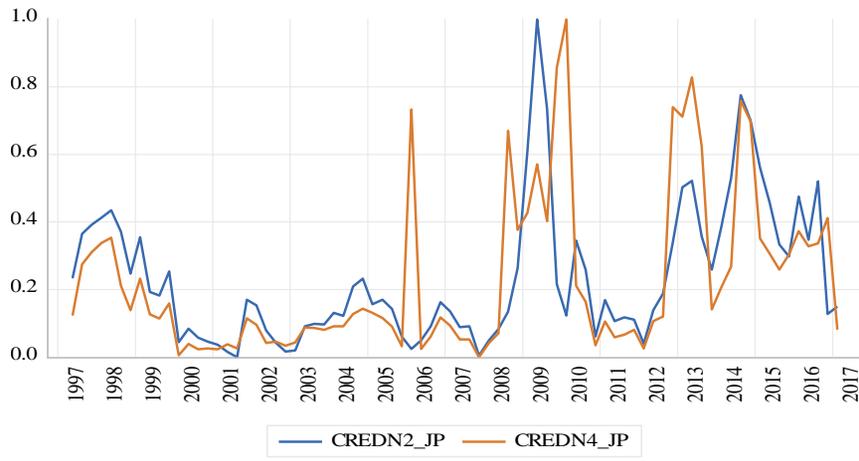
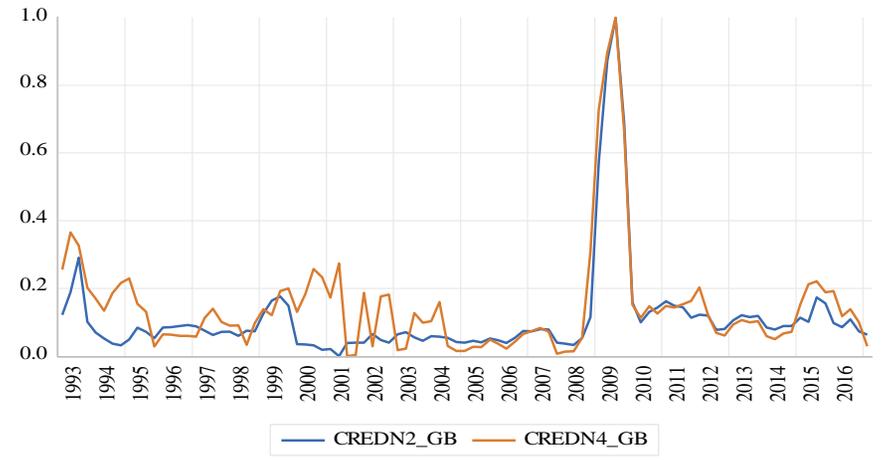
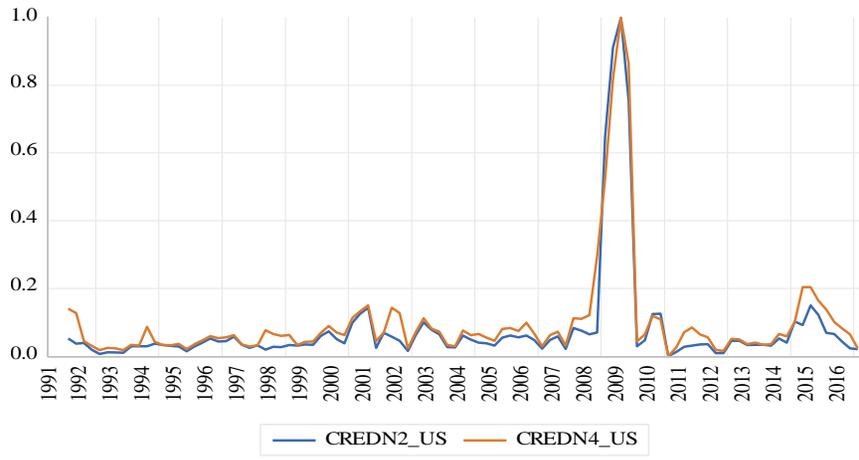
Figure 10 Credibility Estimates

(A) EME versus AE

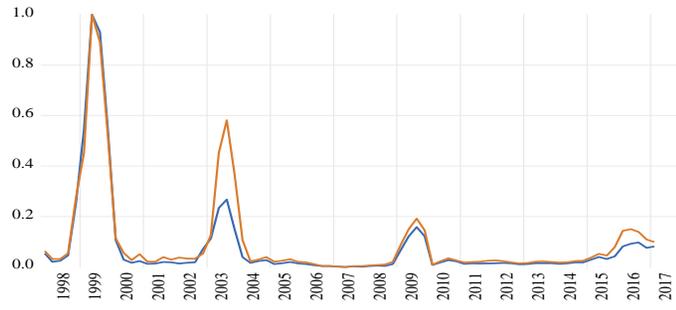


Note: Equation (2) normalized so that CRED ranges between [0,1]. CRED4 is the version that uses inflation lagged one period relative to the first principle component of observed inflation in AE. Mean estimates for AE and EME are shown. Also, see Table 1.

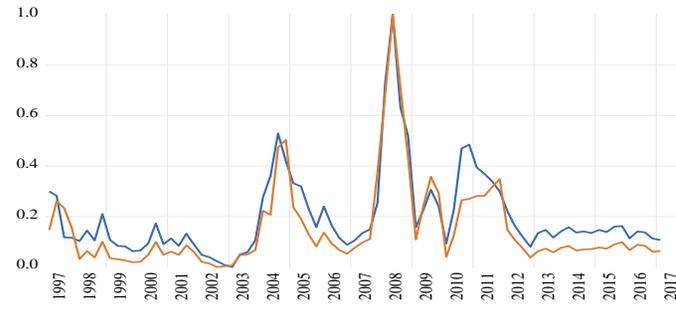
(B) Large AE



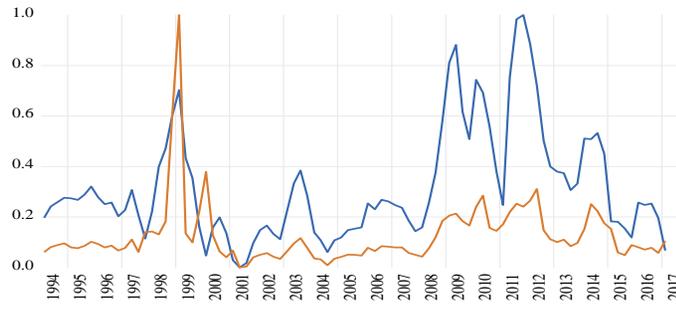
(C) BRICS



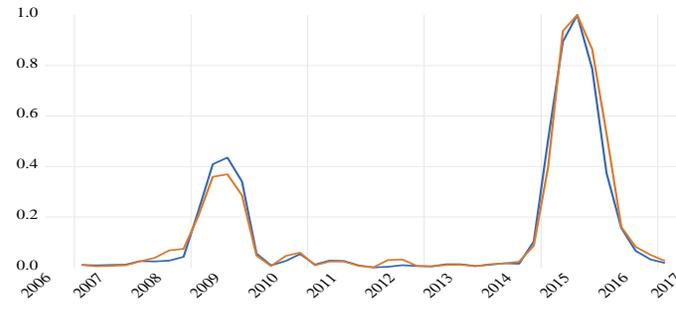
— CREDN2_BR — CREDN4_BR



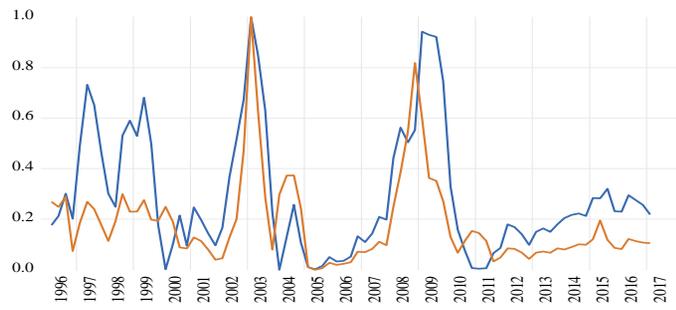
— CREDN2_CN — CREDN4_CN



— CREDN2_IN — CREDN4_IN

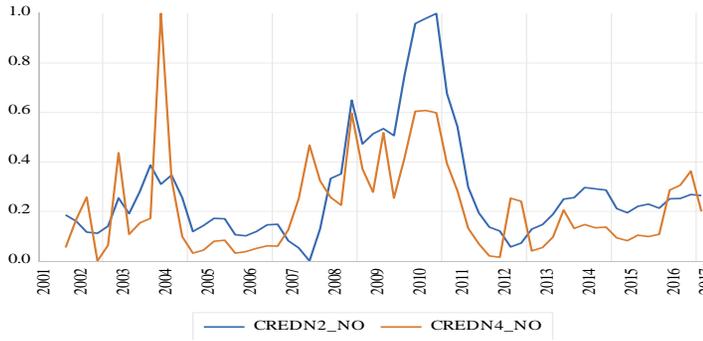
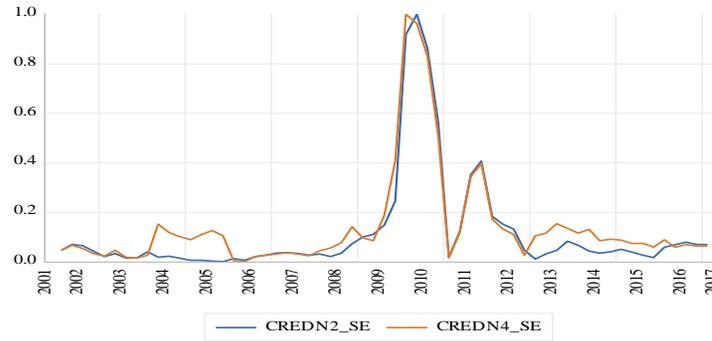
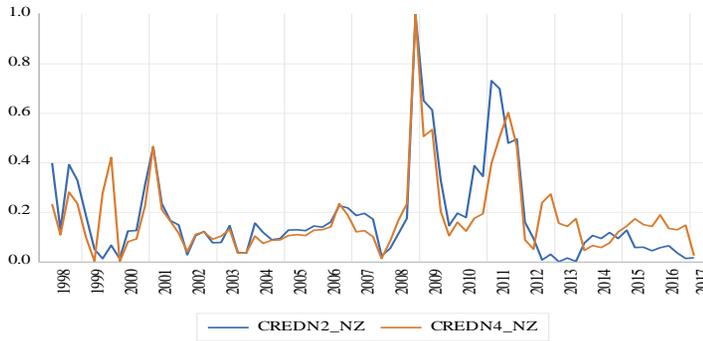
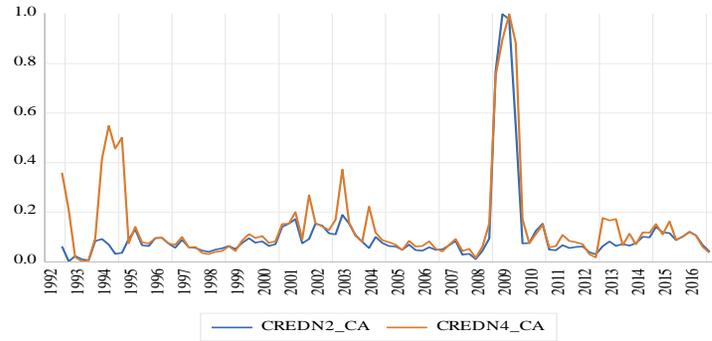
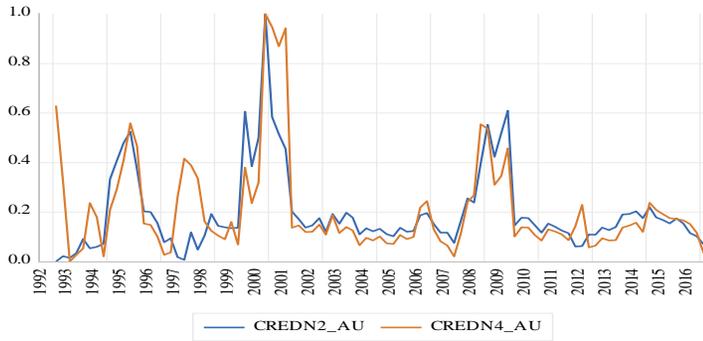


— CREDN2_RU — CREDN4_RU

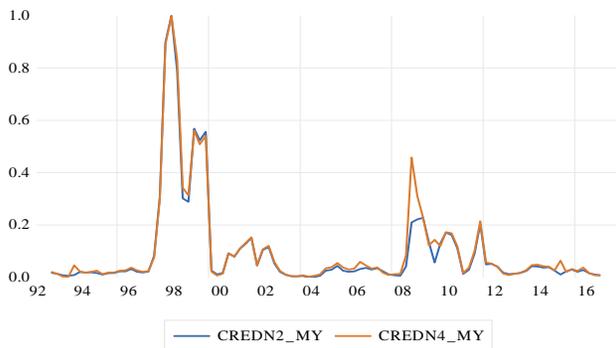
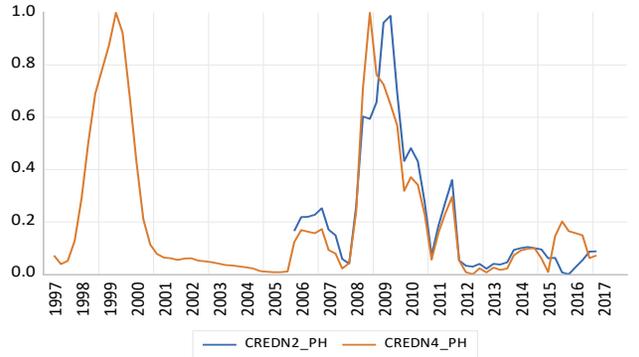
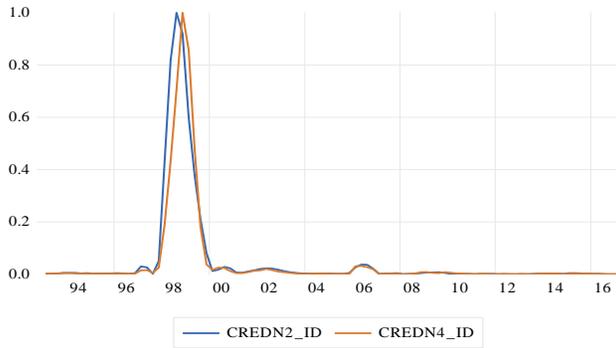
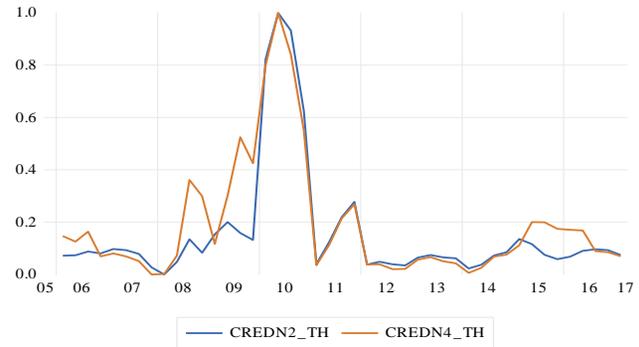
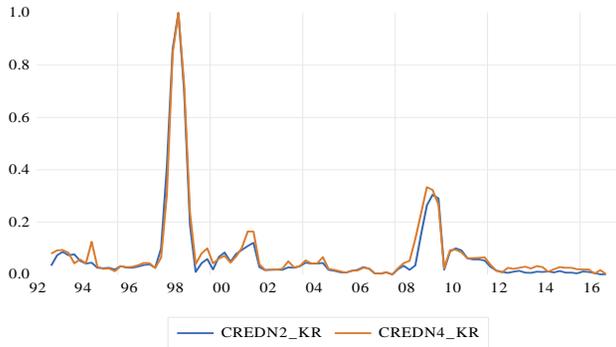


— CREDN2_ZA — CREDN4_ZA

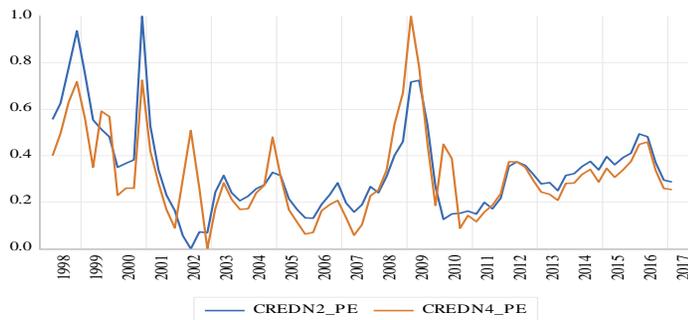
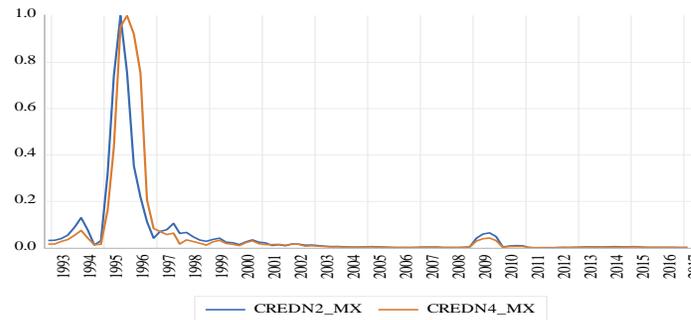
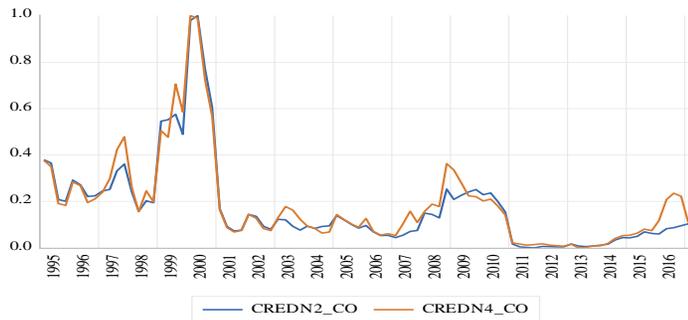
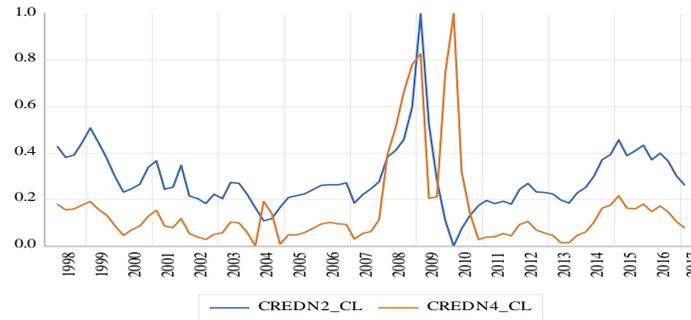
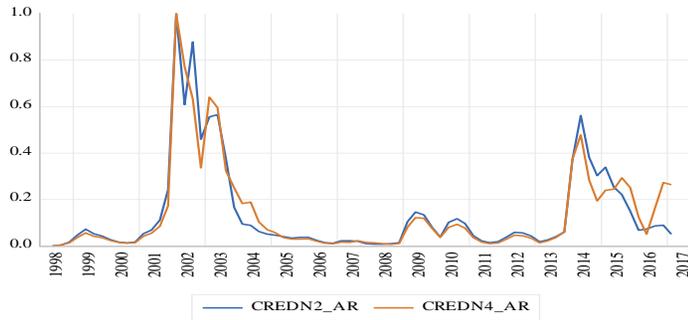
(D) IT in Selected AE



(E) Asia

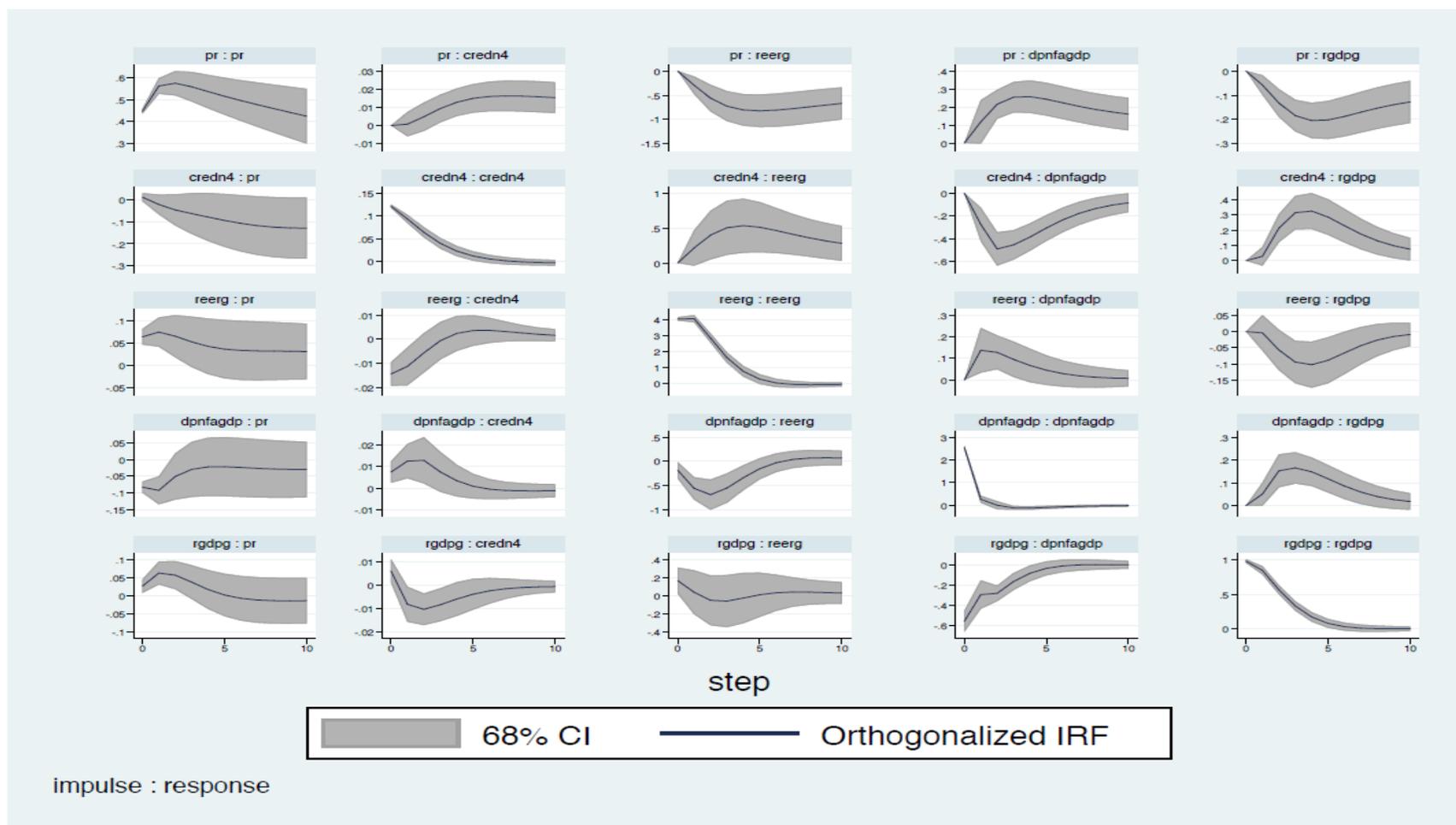


(F) LATAM Countries



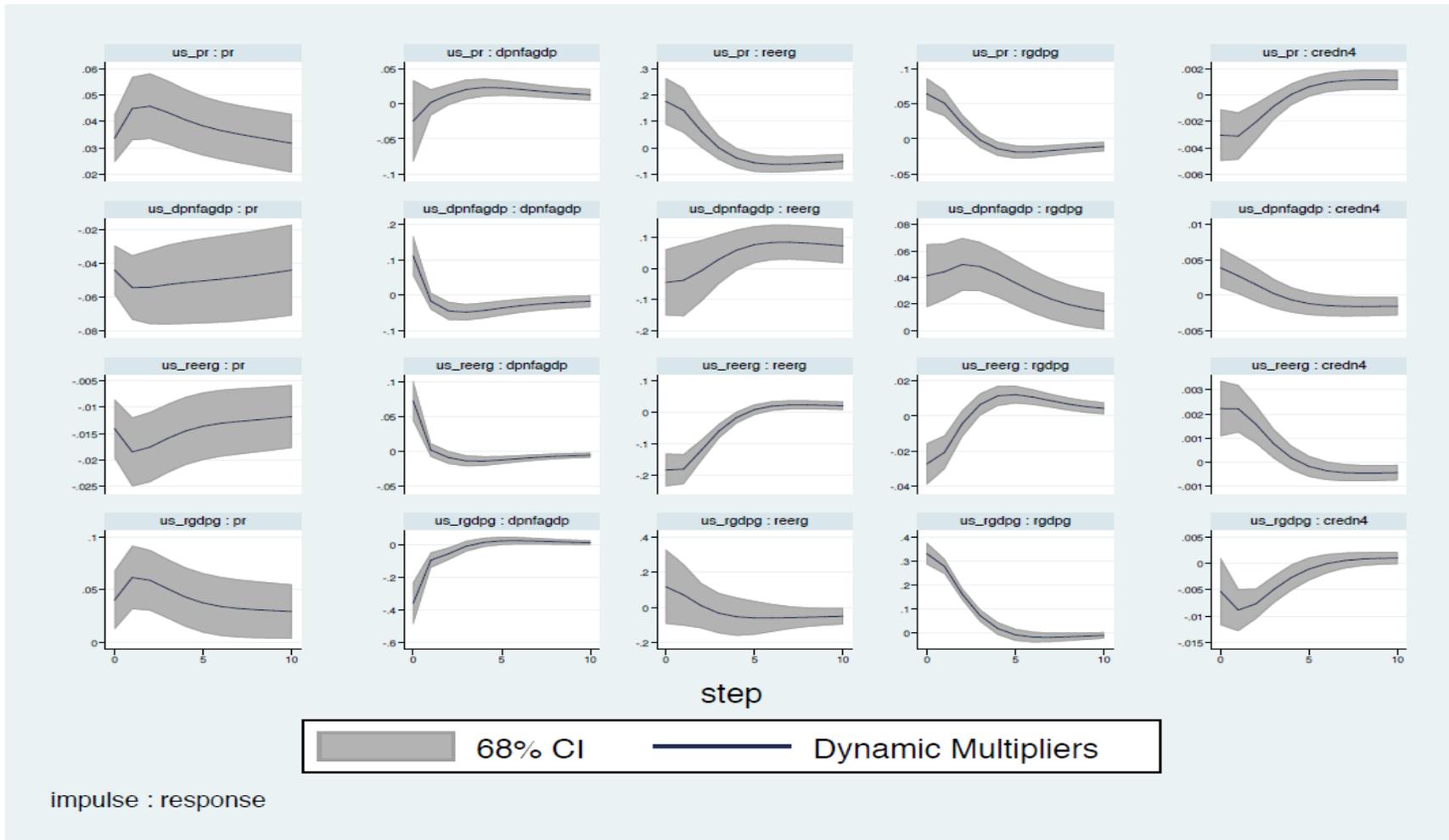
Note: See part A of this Figure. CREDN2 is the normalized version that uses the mean one-year ahead inflation forecast. See the main body of the text for more details.

Figure 11A Impulse Responses: AE Based on Observables



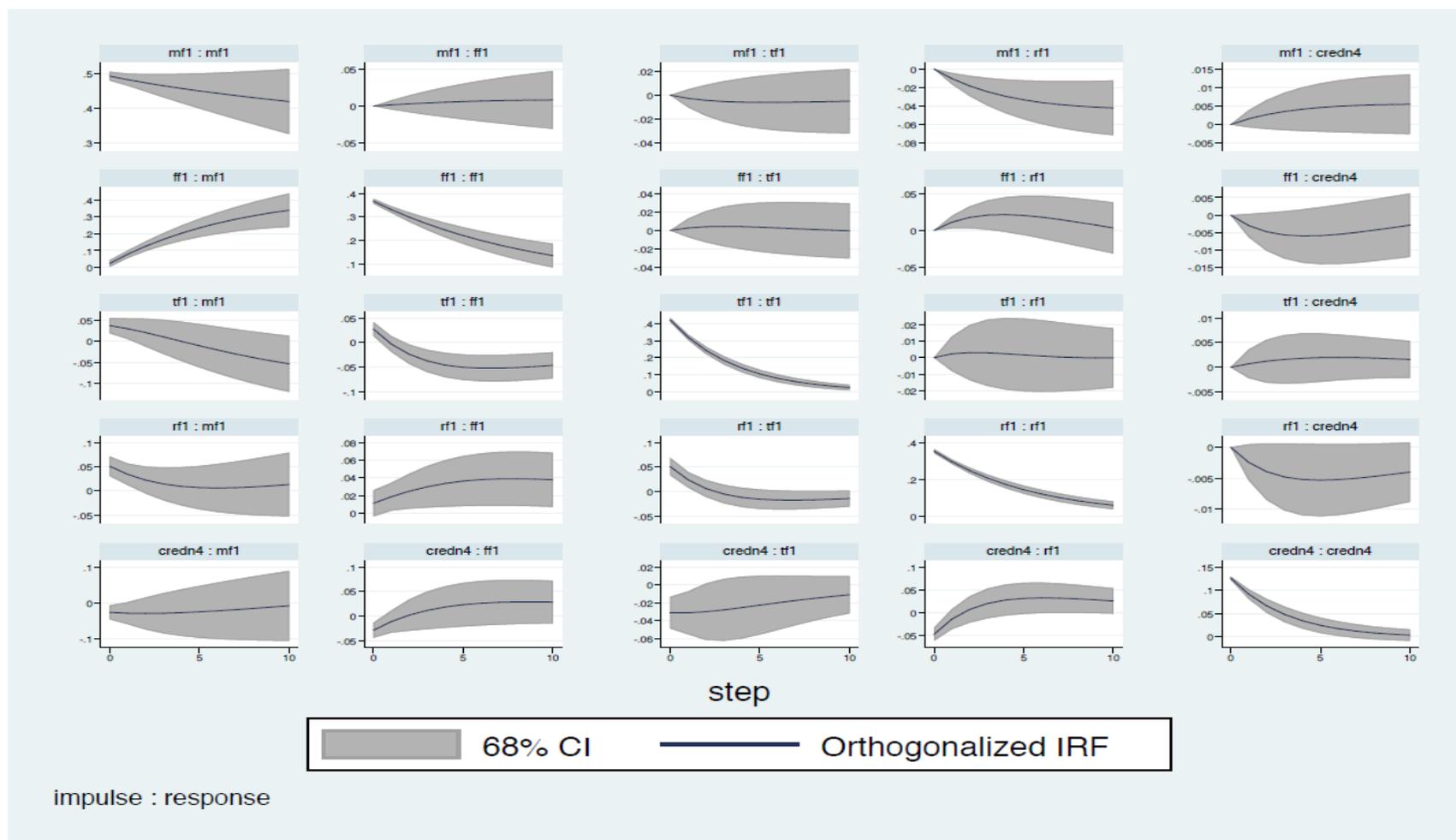
Note: See equations (4) to (6). Variables are defined in Table 2. The ordering of the Panel VAR is from the last row (first) to the first row (last). 1 lag used in the estimation. See the main body of the text for more details.

Figure 11B Dynamic Multipliers: AE Based on Observable Series



Note: Same panel VAR as in Figure 11A. US shocks are treated as exogenous.

Figure 11C Impulse Responses: AE Based on Factor Model Estimates



Note: RF is the real factor, TF is the trade factor, FF is the financial factor. Factors are obtained from the 1st principal component of the series shown in Table 2. 1 lag used in estimation. See the main body of the text for more details and the note to Figure 11A.

Figure 11D Dynamic Multipliers: AE Based on Factor Model Estimates

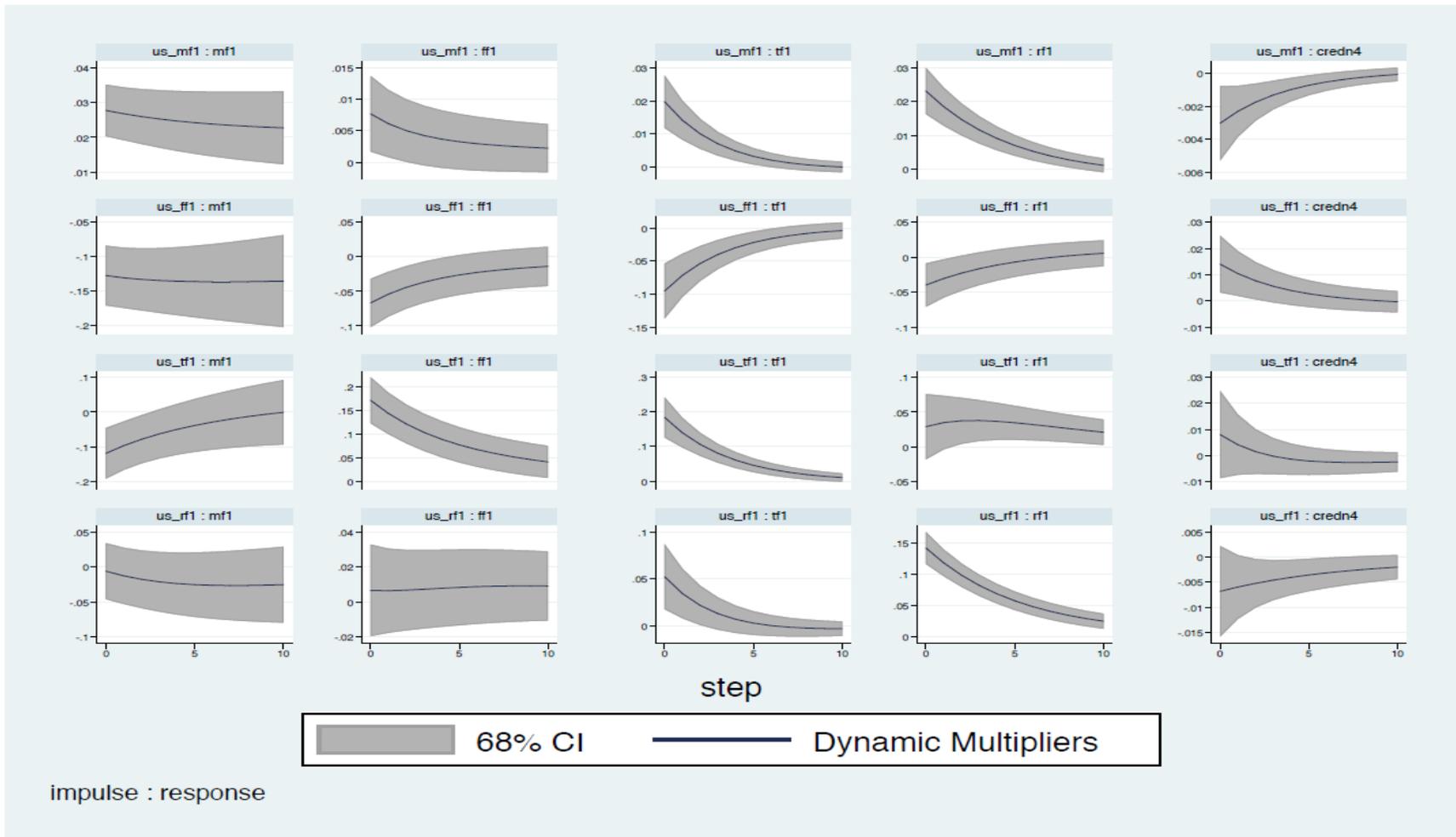
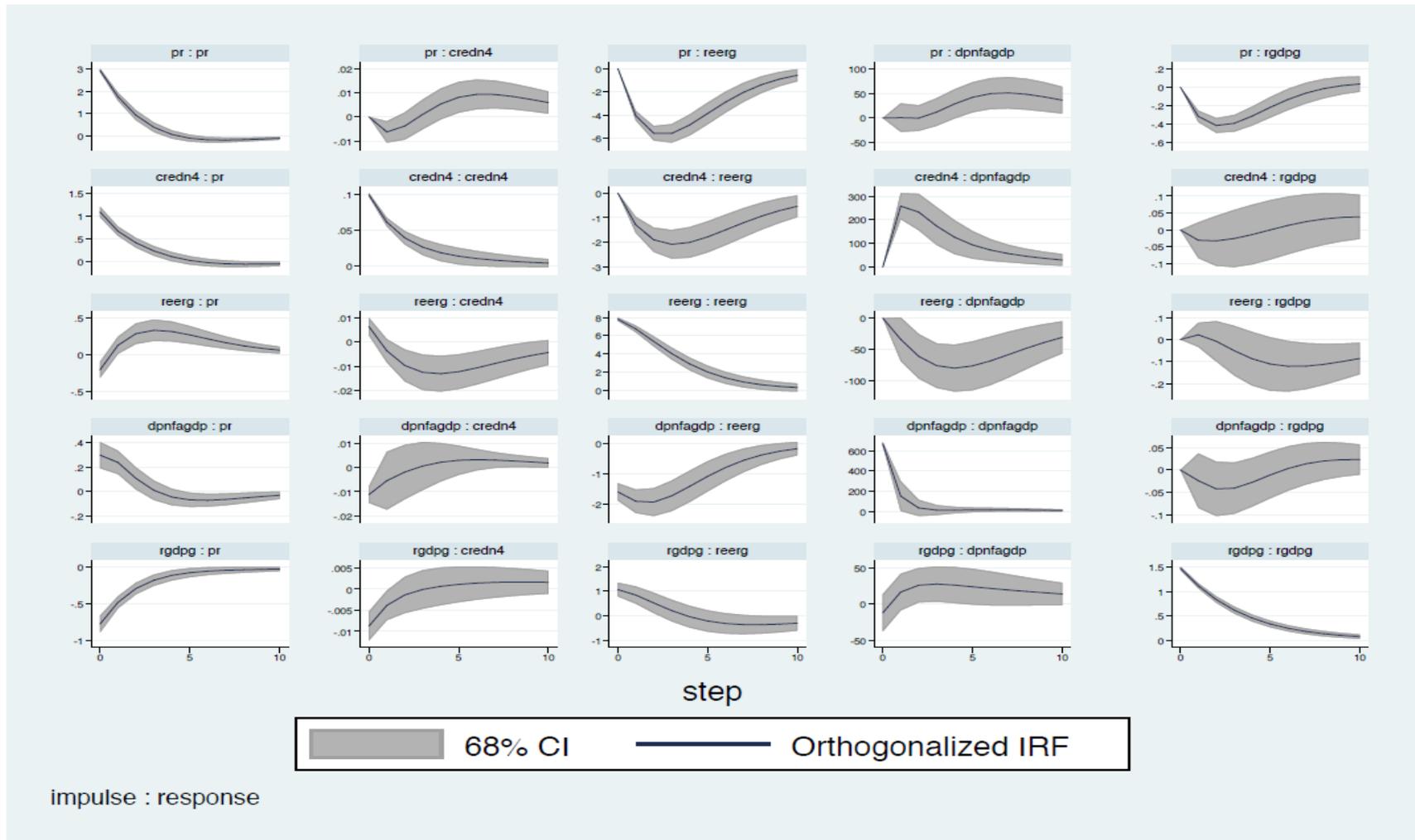


Figure 12A Impulse Responses: EME Based on Observables



Note: see the notes to Figure 11.

Figure 12B Dynamic Multipliers: EME based on Observables

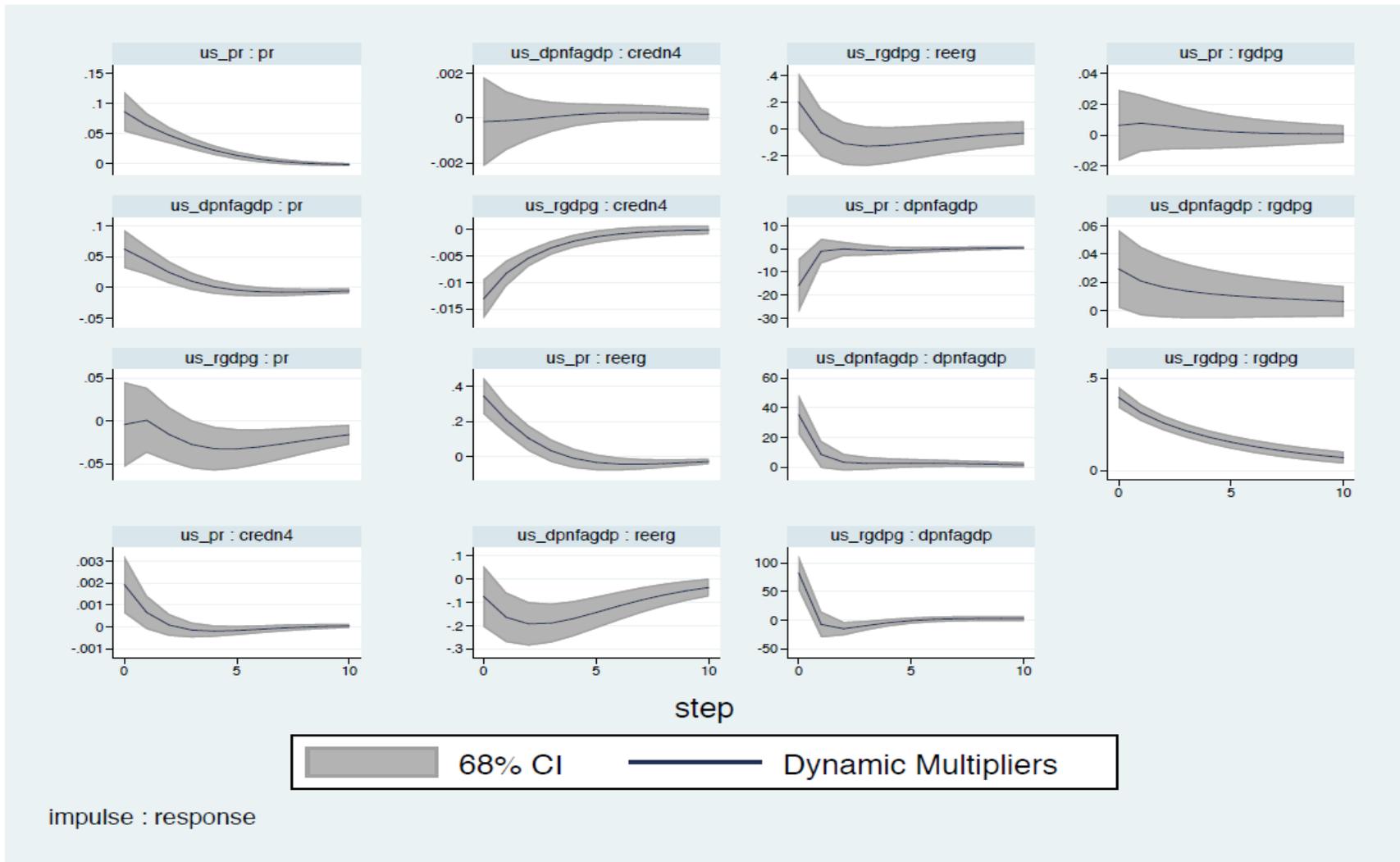


Figure 12C Impulse Responses: EME Based on Factor Model Estimates

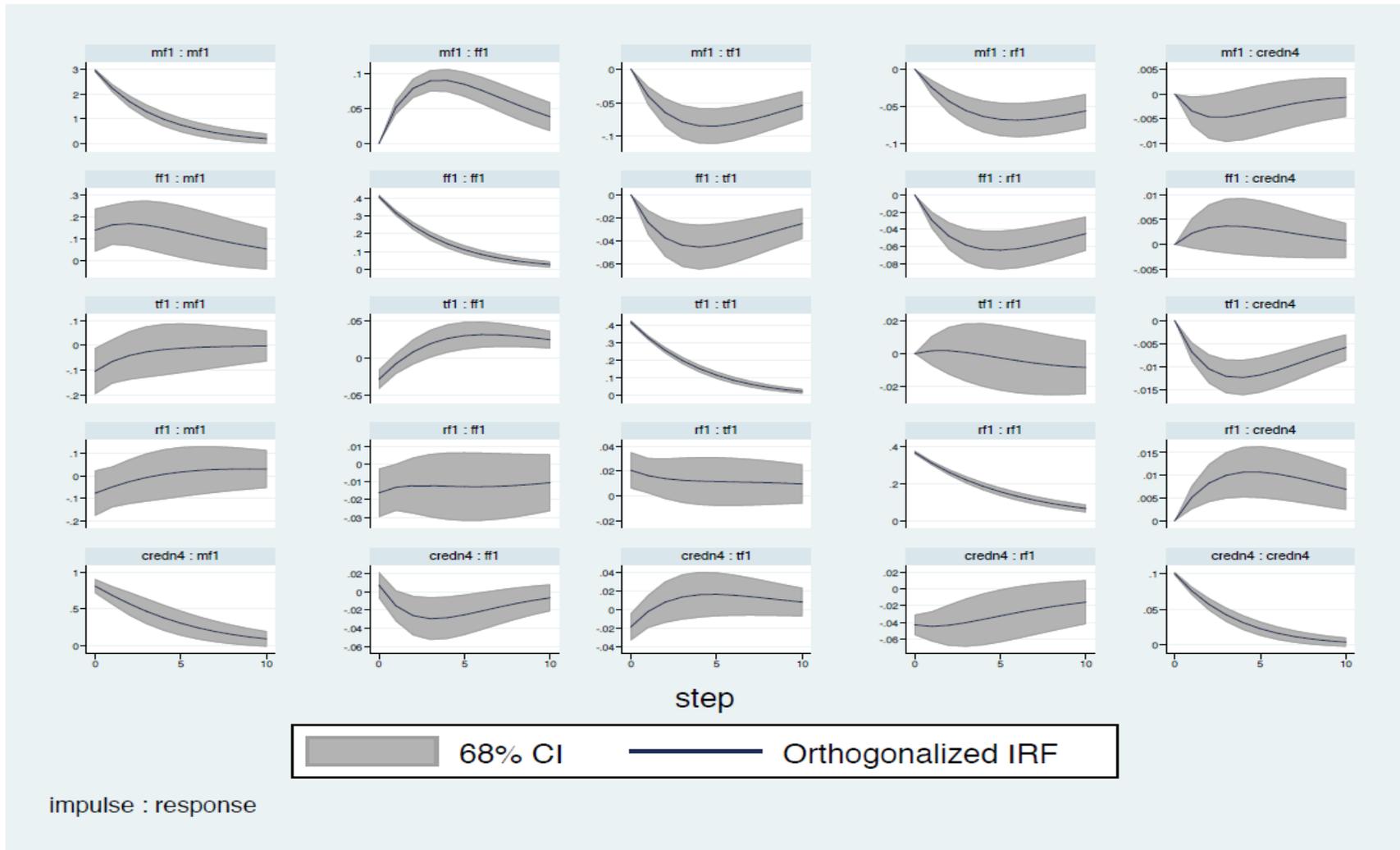
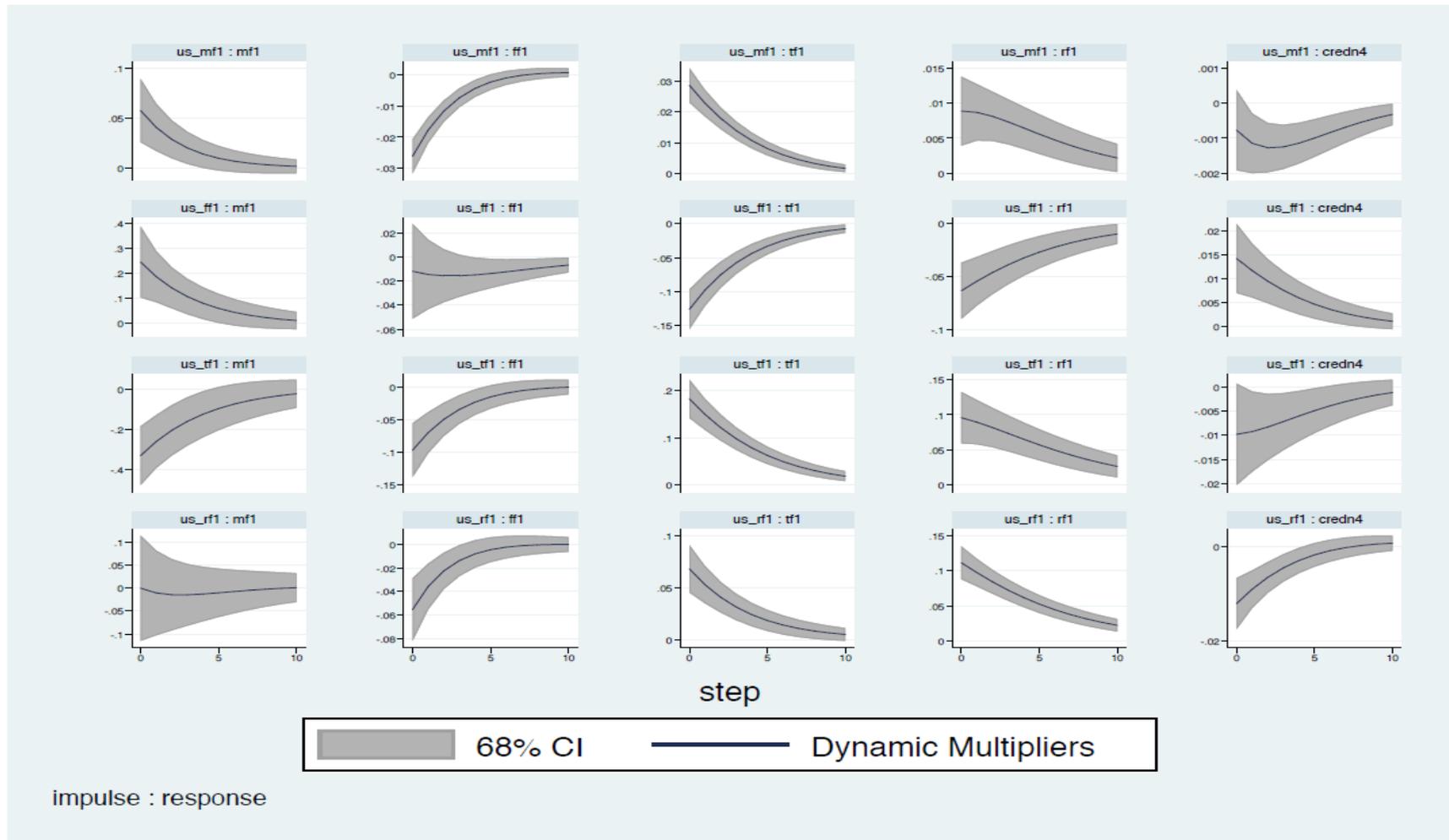


Figure 12D Dynamic Multipliers: EME Based on Factor Model Estimates



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APPENDIX I:

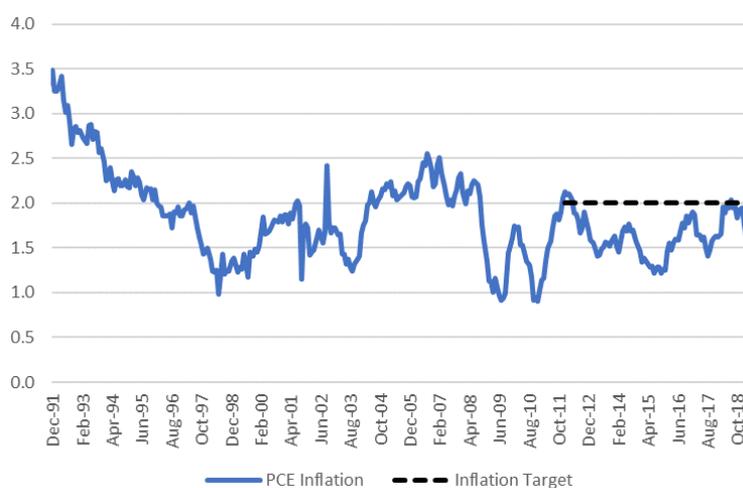
INFLATION PERFORMANCE AND CREDIBILITY IN 6 COUNTRIES⁵⁰

In this Appendix we present narratives on the performance of 6 central banks (3 AEs : US, Canada, Sweden) and 3 EMEs (Chile, Mexico and Colombia) in the post Bretton Woods era. We describe how they achieved credibility for low inflation in the 1980s and 1990s and adopted CBI, CBT and IT and how they fared after the GFC. The narratives are woven around 2 figures: inflation versus the IT; Two measures of credibility (CRDN2 and CREDN4) which are developed in the paper.

Our choice in picking the central banks was pragmatic. For the AEs we picked the US as the leader, Canada as a country that consistently achieved high credibility and Sweden, a country that had a good track record except when it followed LAW policies and supported the housing market in 2011 For the EMEs our choice was driven by the locale of the conference.

USA: The Inflation Target Regime 1991-2018

Figure 1. Inflation – Actual and Target – USA (%)



Source: FRED - Federal Reserve Bank of St Louis

A. Before the GFC

Following the disaster of the Great Inflation, the Federal Reserve reestablished its credibility for low inflation by the mid-1980s seen in declines in nominal interest rates, in the TIPS

⁵⁰ For helpful assistance in preparing these narratives we thank Humberto Martinez Beltran and Cesar Tamayo.

spread and in various measures of inflation expectations. The 20-year episode of good economic performance is referred to as the Great Moderation. Alan Greenspan took over as Fed Chairman in 1987. He quickly prevented a major stock market crash from leading to a banking crisis and then followed the Volcker approach to maintaining credibility for low inflation. This policy was put to the test by the inflation scare of 1994 when rising long-term bond yields signaled a run up in inflationary expectations. The Fed tightened sharply, raising real interest rates. And then when inflation expectations eased, the Fed loosened, preventing a recession. (Goodfriend 1993).

The Great Moderation ended with the Financial Crisis of 2007-2008. Loose Federal Reserve policy of keeping the Federal Funds rate well below the Taylor rule rate from 2003 to 2005, in an attempt to head off potential deflation, added fuel to a burgeoning real estate boom which burst in 2006 triggering the crisis. (Taylor 2007, Bordo and Landon Lane 2013b). The Fed reacted to the crisis by following aggressive monetary policy of cutting the FFR in the fall of 2007, opening the discount window to many nonbank financial institutions and non-traditional markets and by a controversial bailout policy in fall 2008 (bailing out Bear Stearns, AIG and the GSEs) and letting Lehman fail in October. That action triggered a global financial crisis. The Fed reacted to the panic by cutting the FFR to zero and instituting several unorthodox discount window facilities. These policies combined with the Treasury's TARP plan, stress tests and an inter central bank swap arrangement ended the crisis. By late fall 2008 the Fed's policy rate had hit the zero lower bound and with the recession still on going, the Fed instituted its Quantitative Easing policy (QE1) -- the purchase of long-term Treasuries and mortgage backed securities.

B. Since the GFC: 2008-2018

Following the GFC, the Fed very fearful of renewed recession and the sustained high unemployment rate, shifted from following QE1 to QEII and Operation Twist in an effort to lower bond yields. These were three more packages of unconventional monetary policies that the Fed had to use given that its policy rate had reached its zero-lower bound.

A significant increase in emphasis on financial stability added a dimension of caution to the Fed and contributed to a tilt toward easier monetary policy.

In January 2012, the Fed adopted a 2% inflation target and "maximum employment" as longer-run strategy objectives. The maximum employment mandate was undefined which gave the Fed increased flexibility.

During the Summer of 2012 Chairman Ben Bernanke promoted QEIII and then implemented it in November 2012. It was specifically aimed to reduce the unemployment rate and was an important shift in the Fed's reaction function with increased emphasis on reducing unemployment. At the same time, the Fed formally adopted forward guidance as a means to keep bond yields low.

In May 2013, Bernanke announced that the Fed will eventually need to taper its QE. This led to the Taper Tantrum of 100 bps rise in bond yields which had major effects on emerging economies. In addition, inflation stayed below the Fed's official 2% target (See Figure 1) while wage gains remain subdued despite sharp (unanticipated) declines in the unemployment rate.

The Fed announced the tapering strategy in December 2013 and commenced in 2014. Gradually, interest rates fell. In this period, the Fed debated the sequencing of normalization and decided to begin unwinding first their balance sheet prior to raising rates. It believed that their approach would keep bond yields low.

Oil prices collapsed and the US dollar appreciated sharply beginning in mid-2014 through year-end 2016. This had an adverse impact on production and business investment. Moreover, there was a global industrial slump in 2015-mid-2016. US bond yields declined reflecting a combination of a decline in real rates and receding inflationary expectations.

Incoming Fed Chair Janet Yellen in 2015 heightened focus on the unemployment rate and labor market performance. The Fed began to include a "Labor market monitor" on its website. Thus, gradually the Fed was perceived to become more activist.

The Fed's initial rate increase in Dec 2015 and pledge to hike rates gradually in 2016 was nearly immediately sidetracked by a slump in China and other global uncertainties. Economic performance was subdued through 2016, reflecting supply constraints both in monetary channels and nonfinancial sector. The Fed paused until Dec 2016.

After President Trump was elected in November 2016 the policies of deregulation in the nonfinancial sector generated a pickup in business confidence and capital spending. This was followed by tax cuts/reform. The Fed's forecasts of economy were caught flat-footed.

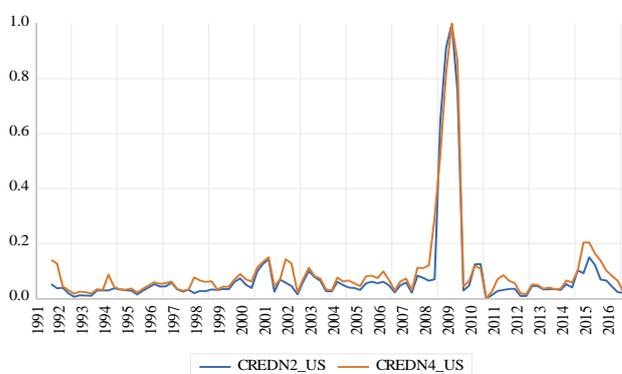
As the unemployment rate continued to fall below the Fed's estimate of the natural rate of unemployment but wage gains remained modest, the Fed argued that the Phillips Curve has flattened, it then lowered its estimate of the natural rate of unemployment.

The Fed continued to raise rates gradually and Oct 2017 sets out strategy on passively unwinding balance sheet. By mid-2017, Jerome Powell became Chairman of the Federal Reserve. The Powell Fed viewed sub-2% inflation as providing flexibility to elongate monetary policy normalization, but there were no major concerns about it being too low or of cutting the zero-lower bound. The Fed continued to forecast that inflation would rise to 2%, and expressed that it did not know why inflation remained below 2%. It introduced the notion that 2% is an average and that's it is important to be symmetrical around its target.

In 2018, particularly after the economy shows signs of slowing, the Fed begins to express more concern about the zero lower bound. It did an about-face in Q4 2018 in response to a stock market correction, signaling that it was done raising rates and that its balance sheet strategy is to maintain an “ample amount” of reserves in the long run, implying maintaining over \$1 trillion in excess reserves.

In May-June 2019, as economic growth slowed and inflation receded toward 1.5%, the Fed expressed increasing concern about inflation being too low and ZLB being a constraint on the Fed's flexibility to ease in response to the next recession. The Fed has signaled that it will be easing monetary policy. (Levy, 2019)

Figure 2. Credibility of the Federal Reserve – 1991 - 2017



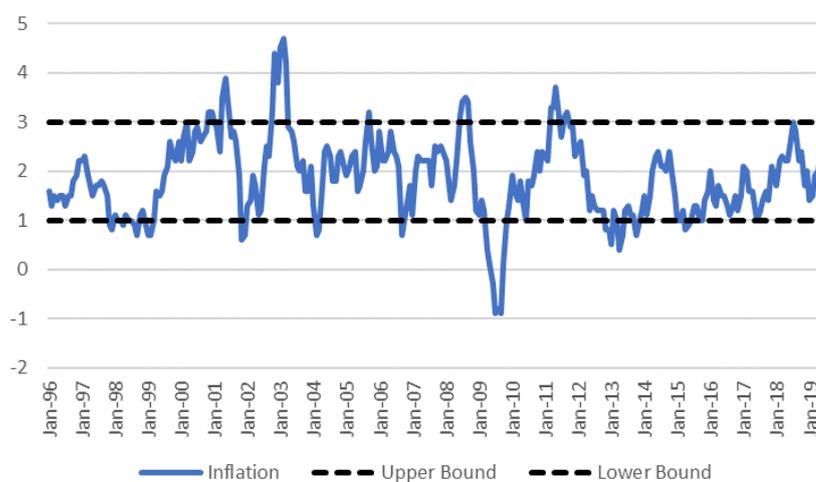
Note: the main body of the text explains how CREDN2 and CREDN4 are estimated.

For the period between 1991 and 2017, the credibility measure shows that, despite not having an official inflation target until 2012, the Federal Reserve managed to have high credibility mostly throughout these years. During the end of 2008 and 2009, the GFC, the Federal Reserve suffered from a loss in credibility. Recall that this was a time of great uncertainty, with inflation declining to 1% and a perception that the risk of deflation was rising, the Federal Reserve lowering its policy rate to its lower bound and was forced to implement unconventional monetary policies to try to reduce long-term rates.

Another period where there is a slight decrease in credibility starts just before 2015. Again, this was a moment after the decline in the international price of oil that coincided with an industrial slump in the world economy, and a reduction in inflation expectations. Inflation finished 2015 at 1.25%, below its 2% target. It is important to note that the ongoing challenge of the Fed since the GFC has been to address subpar inflation performance.

Canada: The Inflation Target Regime 1991 - 2019

Figure 3. Inflation – Actual and Target – Canada (%)



Source: Bank of Canada

A. Before the GFC

The failure of monetary targeting, the end of the Bretton Woods era conspired to create a void in monetary policy. There was no monetary anchor. As a result, pressure came from several quarters to stem inflation with new tools. In 1987, during the course of the Hanson Lecture Governor John Crowe argued that “monetary policy should be geared so as to achieve a pace of monetary expansion that promotes price stability in the value of money. This meant pursuing a policy aimed at achieving and maintaining stable prices.” (Crow 1988, p. 4) Shortly after New Zealand adopted inflation targeting (see below), the Bank, with the tacit encouragement of the federal government, adopted inflation reduction targets in 1991. However, the adoption of a new anchor of policy was not without considerable controversy, somewhat reminiscent of the Coyne affair three decades earlier. The issue was once again whether, in the pursuit of price stability, the Bank deliberately engineered or made worse the recession of the early 1990s.

Canada's inflation targeting regime began with goals to reduce inflation, first to 3% by 1992, and then to 2% by 1995. Inflation fell more quickly than anyone expected and a target range of between 1 to 3%, with a 2% mid-point inflation target, was adopted. Since that time the inflation target remit has been renewed every five years and inflation has remained within the target range much of the time since then. The inflation targeting regime has been in place for over two decades and is, arguably, a success story. Along with the adoption of inflation targets was a commitment to a floating exchange rate and the gradual expansion of the transparency of the Bank of Canada. Governor Gordon Thiessen was largely responsible for these and other changes (e.g., see Laidler 1991, and Laidler and Robson 1993).

The inflation targeting regime survived the global financial crisis but the regime has not been left unscathed. While Canada escaped the worst of the GFC, the events of 2008-13 provide some fodder for the critics of the Bank. The recession of 2008-9 was short-lived but among the sharpest of the post-war era (see Cross and Bergevin 2012). Even if the 2% inflation target has proved to be a durable anchor, observed inflation has been below target roughly half the time since 2005, including all of 2009 and 2013. Inflation returned to the target range beginning in 2018 aided by the strong recovery in the US and rising oil prices. Nevertheless, threats from ongoing trade tensions between the US and other major economies, as well as fears of a slowdown have restrained the amount of monetary policy tightening the Bank of Canada is able or willing to implement.

Prior to 2005 CPI inflation also remained below 2% between 1998 and early 2001. Conventional central banks actions, via changes in a central bank policy rate, became less effective and appeared inoperative once the zero lower bound was reached. Consequently, much of the advanced world adopted unconventional monetary policies. The shift implies emphasis on policies that impact the balance sheet of the central bank.

Canada remained in the eye of the storm that was creating havoc across the industrialized economies. A sound banking system and little bubble-like activity in the housing sector, meant that two direct channels that propagated the financial crisis in the U.S. were absent in Canada. Nevertheless, the Bank of Canada could not avoid the movement of policy rates toward the ZLB. Regardless, the accommodative monetary policy stance still failed to dent the unease about negative spillovers from the deepening U.S. recession; a phenomenon that was apparent throughout the industrial world.

B. Since the GFC: 2008 - 2018

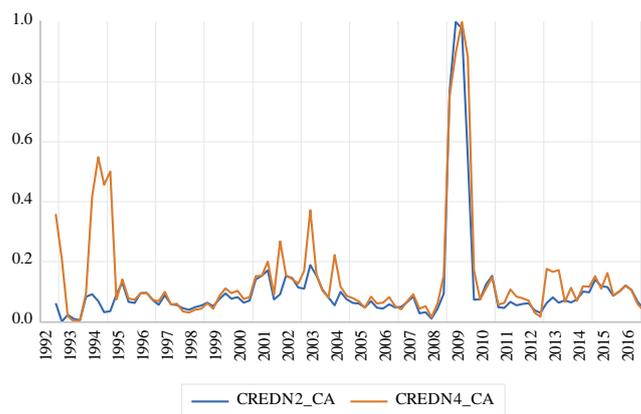
Why, even if Canada's economy was relatively resilient to the sizeable adverse shocks from abroad, could the Canadian economy not fully avoid a recession and the rapid fall in inflation? These events appeared to contradict the intent of the inflation targeting regime which relies crucially on a floating exchange rate regime believed to act as a shock absorber. Consequently, the Bank once again was thrust at the forefront of monetary policy actions when it unveiled its forward guidance policy in April 2009. The aim was to convince the public that the mid-point of the inflation target would not be abandoned and, to underscore its determination to return inflation to its 2% goal, by stating that the policy rate would remain at its ZLB for up to a year. Nevertheless, worried over the possibility that inflationary expectations might become unanchored, the Bank raised the policy rate prior to the expiry date of the CC policy. By some accounts (e.g., Siklos and Spence 2010) the exit was credible. Of course, the CC strategy was modest, took place under crisis conditions, and had a limited horizon.

While the BoC has been a leader in promoting the virtues of forward guidance as a useful tool under crisis conditions (Poloz 2014), to good effect, the central bank appears occasionally incapable of providing clarity about when the economy might return to a state that calls for a more 'normal' monetary policy stance. For example, in the April 2010 MPR, the BoC first sought to justify why monetary policy might remain loose even after signs of inflation and a return to capacity might otherwise have led markets to believe that the policy rate would rise. Unfortunately, the explanation was predicated on an inflation rate below target at a time when observed inflation was above target.

The Bank of Canada has the legal authority and flexibility to act as a lender of last resort through the provision of emergency liquidity assistance or by conducting outright asset purchases. Like other major central banks, the BoC responded to the crisis by significantly extending its lending facilities and aggressively lowering the policy rate. After hitting the zero lower bound on interest rates and worried that the expansionary macroeconomic policies were not sufficient to spark a recovery in the real economy, the BoC used calendar-based conditional commitment to maintain the policy rate at the ZLB. Eventually, the Bank also outlined how it might permit the policy rate to breach the ZLB into negative territory though the possibility has become more remote since the end of the global financial crisis (Bank of Canada 2015) and doubts persist about the effectiveness of monetary policy when the ZLB is reached (Lombardi, Siklos, and St. Amand 2019). Other major central banks were more hesitant in making such commitments, and acted cautiously when they did.

Despite some temporary failures to control inflation or anticipate deflation risks from time to time inflation expectations remain firmly anchored at the 2% inflation target. Hence, there is every reason to believe that the inflation targeting regime has been a credible one. Nevertheless, as the Bank prepares for the next renewal of the monetary policy framework in 2021, there is recognition that more voices are advocating for alternative policy frameworks than at any time since inflation targeting was introduced in Canada almost 30 years ago (Wilkins 2018).

Figure 4. Credibility of the BoC – 1992 - 2017

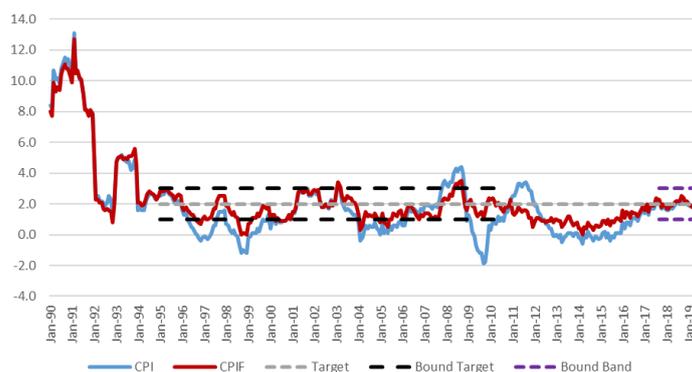


Note: the main body of the text explains how CREDN2 and CREDN4 are estimated.

The measure of credibility identifies only one period of declining credibility for the BoC between 2008 and 2009 which strengthens the argument that Canada’s inflation targeting regime has been mainly a success story. This period coincides with the GFC when, although in Canada the two main channels that caused havoc in the US were absent (unsound financial sector and a burst bubble in the housing market), the BoC was forced to lower its policy rate to the ZLB and start implementing forward guidance. In 2009, inflation eventually was negative and rebounded back to positive variation by 2010.

Sweden: The Inflation Target Regime 1995 - 2018

Figure 5. Inflation – Actual and Target – Sweden (%)



Source: Sweden Statistics, Sveriges Riksbank

A. Before the GFC

After the collapse of Bretton Woods, Sweden, and The Sveriges Riksbank (SRB), followed an inflationary Keynesian full employment policy. It also accommodated both OPEC oil price shocks. In the face of these supply shocks and the inflationary response to them, Sweden was forced to devalue several times. According to Fregert and Jonung (2008) “the nominal anchor in the form of an ex ante fixed exchange rate for the krona quickly lost its ability to anchor long-run expectations ex post...the policy rule from the mid 1970s to the early 1990s has been characterized as a full employment policy rule accompanied by a wage price spiral caused by the use of devaluation to accommodate wage increases”.

In the mid 1980s Sweden adopted a fixed exchange rate to the DM as an irrevocable nominal anchor. Adhering to this policy, once the DBB tightened monetary policy in 1991 led to a serious currency crisis /banking crisis in the fall of 1992 accompanied by a recession with high unemployment. This led the Riksbank to abandon the peg.

In January 1993, after switching to floating exchange rates, the Riksbank adopted an explicit inflation target at 2% (bounded on either side by 1%) to be enforced after January 1995. This policy led to the greatest improvement in inflation credibility in a century measured by the length of wage contract (Fregert and Jonung 2008). The Riksbank began following a flexible inflation targeting regime—allowing supply shocks to affect inflation in the short-run and limiting fluctuations in the output gap. The Riksbank became independent in 1999. Sweden followed the Maastricht criteria of low inflation, fiscal deficits and debt ratios but stayed out of the Exchange Rate Mechanism (ERM). Sweden decided in a referendum in 1992 to not join the euro area when it would start in 1999 and has stayed out ever since. Based on the length of long-term contracts, Fregert and Jonung (2008) find that Sweden had credible

inflation regimes in the Classical gold standard era, during Bretton Woods and during the inflation targeting regimes and possibly in the 1930s price stability rule period. They see the 1940s, 70s and 80s as unstable regimes.

In 2007, the SRB implemented a major change to their monetary policy regime by changing from inflation forecast to interest rate forecast. This policy change, according to Andersson and Jonung (2018), was a result of a recommendation coming from a review to the SRB by Giavizzi and Mishkin. By making public its interest rate forecast, the SRB expected to influence market expectations. However, Andersson and Jonung (2018) argue, citing Goodfriend and King (2016), that this didn't happen and in fact, these forecasts became a major binding constraint for policy makers who were afraid of contradicting such forecasts even if the new available information suggested a different interest rate path.

B. Since the GFC: 2008-2018

The Great Financial Crisis of 2008-2009 was a major challenge for policymakers at the SRB. According to Andersson and Jonung (2008, page 10), this worldwide event "marks the start of a new phase for the Riksbank characterized by crises, uncertainty, continuous changes to both the policy framework and the inflation target".

With the filing for bankruptcy by Lehman Brothers, the confidence of market participants all over advanced economies on the creditworthiness of their counterparties took a major hit. Consequently, funding became extremely scarce and expensive which put in jeopardy financial institutions that had funded themselves earlier through short-term cheap loans. Additionally, greater risk premiums, at the time, diminished the potential impact of conventional monetary policy.

The SRB implemented both conventional and unconventional policies to alleviate the effects of the international crisis on Sweden and, also, on its neighboring countries. With the purpose to improve the workings of financial markets, the SRB started to offer short-term loans in US dollars to Swedish banks by October 2008 and complemented this measure with longer term loans in Swedish Kroner (SEK). Offering loans in US dollars was possible due to an existing stock in foreign currency of the SRB and to the temporary swap lines offered by the Federal Reserve to different central banks at the time.

In terms of monetary policy, the SRB reduced the policy rate to 0.25% by July 2009 and also committed to not increase this rate until Autumn of 2010. Additionally, the SRB offered three different rounds of fixed-rate one-year maturity loans to support monetary policy

between July and November 2009. The total amount of lent by the SRB in both fixed and variable rates reached 9% of GDP.

As argued by Elmér et al. (2012), the purpose of fixed rate loans was to support monetary policy and not to promote financial stability. The effect of this policy should help monetary policy have its intended impact through two channels: liquidity and signaling channels. By increasing the supply of currency in the banking system and reducing bank's cost of financing, market interest rates should fall which should lower lending rates to the private non-financial sector. Additionally, by offering fixed rate loans, the SRB signaled that it was committed to keep the policy rate at this level because if it were to increase it, the SRB would incur in losses with those loans. Elmér et al. (2012) find that this program potentially lowered short-term interest rates in 20 basis points and also had an effect on longer maturities (for example 40 basis points on bonds with maturities up to 2 years) while little to no effect on the exchange rate.

During the second half of 2010, following an improvement in financial markets and an economy growing at 6.1%, the SRB started to implement an exit strategy for the extraordinary measures implemented in the wake of the 2008 crisis. First, it increased its policy rate reaching 1.25% by the end of 2010. Second, it increased the interest rate and shorten the maturities of loans with variables interest rates, and last, it decided not to renew its fixed-interest rate loans, consequently, these loans were smoothly phased out as they were being paid. The final installment of these fixed rate loans was paid in October 2010.

Another major change in Swedish monetary policy occurred in June 2010. The Executive Board of the SRB decided to remove the target range from the monetary policy objective and only leave the 2% inflation target. According to the SRB (2010), the target range was implemented with the purpose to make clear that deviations from the inflation target were very likely and that the SRB would focus on limiting those variations. Yet, after 15 years of implementation of the inflation target regime, the target range had become obsolete since the SRB explained any variation from 2% and expectations seem to remained anchored regardless of inflation being outside or within this range. However, Andersson and Jonung (2018) state that, instead of giving the SRB more flexibility, the removal of what the SRB called the tolerance band caused an increase in the demands to have inflation exactly at 2%.

Following the normalization of the monetary policy stance that started in 2010, the policy rate reached 2% in 2011. Goodfriend and King (2016) argued that rapid recovery of the Swedish economy after the GFC called for the tightening of monetary policy. In fact, by mid-

2011, inflation reached 3.3%. However, these authors also state that the majority of members of the Executive Board of the SRB were overoptimistic and slow to identify the risks coming from the Euro area, and, as a result, the SRB were slow to reduce the policy rate in 2013. The SRB started reducing its policy rate from 2% by the end of 2011 to 1.75% but by the end of 2013 it was only reduced a further 100 basis points to 0.75%.

Additionally, Goodfriend and King (2016) consider that between 2012 and 2013, there were major disagreements within the Executive Board about the policy objectives that the SRB should follow. These authors suggest that *“the majority on the Executive Board were concerned about the impact of rising asset prices and indebtedness on the economy and felt that if no-one else was going to do something about it then they should”* (Goodfriend and King, 2016; page 8). Therefore, the SRB prioritize concerns about financial stability over decisions of monetary policy. This occurred despite the fact that inflation floated around 0% throughout 2013.

Svensson (2014), who was a member of the Executive Board at the SRB until 2013, considered that the potential benefits of using monetary policy to address concerns of financial stability were insignificant with a high cost of too low inflation and higher unemployment. This author used the Swedish case between 2010 and 2014 to study whether inflation targeting should involve some leaning against the wind (LAW). He defines LAW as a policy bias to set monetary policy tighter than what is justified to stabilize inflation and unemployment in order to minimize financial instability risks. Svensson states that the SRB followed a LAW monetary policy since the summer of 2010, based on concerns of high household debt to income levels, this led to inflation way below target and higher unemployment rate than any reasonable long run rate. Svensson (2014) concluded his study of the Swedish case by arguing that monetary policy should not be used to address concerns of financial stability (household debt).

The debate of whether monetary policy was too tight, or not, between 2010 and 2013 gained strength because the Swedish economy started faltering. For Andersson and Jonung (2018), one of the main problems of the monetary policy stance during that period was that the euro area and the Federal Reserve were, at the same time, pursuing expansionary monetary policies. Therefore, given the openness of the Swedish economy, capital started flowing into Sweden appreciating the krona. As a result, the export sector was hurt, inflation fell, economic growth declined and unemployment continued to hit higher levels. GDP declined 0.3% in 2012 and expanded modestly 1.2% the following year.

Ingves (2017), Governor of the SRB since 2006, argues that free capital movement limits the freedom for domestic monetary policy and perceived that it is not possible to have a fully independent monetary policy with free capital movements even when there is a floating exchange rate. For the SRB Governor, it's a dilemma and not a trilemma. Not surprisingly, Ingves (2017) stated that the SRB was motivated to cut the policy rate down to negative levels and to introduce purchases of government bonds by the beginning of 2015. This was in reaction to the expansionary policies pushed forward by the ECB which threatened to make the krona too strong against the euro. In a context where inflation was at -0.3% at the end of 2014 and expectations were declining, Ingves (2017) argued that it was important to offset the effects of the ECB policies and avoid a rapid appreciation of the Krona.

The abrupt shift in the monetary policy stance between 2013 and 2015 from a too tight monetary policy to policy rates in negative territory was made possible by two reforms from the Swedish Government in December of 2013. First, the Government made the Finansinspektionen, the Swedish financial supervisory authority, responsible for financial stability. And second, it established the Financial Stability Council which is a forum where members of the Government, the Finansinspektionen, the Swedish National Debt Office and the SRB get together to "discuss financial stability issues, the need for measures to prevent financial imbalances from building up and, in the event of a financial crisis, the need for crisis measures"⁵¹. Consequently, other authorities were created, different from the SRB, responsible for addressing any concerns about financial imbalances. After these policy decisions by the Government, the SRB made it clear that it would focus solely on reaching the inflation target and a monetary policy aimed at limiting the effects of monetary policies in the United States and the euro began to be implemented (Andersson and Jonung 2018).

From 2016 to 2018, inflation, measured by the CPI, registered an average of 1.6% and finished 2018 at 2%. Despite this surge in inflation, according to the SRB, it is necessary for monetary policy to proceed slowly and remain expansionary for the time being since there are concerns over the strength of inflationary pressures. The policy rate continues to be below 0% and the SRB continues to reinvest principal payments and coupons on government bonds.

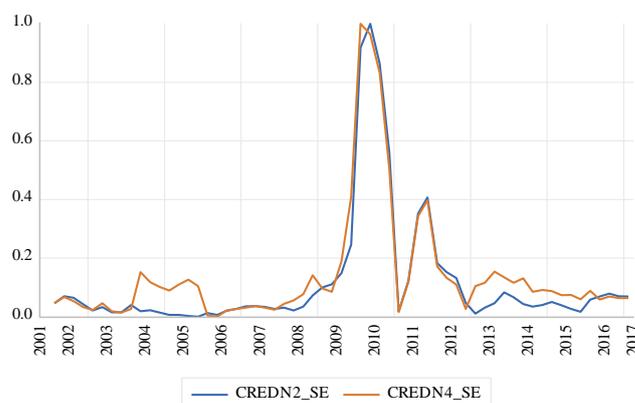
Moreover, the SRB decided to make a third change to its monetary targeting regime in September 2017. The SRB decided to reintroduce the tolerance band of +/- 1% to the inflation target. However, this band is a guide and should not be interpreted as an inflation target range. More importantly, the SRB decided to change the official price index from the

⁵¹ <http://www.sou.gov.se/finansiella-stabilitetsradet/english-version/>

Consumer Price Index - CPI to the Consumer Price Index with fixed interest rate - CPIF. This change was necessary, according to the SRB, because changes in the policy rate not only impacts directly the CPI but it does so in the opposite direction than the one intended by the policy. The CPIF index is not affected by changes in the policy rate since it is measured with a fixed interest rate. According to Andersson and Jonung (2018), these changes were the response of the SRB to the phenomenon that, after the introduction of interest rate forecast and the elimination of the target range in 2010, monetary policy was treated as an exact science by the public which meant that any deviation of inflation from its target was perceived as an intentional decision of the SNB.

It is worth mentioning that, even though the SRB began to focus monetary policy solely on achieving the inflation target since the end of 2013, it was still aware of the financial imbalances that the expansionary monetary policy was creating. In Ingves (2017), the Governor called for a clarification of the responsibility of the SRB for financial stability, and, in fact, it has been arguing that the Sveriges Riksbank Act should explicitly include financial stability as one of the bank's responsibilities. From the Governor's perspective, monetary policy and financial stability are too closely linked to make a division between them, thus, it would be appropriate for the SRB to have the main responsibility over macroprudential policy instead of the Finansinspektionen.

Figure 6. Credibility of the SRB – 2001 - 2017



Note: the main body of the text explains how CREDN2 and CREDN4 are estimated.

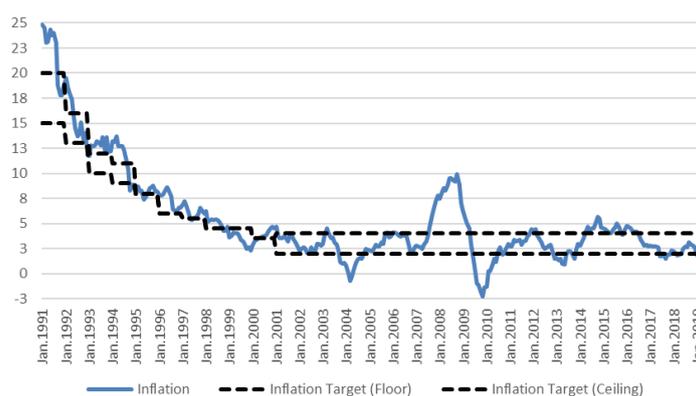
The credibility measure of the SRB signals two periods when this central bank suffered from a loss in credibility. The first was between 2008 and 2010 which coincides with the GFC. The SRB reduced of policy rate to, almost, zero percent and offered different liquidity facilities to assure the stability and the well-functioning of the financial system. Although it did not implement a large asset purchase program at this time, it did offer fixed rate loans in Krona to push interest rates lower beyond the limits of the zero lower bound. However, it is worth

mentioning that right before the crisis the SRB decided to implement an interest rate forecast communication policy and in 2010 it decided to eliminate the target range as it was considered to be obsolete. Andersson and Jonung (2018) argue that both of these changes made monetary policy more difficult as it confused markets and restrained policy makers.

The second period began in 2011 and continued to 2017. This period is characterized by two different phases. In the first phase (2011-2013), Svensson (2014) argued that the SRB implemented a LAW monetary policy favoring financial stability more than achieving the inflation target. As a result, inflation fell to close to 0% and even in some months registering negative variations. From 2014 to 2017, the SRB has implemented an expansionary monetary policy by reducing the policy rate below to 0% and began a government bond purchases program. Inflation picked up and reached the 2% target by mid-2017.

Chile: The Inflation Target Regime 1991-2018

Figure 7. Inflation – Actual and Target – Chile (%)



Source: Banco Central de Chile

A. Before the GFC

The Banco Central de Chile (BCC) was granted full goal and instrument independence from the government with the constitutional amendment of 1989. The BCC was then charged with the stability of the currency and the payments system. The choice of nominal anchor was the inflation rate itself, leaving Chile at the vanguard of the inflation targeting strategy (second after New Zealand). The first inflation target was announced in 1990 to be met at the end of 1991 defined as a range of between 15% and 20%. In time, the exchange rate regime became increasingly flexible and the exchange rate band became wide enough so as to accommodate external shocks to a certain extent. However, in the first years under the IT regime, the credibility of the BCC policies was less than perfect. A combination of an

incomplete adoption of the IT framework and the effective pursuit of two goals (inflation and the exchange rate band) with one instrument (the interest rate) may be responsible for this initial lack of credibility. Evidence of this can be found in the exchange rate-to-inflation pass-through coefficient, which remained high for the most part of the 1990s (Garcia and Restrepo 2001; Bravo and Garcia 2002). Thus, throughout the first decade of BCC operation, monetary policy was conditioned by the central bank's intervention in the foreign exchange market; a number of discretionary changes in the width of the exchange rate band were necessary while the capital inflows surge of the early 1990s resulted in a sharp real appreciation and a four-fold increase in central bank's foreign reserves between 1990 and 1994 (see Calvo, Leiderman and Reinhart, 1996). It should be stressed, however, that such strong appreciation of the peso actually contributed to the initial success of BCC in bringing down inflation almost monotonically throughout the 1990s (for evidence, see, e.g., Corbo, 1998).

The Asian crisis and the subsequent Russian default brought substantial turmoil to Latin American countries and the Chilean peso depreciated significantly (30% between 1997 and 1999). In September 1999, the exchange rate band was finally dismantled and the peso was allowed to float. With this major policy shift began what De Gregorio, Tokman and Valdes (2005) call Chile's experience with a full-fledged IT strategy. This new policy environment included a public announcement of a long-term inflation target range – between 2% and 4%– and foreign exchange intervention only under extraordinary circumstances (to be materialized in 2001 and 2002).

By 2001, and due to the systematic fall in inflation and indexation, the BCC was in a position to begin using the nominal interest rate as the main policy instrument. More formal measures of success and credibility of the central bank's strategy can be found as well. Landerretche, Morande, and Schmidt-Hebbel (1999) show that one-year-ahead (model-based) inflation forecasts made before the announcement of the inflation target each year have systematically overstated actual inflation. In other words, the announcement of a target has helped correct inflation forecasts which in turn contributes to anchoring actual inflation.

Another strategy to assess the credibility of the BCC is followed by Cespedes and Soto (2005, 2007). These authors formally show that when credibility is low, the policy tradeoffs are more pronounced (e.g., higher "sacrifice ratio") and the central bank would be less aggressive in implementing its monetary policy in order to avoid large output losses. In the case of Chile, these papers provide evidence that the monetary policy rule has become more

forward-looking in terms of inflation and more aggressive in fighting deviations of inflation from the target. Inflation expectations as measured by survey data further reinforce this idea that BCC has been building credibility during the two decades under an IT regime. In fact, until 2002, expected inflation was systematically above the midpoint of the target (except in 1999) but had fallen below the midpoint of the target ever since (see Figure 7). Cespedes and Soto (2007) also point out the market for nominal instruments, which had existed in Chile for decades, only began flourishing at the turn of the century once the central bank was perceived to have inflation under control and started using the nominal interest rate as its main instrument.

B. Since the GFC: 2008-2018

Under the IT regime of the BCC, the policy goal is for forecast inflation to lie within 1 pp of 3% in the following two years.

According to the BCC, monetary policy should be guided towards assuring that expected inflation for the following two years lands within 1 percentage point of 3%. At the end of 2003, the BCC expected that inflation two years ahead would be around 3% while the market expected inflation to land below 2%. Facing the danger of unanchored expectations, the BCC decided to reduce the policy rate. Eventually, two-year market expectations returned within the acceptable target range by mid-2004.

In 2007, inflation finished the year at 7.8%, way above the acceptable target range (2%-4%). The BCC argued that this result was driven by high food prices (high world food prices and negative local supply shock on agricultural goods due to “heladas”), unexpected increases in the price of fuel, due to higher oil price, and in the price of electricity. Even though, inflation market expectations remained close to 3% in the long run, the BCC decided to increase the policy rate at the last meeting of the year to reaffirm its commitment with the 3% inflation target.

As for most countries in the region, 2008 was a challenging year for Chile. During the first nine months of the year, the BCC focused on increasing the policy rate as a response to inflation above its target, however, the policy stance had to change with the beginning of the GFC. The financial crisis in advanced economies pushed down the price of oil and copper. The latter, in particular, was relevant for Chile since it is its most important exported good and, thus, the economy suffered a negative shock on its terms of trade. Moreover, the domestic economy suffered from worse credit conditions and a surge in agents’ pessimism.

However, at the same time by the end of 2008, inflation remained way above the inflation target range at 7.1%. The economy slowed down from 5% to 3.5% between 2007 and 2008, and by December, it was expected to slow down even further to 2% in 2009. Consequently, considering that the inflationary forces were destined to subside in 2009 and inflation would converge to 3%, the local economy needed active fiscal and monetary policy to face the challenges caused by the GFC, the BCC started a reduction in its policy rate in September which finished by mid-2009. During this phase of expansionary monetary policy, the rate fell from 8.25% to 0.50%.

The year 2009 was worse than what the BCC initially expected. Inflation fell drastically and reached negative ground by August while economic activity suffered from a strong reduction in inventories which drove the economy to a contraction of 1.6% during 2009. For the BCC, the fall in inflation was mainly the result of two coinciding forces: the weaker domestic demand and the quick pass-through of lower international prices to domestic prices. Unlike previous crises, the exchange rate didn't depreciate as much and, therefore, inflation wasn't favored by higher prices of imported goods. As a monetary landmark, the BCC started to use forward guidance by committing itself to leave the policy rate unchanged at 0.50%, at least, until the second quarter of 2010. Additionally, the BCC, by mid-2009, gave access to financial institutions to a short-term liquidity facility (Facilidad de liquidez a Plazo – FLAP) that provided funds at a rate of 0.5% with maturities of 90 and 180 days. The purpose of this facility was to increase the speed of the effect of the low policy rate on short-term market rates given that the policy had basically reached its ZLB.

2010 was a year of recovery. Economic growth jumped to 5.8% and inflation pushed up to positive ground finishing the year at 2.9%. The recovery was driven by an increase in the international price of copper that pushed up Chile's terms of trade 20%, the decline in uncertainty that had frozen agents' expenditure during the previous year, the rebuilding after the earthquake of February 2010 and the implementation of monetary policies in advanced economies that drove capital flows to emerging markets. The good momentum of inflation and the economy allowed the BCC to reduce the monetary push; by mid-2010, it started increasing the policy rate from 0.5% and finished the year at 3.25%.

During 2011, the BCC continued to normalize the monetary stance with five increases of the policy rate during the first half of the year. For the second half, the BCC took a precautionary stance given that the economy continued to show a good performance, inflation was expected to fall within the acceptable range (2%-4%) but the uncertainty regarding the situation of the eurozone increased. Nevertheless, inflation finished above the target range

at 4.4%, a result explained by the performance of the prices of transport and fruits and vegetables. The supply of the latter was negatively affected by weather conditions.

At the beginning of 2012, the BCC reduced by 25 basis points the policy rate as a preventive measure against the potential set back to the economy brought by the difficult situation in the eurozone. This decision was made despite the fact that inflation was, at the moment, above the target range. However, the BCC believed that inflation would converge back to 3% by mid-year. In fact, inflation finished 2012 below the target range at 1.5%. This inflation result was driven by a positive supply shock to fruit and vegetables, and the high prices observed in 2011 (high base).

During 2013, inflation remained most of the year below the 2% mark but managed to reach 3% by December. The lackluster performance of inflation is explained by lower international prices of fuel, according to the BCC.

2014 was an interesting year for Chilean monetary policy because it combined an unexpected rising inflation with a slowing down in economic activity. Inflation results throughout the year were higher than expected due to a stronger pass-through of a depreciated exchange rate and the rise in fruit and vegetable prices. However, economic activity slowed down dramatically and pessimism among agents increased. Throughout the year, the BCC reduced the policy rate 150 basis points down to 3%. This monetary push was supposed to help the economy and was considered not to put in danger the convergence of inflation to 3% in 2015. Inflation finished the year at 4.7% and the economy exhibited a mediocre growth of 1.7%.

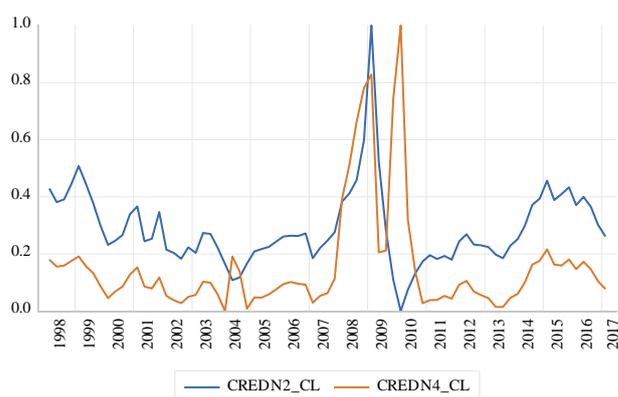
Inflation levels, during 2015, turned out to be more persistent than expected. This persistence was explained by the consistent depreciation of the exchange rate and by a resilient labor market despite the poor performance of the economy. Inflation finished the year, again, above the target range at 4.5%. Consequently, the BCC started to reduce the monetary stimulus in October since the policy rate could put in danger inflation's convergence or un-anchor expectations.

Inflation finally started to subside in 2016 as a consequence of the appreciation of the exchange rate. In fact, the inflationary forces were so weak by the last quarter of the year that discussions at the BCC were whether to stay put with the policy rate or reduce it because of the probability of inflation falling below the acceptable target range. Inflation ended this year at 2.7% and economic performance remained weak at 1.7%.

Low inflation levels continued to be observed during 2017. This persistence was explained again by the effect of the pass-through of the exchange rate. Economic performance continued to be subpar, and the BCC decided to reduce the policy rate 100 basis points during the first half of the year.

According to our measure of credibility of the BCC, two periods can be clearly identified of decreasing credibility since 1998. The first happened between 2007 and 2010. During this period, inflation registered above the target range due to world food prices and the oil price. In 2008, inflation ended at 7.1% but the BCC started to reduce the policy rate in October of that year given the potential negative effects of the GFC. In 2009, inflation dropped dramatically to negative ground and the policy rate finished closed to 0%. The BCC did not expect such an economic downturn. The economic recovery during 2010 pushed inflation back to the target range.

Figure 8. Credibility of the BCC – 1998 - 2017

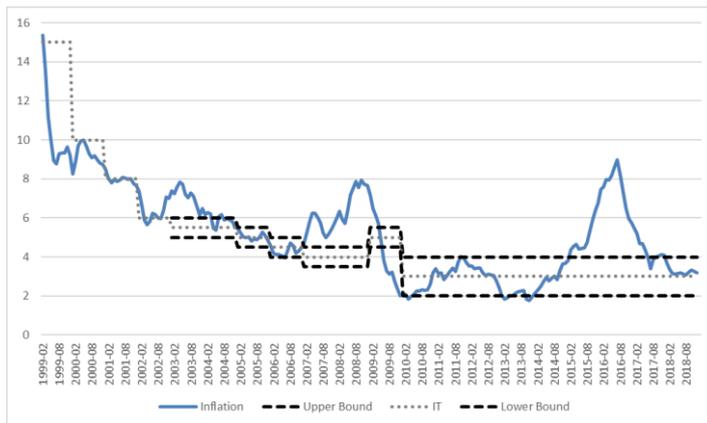


Note: the main body of the text explains how CREDN2 and CREDN4 are estimated.

The second period starts in 2014 and can be characterized by the fall of the international price of copper. This shock depreciated the exchange rate which caused inflation to increase above the target range. The BCC initially expected this inflationary pressure to be less persistent and reduced the policy rate to boost a slowing down economy. However, the depreciation was more persistent than expected. Only until the end of 2015, the BCC started to increase the policy rate as a response to a high inflation. The CPI variation fell once the exchange rate started to appreciate.

Colombia – The Inflation Targeting Regime: 1999-2018

Figure 9. Inflation – Actual and Target – Colombia (%)



Source: Banco de la República

A. Before the GFC

The roots of the IT strategy in Colombia can be traced back to 1991, when a new constitution was drafted reinstating the Banco de la República (BR), Colombia's central Bank, as the sole authority in charge of monetary control. After almost three decades of government-run monetary policy, the constitution formally made BR an autonomous agency with full operational independence and an explicit mandate to maintaining price stability.

Although an inflation target was announced by the BR for the first time in 1991, monetary policy didn't jump immediately to a pure IT regime. For almost 25 years before 1991, Colombia implemented a crawling peg as its exchange rate regime, and mostly political constraints wouldn't let the BR implement a full-flexible exchange rate regime (Urrutia et al., 2014).

With the financial turmoil of 1998 and 1999, the central bank had to intervene repeatedly in the foreign exchange market and the currency band was adjusted upwards twice while the band itself was widened once. Eventually, the central bank was forced to let the currency float amidst large capital outflows and the most severe economic recession that Colombia has experienced since the 1930s which in turn called for IMF assistance and the beginning of a stand-by program.

Once the currency was allowed to float, the last requirement for a full-fledged IT strategy – which BR announced in 1999– was met and the central bank was finally able to set its monetary policy stance by using a single instrument: the interest rate or policy rate.

With the recession at the turn of the century, inflation fell steeply down to a single digit and contributed to breaking inertia in both actual inflation and, more importantly, expectations. This in turn allowed BR to reduce its inflation target from 15% in 1999 to 10% in 2000 and 6% in 2002.

From 2003 to 2006, the BR managed to reduce the inflation target as inflation seemed under control. However, throughout 2007, Colombia experienced inflationary pressures that drove the BR to increase the policy rate in seven different occasions. Despite these efforts, inflation finished the year at 5.7%, more than 100 percentage points above the inflation target rate for the year (3.5%-4.5%). The Central Bank argued that inflation missed the target mostly due to a transitory increase in inflation of food prices and regulated prices which are not as sensitive to monetary policy changes as other prices.

Inflation also missed BR's target (3.5%-4.5%) in 2008 finishing at 7.7%, a result that exhibited an acceleration in inflation relative to the previous year. This result came as consequence of high oil and food prices, especially during the first three quarter of the year. After the Lehman Brothers crisis and with the fall of the price of oil, food price inflation in Colombia didn't subside mostly because of the simultaneous depreciation of the exchange rate that compensated the plummeting oil price. To this scenario, the BR answered by augmenting the policy rate two times during the first half of the year but reverted this decision during the last meeting of the year due to a slowing down of economic activity and the uncertainty around the world economy which should reduce inflationary pressures for 2009.

Nevertheless, in November of 2008, the BR also decided to increase the inflation target range for 2009 from 3.5%-4.5% to 4.5%-5.5%. This change, according to the BR, was justified by the strong increase in food prices and regulated prices, a trend observed worldwide during 2008, which deviated inflation from its target. The BR additionally argued that this decision was consistent with the long run goal of a 3% inflation target. Although, at the time, the BR expected that inflation would subside in 2009, it clearly didn't think that it would fall back to the initial target rate, hence, it increased it in order to potentially prevent a third year in a row of missing the target.

B. Since the GFC: 2008-2009

In 2009, inflation dropped dramatically and finished the year at 2%. This fall was driven by a reduction in food and regulated prices and it allowed the Central Bank to implement an expansionary monetary policy by reducing the policy rate by 600 basis points throughout the year. The Central Bank argued that this decreasing trend in the policy rate should boost economic activity amid a world of falling inflation. It should be mentioned that, beyond the consequences on Colombia's economic activity of the recessions experienced by advanced economies, the country was also experiencing the shock of the end of trading relationships with Venezuela which, up to that point, was Colombia's biggest trading partner. Despite

these negative shocks, the Colombian economy showed resilience and still managed to grow 1.2% in 2009.

At the end of 2009, the BR updated the inflation target range one more time to 2%-4%, which they denoted as the long-run inflation target range. This was the last time the inflation target was changed until now.

Between 2010 and 2014, inflation basically registered within the long-run target range. This, together with improving economic performance, allowed the BR to normalize its monetary stance by the start of 2012. However, this would not last since fears over the domestic economy due to the euro sovereign crisis and the slowdown exhibited in the US and some EM economies, plus downward inflationary pressures, drove the BR to start reducing its policy rate by the second half of 2012.

In 2014, inflation ended the year within the target range at 3.66%. Additionally, the economy overperformed other economies in the region during most of the year, according to the Central Bank, due to the expansionary monetary and fiscal policy stance, and the good behavior of housing construction. This momentum allowed the Central Bank to seek a more neutral monetary policy stance with 5 increases through the year that added up 100 basis points to the policy rate.

However, the decline of the oil price in international markets that started in August 2014 was a major landmark for the Colombian economy. By the end of 2014, the price of oil had fall more than 50% relative to what was registered by June of the same year. Although the Central Bank acknowledged the potential negative effects on the Colombian economy of a lower oil price (lower exports, lower government income, lower FDI and lower terms of trade), it expected that other variables such as the depreciation of the exchange rate and the construction sector would offset these effects and the economy would grow 3.6% in 2015. Likewise, it expected that inflation would remain in the upper tier during the first half of 2015 and it would converge towards 3% during the second semester. This forecast was based on the idea that the depreciation of the exchange rate which affects tradable goods mostly would be offset by a lower oil price that reduces the cost of intermediate goods and aggregate demand shouldn't exceed the productive capacity of the economy.

However, BR expectations were not accurate. In 2015, inflation finished at 6.8% with the average of different measures of basic inflation at 5.4%. This result, according to the BR, was mainly explained by the pass-through of the exchange rate, which was higher and more persistent relative to historical standards, and a negative shock of the supply of agricultural

goods due to an extremely dry season. At this moment, the BR expected inflation to start converging back to 3% by mid-2016 and reach this level in 2017. However, implicit market expectations remained above 4.5% for government bonds with maturities over 5 years. Consequently, the Central Bank increased the policy rate by 125 basis points during the last quarter of 2015.

During the first half of 2016, inflation continued to rise and broke the ceiling of 8%. Again, this surge in prices was explained by the extreme dry season that Colombia experienced during that time and the depreciation of the exchange rate. This increase in inflation, although produced by temporary factors, pushed up market inflation expectations which drove the Central Bank to continuously increase its policy rate during the first half of 2016 (155 basis points). Inflationary pressures ceased partially during the second half of the year and the consumer price index increased 5.75% during 2016.

Although market inflation expectations remained above 3% and the inflation convergence process had been slower than expected, the BR considered to reduce its policy rate in the last meeting of the year (by 25 basis points) due to a slower than expected adjustment of the local economy to the 2014 oil shock, greater uncertainty around the world economy, and the belief that inflationary pressures that pushed inflation above target had ceased.

During 2017, the BR reduced the policy rate 275 basis points down to 4.75%, even though the convergence process of inflation towards the target range was slower than expected. This policy decision was driven by a more than expected slowdown of domestic economic activity. According to the Central Bank, there was a high risk that economic activity would grow lower than what could be expected after the oil shock of 2014. Households had to absorb the negative shock of an increase in VAT from 16% to 20% which reduced their expenditure. The tax reform was necessary, according to the Government, to maintain Colombia's fiscal sustainability and to continue to satisfy the fiscal rule which establishes a decreasing upper bound path for the fiscal deficit (1% of GDB by 2021). Inflation finished the year at 4.1%, again above the inflation target range, although only slightly this time.

In 2018, inflation, at 3.2%, finished the year within the target inflation rate for the first time in three years. The policy rate was further reduced 50 basis points at the beginning of the year due to a lackluster performance of the economy. It has remained at 4.25% since then, a point that is considered to be slightly expansionary by the BR.

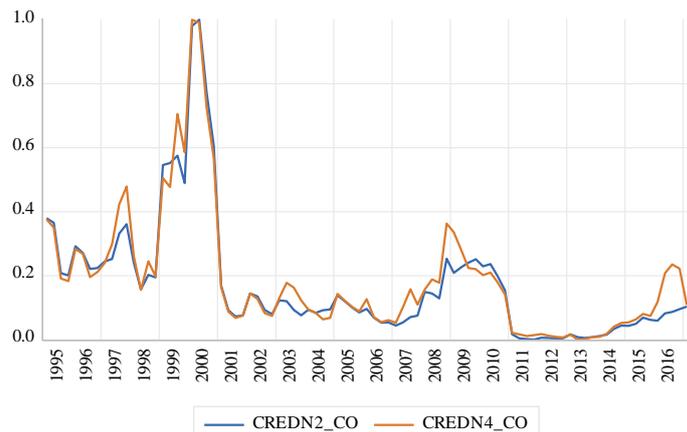
Although the BR officially let the exchange rate float back in 1999, which would supposedly lead to the implementation of a pure IT regime scheme, FX interventions have been a policy

tool more than seldomly used between 1999 and 2019. In fact, during this period, the BR bought USD 43.2 billion in the market with the stock of foreign reserves increasing from USD 8 billion to USD 52 billion.

The BR argues that its intervention policy satisfies three objectives: i) increase the stock of foreign reserves to reduce domestic vulnerability and facilitate access to foreign financial markets, ii) mitigate exchange rate movements that don't reflect the behavior of fundamentals and could negatively affect inflation and economic activity, and iii) moderate sudden and persistent movements of the exchange rate with respect to its tendency with the objective to avoid disorderly behavior in financial markets. However, according to Urrutia et al. (2014), even though the BR has never stated an explicit exchange rate target, interventions have often been stepped up when there were perceived FX misalignments and strong political pressure from groups of interest and even the government to intervene, suggesting that the exchange rate could be part of the policy reaction function. This argument is strengthened by the fact that FX interventions were more likely to occur during periods of a stronger peso.

The relevant question is whether these FX interventions have put in danger the inflation targeting regime. The best answer to this question is that most likely it hasn't. First, explicit guidelines of BR's intervention policy indicate that the BR's goal is inflation targeting. Second, FX interventions are sterilized which means that every purchase is offset so that the effect on the monetary supply is neutral. This is done so the policy rate doesn't deviate from the level determined by the BR. Third, Urrutia et al (2014) find that FX interventions have not induced agents to believe that there is a de-facto fixed exchange rate regime in Colombia. And, finally, as it is explained below, the periods where the BR's has lost credibility can be explained by exogenous shocks to the Colombian economy and not by periods with FX interventions.

Figure 10. Credibility of the BR – 1996 -2018



Note: the main body of the text explains how CREDN2 and CREDN4 are estimated.

According to the measure of credibility of the BR, there are three periods where the BR has suffered from a decreased on this gauge. The first is between 1999 and 2000 which coincides with a severe economic crisis that affected the financial sector (mortgage market) and caused the end of the currency band (crawling peg) exchange rate regime in Colombia and the start of a full inflation targeting regime.

The second period is between 2007 and 2010 when inflation finished above the target due to high world food and oil prices. For 2009, the BR changed upwards the inflation target range with the expectation to meet the target as it thought that inflation would finish between 4.5% and 5.5%. Yet, due to the Great Financial Crisis, inflation fell to 2%.

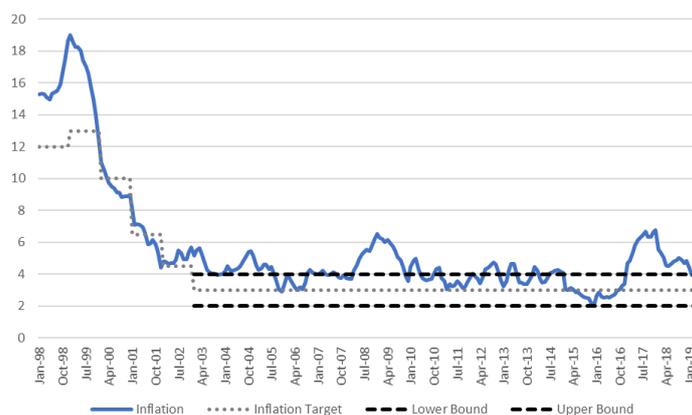
And the third period started in 2014 and continues to the present. This period is marked by the extreme drop in the price of oil that started mid 2014 which had severe effects on the Colombian economy. Oil represented more than 50% of exports, around 25% of government's income, and most of the FDI was directed to this sector. This shock caused an excessive depreciation of the exchange rate (21% in 2014 and 38.4% in 2015) which, together with a negative supply shock of agricultural goods caused by an extreme dry season, pushed inflation above the target range for three years (2015, 2016, and 2017). Initially, the BR increased the policy rate to anchor expectations around the long run inflation target (3%), however, by the end of 2016, it started to reduce the policy rate in order to boost the economy which was failing to adjust quickly to the new reality following the oil shock of 2014.

Another insight that comes from our credibility measure is that the average level of this index has been lower during the implementation of the inflation targeting regime with a flexible exchange rate (post 1999) than during the period where the inflation targeting

regime was implemented together with a currency band for the exchange rate. This result is in line with Reviez (2002) who argued that during this time the formation of inflation expectations was difficult due to the existence of a multiplicity of targets.

Mexico: The Inflation Target Regime 1991-2018

Figure 11. Inflation – Actual and Target – Mexico (%)



Source: Banco de Mexico

A. Before the GFC

A major enhancement to the credibility of Mexican monetary policy came in 1993, when Article 28 of the Constitution was amended to grant full administrative and operational autonomy to the Banco de Mexico (BM), as well as an explicit mandate to guard purchasing power. With the introduction of these changes in the Bank’s workings and scope, the period after 1993 is characterized by Turrent-Diaz (2007) as one of “institutional” central bank autonomy, where independence is rooted on solid legal and constitutional grounds, as well as on a widespread popular support.

After only three years of relative stability and falling inflation rates, the Tequila crisis put the central bank to the test once again. The years of large capital inflows and high private and public spending gave way to several months of severe financial distress. While the short maturity of dollar denominated debt was at the heart of the debt crisis, it was the capital flows reversal which exposed the conflict between the Central Bank’s exchange rate policy, currency band, and its low-and-stable inflation goal (the “tri-lemma” of international finance). As the need for a large exchange rate adjustment grew, the credibility of both policies was heavily undermined, which ultimately led to a currency crisis and a bout of inflation, with the exchange rate depreciating more than 100% in December 1994 and annual inflation reaching over 40% in early 1995 (Carstens and Werner 2000). These

developments forced the Mexican authorities to pursue a rapid transition toward a floating exchange rate regime and a monetary regime based solely on price stability.

The need to rehabilitate the much-damaged central bank credibility in the face of a depreciation-fueled inflation spike can help explain why short-term interest rates continued to rise substantially even after abandoning the currency band. However, regaining credibility in the monetary policy strategy would require a combination of increasing monetary control and the leadership of Guillermo Ortiz Martínez, the technocrat with a sterling reputation who had weathered the 1994-1995 crisis as Finance Secretary.

Once the Peso was allowed to float, the central bank could finally adopt an inflation targeting (IT) approach in 1996, first as an internal strategy and finally as a public commitment in 2001 by establishing that the inflation target starting in 2003 was 3% with a tolerance band of 1 percentage point of width. The bank also drifted away from its quantity-based instrument approach (reserve requirements) and into a price-based instrument such as short-term interest rates in the way modern central banks set the monetary policy stance.

From the start of the implementation of the fully-fledged IT regime in Mexico up to 2007, the BM was mostly successful in controlling inflation. The growth of consumer prices hovered close to the upper range of the inflation target (4%) except for 2004 when inflation finished above the target at 5.2%. The year of 2004 was a year when the world economy grew at its highest rate since the 1970's, favoring the recovery of economic activity after the dot-com bubble. This world trend favored economic activity in Mexico as well but, at the same time, created inflationary pressures. According to the BM, prices were pushed upwards by two exogenous shocks. The first was increased international prices of different commodities as result of the overperformance of countries, like China, that are characterized for an intensive use of metals and energy. Additionally, a second factor that drove inflation above its target was generated by adverse weather conditions both in Mexico and in the US which reduced the supply of agricultural goods.

B. Since the GFC: 2008-2018

Similar to other countries in the region, 2008 and 2009 were challenging years for Mexico. Inflation increased consistently month to month throughout 2008 and finished way above target at 6.5%. According to the BM, this upward trend during the first half of the year is explained by significant increases in the international prices of food, metals and energy

commodities whereas, during the second half of the year, inflation surged due to the depreciation of the Mexican peso after the fall of Lehman Brothers.

Following the behavior of inflation, the BM increased the policy rate between June and August by 75 basis points to maintain inflation expectations anchored to the inflation target. However, unlike other central banks in the region, it didn't switch to an expansionary monetary policy stance during the last months of the year to offset the consequences of the GFC, instead it decided to keep the policy rate at 8.25%.

Nevertheless, the BM did take measures after the fall of Lehman Brothers to improve the conditions of the foreign exchange market which was highly volatile and showing signs of illiquidity. First, the BM implemented daily bids through which were offered USD 400 million. Similarly, the BM satisfied exceptional demands for foreign currency during October of 2008 through extraordinary bids. Finally, the BM agreed with the Federal Reserve to establish a swap line for up to USD 30 billion, to calm investors that were concerned that the BM was depleting its stock of foreign reserves to fast.

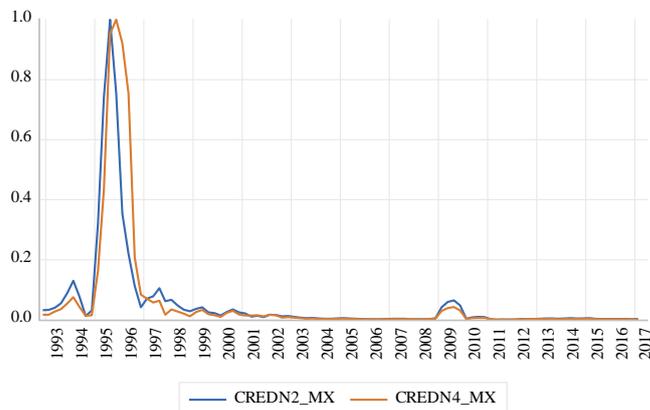
In 2009, the Mexican economy suffered a contraction of 6.5%, similar to the one experienced in 1995 during the Tequila Crisis (6.2%). This poor performance was a direct consequence of a weak demand for Mexican manufactured goods, specially from the US. Additionally, the domestic economy also was negatively impacted by the surge in cases of the A(H1N1) virus. To help the economy, the Mexican government implemented an active fiscal policy by increasing expenditure, and the BM reduced the policy rate in 375 basis points and it reached an additional agreement with the IMF to increase the available sources for international liquidity for the domestic economy. In turn, inflation exhibited a downward trend throughout the year and finished within the target range at 3.57%. This reduction in the variation of prices was possible, in spite of the depreciation of the exchange rate, due to a government policy to reduce and freeze regulated energy prices and the end of the inflationary pressure experienced in 2008.

From 2010 to 2014, inflation behaved similarly as it did pre-GFC as it floated around 4%. However, during 2015 and most of 2016, inflation lay in the lower part of the target range. Inflation was driven below the 3% target by moderate economic activity growth and the reduction in prices of raw materials, energy services and telecommunication services.

Inflation picked up after the election of Donald Trump as US President in November 2016. This event generated great uncertainty regarding the future bilateral relationship between the US and Mexico because Trump ran a campaign based on anti-immigration and

renegotiating the NAFTA trade agreement. As a result, the Mexican peso depreciated driving inflation upwards. Additionally, at the same time, fuel, gas, transport and some agricultural prices increased. In response, the BM increased its policy rate in order to avoid first and second order effects on inflation.

Figure 12. Credibility of the BM – 1993 - 2017



Note: the main body of the text explains how CREDN2 and CREDN4 are estimated.

All in all, the most recent monetary regime (IT) has enjoyed widespread success. For one, there is ample evidence that the exchange pass-through has dropped significantly under the new regime (Cortes 2013), at least until this last period after the election of Donald Trump. This has reinforced the central bank’s instrument independence and has made credible announcements that priority is given to price stability and not exchange rate targeting. Indirect evidence of such credibility can be found in the systematic efforts by the corporate sector to reduce their foreign currency debt in the expectation that, when pressed, the central bank will rather concentrate on inflation than defend any hypothetical exchange rate level (Martinez and Werner, 2002). Similarly, several characterizations of inflation through its time-series properties portray the process as non-stationary before the year 2000, but stationary thereafter (Chiquiar et al. 2010), reflecting the fact that the announcement of inflation targets has served as an effective (credible) nominal anchor.

A final piece of evidence suggestive of the relatively high credibility of Banco de Mexico’s policies, at least before the Great Financial Crisis, is reflected in the backward/forward looking nature of price setting by firms (which also embeds the outcomes of wage bargaining). Ramos-Francia and Torres (2006) provide conclusive evidence that after 1997, the gradual fall in inflation has resulted in firms adjusting their prices less frequently and becoming more forward-looking (than in the years prior to 1997) in their price setting-behavior.

The success of the IT regime can be seen in the credibility measure of the BM. Note that this measure has remained at zero since the start of the fully-fledged IT regime except for a small blip during the GFC.

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APPENDIX II:
OTHER RESULTS & IT AROUND THE WORLD

COUNTRY/ECONOMY

<i>COUNTRIES AND ISO CODES</i>	NAME
AR	ARGENTINA
AU	AUSTRALIA
BR	BRAZIL
CA	CANADA
CL	CHILE
CN	CHINA
CO	COLOMBIA
CZ	CZECH REPUBLIC
EZ	EURO AREA
GB	UNITED KINGDOM
HU	HUNGARY
ID	INDONESIA
IL	ISRAEL
IN	INDIA
JP	JAPAN
KR	KOREA
MX	MEXICO
MY	MALAYSIA
NO	NORWAY
NZ	NEW ZEALAND
PE	PERU
PH	PHILLIPINES
PL	POLAND
RU	RUSSIA
SE	SWEDEN
TH	THAILAND
TR	TURKEY
US	UNITED STATES OF AMERICA
ZA	SOUTH AFRICA

NOTE: HIGHLIGHTED COUNTRIES/ECONOMIES BELONG TO THE ADVANCED ECONOMIES (AE) GROUP AS OF 2019. ALL OTHERS ARE CLASSIFIED AS EMERGING MARKET ECONOMIES (EME).

NOTES ABOUT THE DATA

CERTAIN PERIODS OF VERY HIGH INFLATION (I.E., INFLATION ABOVE 75% WERE EXCLUDED FROM STATISTICAL TESTING AND PLOTS.

BR: 1981Q1-1995Q2

RU: 1993Q1-1996Q1

IL: 1980Q1-1986Q1

PE: 1983Q1-1986Q1 & 1987Q3-1992Q2

PL: 1982Q1-1982Q4 & 1989Q1-1991Q2

MX: 1982Q4-1983Q4 & 1986Q2-1988Q3

TR: 1980Q1-1980Q4, 1992Q1, 1994Q2-1998Q3

DATA INFORMATION AND SERIES DEFINITIONS

<i>VARIABLES DEFINITION</i>			
<i>VARIABLE NAME</i>	<i>DESCRIPTION</i>	<i>SOURCE(S)</i>	<i>MORE DETAILS / DESCRIPTION IN SOURCE</i>
BCPT	BUSINESS CYCLE PEAKS AND TROUGH <i>BUSINESS_CYCLE</i>	NBER, CEPR, ECRI	HTTPS://WWW.NBER.ORG/CYCLES.HTML (FOR USA DATA) ; HTTPS://CEPR.ORG/DATA (FOR EURO AREA DATA) ; HTTPS://WWW.BUSINESSCYCLE.COM/ECRI-BUSINESS-CYCLES/INTERNATIONAL-BUSINESS-CYCLE-DATES-CHRONOLOGIES (FOR SOME SELECTED COUNTRIES)
CA	CURRENT ACCOUNT BALANCE <i>CURRENT_ACCOUNT</i>	IFS	BALANCE OF PAYMENTS, CURRENT ACCOUNT, GOODS AND SERVICES, GOODS, NET, MILLION US DOLLARS
CB	CENTRAL BANK ASSET TO GDP RATIO <i>CB_BALANCE_SHEET</i>	AUTHORS' COMPUTATION (ALSO SEE WORLD BANK GLOBAL FINANCIAL DEVELOPMENT)	AUTHORS' COMPUTATION FOR ADEMUYIWA, ST AMAND AND SIKLOS (2018).
CRGOVGDP	TOTAL CREDIT TO GOVERNMENT SECTOR AS PERCENTAGE OF GDP <i>GOV_CREDIT</i>	BIS	
CRPS	TOTAL CREDIT TO PRIVATE NON-	BIS	

	FINANCIAL SECTOR AS PERCENTAGE OF GDP <i>PRIVATE_CREDIT</i>		
CY_CYX_P	ONE YEAR AHEAD FIXED EVENT INFLATION FORECAST <i>CONSENSUS_INFLATION</i>	CONSENSUS FORECASTS	PERIOD AVERAGE (FROM MONTHLY TO QUARTERLY)
CY_CYX_Y	ONE YEAR AHEAD FIXED EVENT REAL GDP GROWTH FORECAST <i>CONSENSUS_GROWTH</i>	CONSENSUS FORECASTS	PERIOD AVERAGE (FROM MONTHLY TO QUARTERLY)
EQ	EQUITIES PRICE INDEX <i>EQUITIES</i>	IFS / OECD	IFS - FINANCIAL MARKET PRICES, EQUITIES, END OF PERIOD, INDEX (2010 = 100) ; OECD - SHARE PRICES (2015 = 100)
ER	NOMINAL EXCHANGE RATE <i>EXCHANGE_RATES</i>	IFS	EXCHANGE RATES, DOMESTIC CURRENCY PER U.S. DOLLAR, PERIOD AVERAGE, RATE
GOVC	CREDIT TO GOVERNMENT AS PERCENTAGE OF GDP <i>GOV_CREDITTOGDP</i>	BIS	CREDIT TO GOVERNMENT AS PERCENTAGE OF GDP (NOMINAL VALUE)
HP	HOUSING PRICES <i>HOUSE_PRICE</i>	BIS / OECD	BIS - DETAILED RESIDENTIAL PROPERTY PRICE STATISTICS OR REAL RESIDENTIAL PROPERTY

			PRICE INDEX (2010 = 100); OECD - HOUSING PRICES INDEX (2015 = 100)
INF	INFLATION <i>INFLATION</i>	IFS / OECD	IFS - PRICES, CONSUMER PRICE INDEX, ALL ITEMS, PERCENTAGE CHANGE, CORRESPONDING PERIOD PREVIOUS YEAR, PERCENT; OECD - CPI, ALL ITEMS, PERCENTAGE CHANGE ON THE SAME PERIOD OF THE PREVIOUS YEAR FROM 4 TH ORDER LOG DIFFERENCE.
INTDIFF	INTEREST RATE DIFFERENTIAL <i>INTEREST_DIFFERENTIAL</i>	AUTHORS' COMPUTATION	COMPUTED AS A COUNTRY'S SHORT-TERM INTEREST RATE (<i>STR</i>) MINUS US SHORT TERM INTEREST RATE (<i>US STR</i>)
IT	INFLATION TARGETS <i>IT</i>	SIKLOS (2017), UPDATED. SEE THIS APPENDIX	[0,1] AS WELL AS MID-POINT OF TARGET RANGE OR TARGET VALUE (IN %).
LTR	LONG TERM INTEREST RATE <i>LONG_TERM_I</i>	OECD / IFS / FRED (FOR USA DATA)	OECD - LONG-TERM INTEREST RATE; IFS - FINANCIAL, INTEREST RATES, GOVERNMENT SECURITIES, GOVERNMENT BONDS, PERCENT PER ANNUM; FRED - LONG-TERM GOVERNMENT BOND YIELD: 10 YEARS.
MPU	MONETARY POLICY UNCERTAINTY	AUTHORS' COMPUTATION	COMPUTED AS: $ISO_MPU=(ISP_CYX_P-CA_WEOP)^2+(CA_CYX_Y-CA_WEOY)^2$
NEER	NOMINAL EFFECTIVE EXCHANGE RATE <i>NOM_EFF_EXCHRATE</i>	BIS	BIS - NOMINAL EFFECTIVE EXCHANGE RATES, CPI-BASED, BROAD INDICES, PERIOD AVERAGES (2010 = 100)

PNFA <i>PRIV_NONFIN_ASS ETS</i>	BANK CREDIT TO PRIVATE NON- FINANCIAL SECTOR	BIS	BANK CREDIT TO THE PRIVATE NON-FINANCIAL SECTOR (CORE DEBT) IN BILLIONS USD
PR <i>POLICY_RATE</i>	CENTRAL BANK POLICY INTEREST RATE	BIS / CENTRAL BANKS' WEBSITES	CENTRAL BANK POLICY RATES
REER <i>REAL_EFF_EXCHR ARTE</i>	REAL EFFECTIVE EXCHANGE RATE	BIS / IFS	BIS - REAL EFFECTIVE EXCHANGE RATES, CPI- BASED, BROAD INDICES, PERIOD AVERAGES (2010 = 100) ; IFS - REAL EFFECTIVE EXCHANGE RATE BASED ON CONSUMER PRICE INDEX, (2010 = 100)
RES <i>FOREX_RESERVES</i>	FOREIGN CURRENCY RESERVES	IFS	INTERNATIONAL RESERVES, OFFICIAL RESERVE ASSETS, MILLIONS, US DOLLARS
RGDPG <i>REAL_GDP_GROWT H</i>	REAL GDP	OECD / IFS / CEIC	OECD - GROSS DOMESTIC PRODUCT - EXPENDITURE APPROACH, MILLION US DOLLARS, VOLUME ESTIMATES, FIXED PPPS, OECD REFERENCE YEAR, ANNUAL LEVELS, SEASONALLY ADJUSTED (VPVOBARSA) <i>OR</i> GROSS DOMESTIC PRODUCT - EXPENDITURE APPROACH, MILLIONS, NATIONAL CURRENCY, CHAINED VOLUME ESTIMATES, NATIONAL REFERENCE YEAR, QUARTERLY LEVELS, SEASONALLY ADJUSTED (LNBQRSA); IFS - NATIONAL ACCOUNTS, EXPENDITURE, GROSS DOMESTIC PRODUCT, REAL, MILLIONS, DOMESTIC CURRENCY; CEIC - CHINA REAL GDP, BILLIONS, REMNIBI
SHADOW_PR	WU-XIA SHADOW POLICY RATE OR	WU AND XIA, 2016 KRIPPNER FROM RBNZ WEBSITE	HTTPS://SITES.GOOGLE.COM/VIEW/JINGCYNTHIAW U/SHADOW-RATES; HTTPS://WWW.RBNZ.GOV.T.NZ/RESEARCH-AND-

	KRIPPNER'S ESTIMATES		PUBLICATIONS/RESEARCH-PROGRAMME/ADDITIONAL-RESEARCH/MEASURES-OF-THE-STANCE-OF-UNITED-STATES-MONETARY-POLICY/COMPARISON-OF-INTERNATIONAL-MONETARY-POLICY-MEASURES
STR <i>SHORT_T_RATES</i>	SHORT-TERM INTEREST RATE	OECD / IFS / FRED (FOR USA DATA)	OECD - 3 MONTH INTERBANK RATE; IFS - FINANCIAL, INTEREST RATES, GOVERNMENT SECURITIES, TREASURY BILLS, PERCENT PER ANNUM; FRED - (CN: DISCOUNT RATE; US: 3 MONTHS TREASURY)
VIX	VOLATILITY INDEX	CBOE	STOCK MARKET IMPLIED VOLATILITY (US-BASED)
WEOP / WEOY	ONE YEAR AHEAD INFLATION/GROWTH FORECASTS	IMF WEO HISTORICAL FORECASTS	SERIES WERE CONVERTED TO QUARTERLY USING CHIN-LIN DECOMPOSITION METHOD
YC	YIELD CURVE	AUTHORS' COMPUTATION	COMPUTED AS LONG-TERM INTEREST RATE (<i>LTR</i>) MINUS SHORT TERM INTEREST RATE (<i>STR</i>)
TOP	TRADE OPENNESS	WORLD DEVELOPMENT INDICATOR, WB	COMPUTED AS RATIO OF TRADE (SUM OF EXPORTS AND IMPORTS OF GOODS AND SERVICES) TO GDP

SKEWNESS IN INFLATION RATES AND INFLATION FORECASTS: ROLLING SAMPLES

A. ADVANCED ECONOMIES

SAMPLES	AU	CA	CZ	EZ	IL	JP	KR	NO	NZ	SE	US	GB
92-96	.69 .55	-.70 .19	1.18 -.33	.52 NA	.55 NA	.22 1.28	.61 1.25	-.53 NA	.92 NA	.20 NA	-.23 .67	2.82 1.33
94-98	.40 .11	-.15 .54	.67 .19	-.38 NA	-.28 NA	.77 -.94	1.03 1.04	-.33 NA	.74 -.46	-.21 NA	-.62 -.95	.17 .45
96-00	.97 .48	.34 1.00	.07 -1.43	.02 .60	-.13 NA	.87 -.01	.28 .68	-.57 NA	.13 .30	-.46 NA	-.06 .01	.17 -.61
98-02	.58 .48	.20 .73	1.31 .34	-.17 .47	.04 .38	1.85 .25	.89 1.53	-.39 .19	-.40 -.52	-.12 -.11	.29 .02	-.16 .60
00-04	1.27 1.14	.37 .03	-.77 -.28	.74 .54	.51 .81	.24 .10	.09 -1.00	.42 -.80	.33 -.12	.07 .13	-.26 .21	-.45 -.64
02-06	.64 .15	1.08 .52	-.35 .47	-.45 .10	.24 1.00	-.41 -.01	.40 -.13	-.09 .29	-.17 .29	.36 .32	-.01 .47	.57 .23
04-08	.65 1.00	.08 -.37	1.18 -.73	1.29 .80	.03 .01	1.11 .14	.82 .32	-.01 -.23	.48 -.43	.71 -.27	.18 -.22	1.21 .52
06-10	.22 -.33	-1.07 -1.22	.92 .34	-.23 -.29	-.78 .19	-.13 -.30	1.07 -.87	-.04 .44	.45 .29	-.11 -.69	-.49 -.56	.71 .91
08-12	.26 -.54	-.60 -1.05	.49 .84	-.60 -.18	.16 -.92	.20 .09	.21 -.82	.42 .56	.40 .51	-.12 .20	-.32 -.52	.05 .40
10-14	-.48 -1.01	.39 -.26	.31 -.17	-.32 -.53	.12 -.59	1.22 .41	.38 -.05	-.15 -.36	1.32 .87	.74 -.59	1.06 -1.11	.06 .23
12-16	.43 -.32	.73 .51	.97 .32	.67 .17	.01 .03	1.02 .56	1.30 .36	-.005 -.43	.16 -.12	.98 .96	-.37 -.28	-.05 -.31
14-18	.86 .08	.48 .15	.40 1.40	.38 .03	.49 .66	1.01 .48	.42 .63	.68 1.15	.83 .05	.08 .24	-.44 .03	-.19 -.30

B. EMERGING MARKET ECONOMIES

SAMPLES	AR	BR	CL	CN	CO	HU	ID	IN	MX	MY	PE	PH	PL	RU	TH	TR	ZA
98-02	2.15	-.33	.37	.28	1.08	.41	1.20	1.47	.26	1.18	.26	.67	-.13	1.50	1.45	-.73	.46

	<i>1.84</i>	<i>.92</i>	<i>.84</i>	<i>1.50</i>	<i>.27</i>	<i>.61</i>	<i>.72</i>	<i>.13</i>	<i>-.21</i>	<i>.62</i>	<i>.16</i>	<i>NA</i>	<i>.20</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>-.30</i>
00-04	1.48 <i>.71</i>	1.45 <i>.76</i>	-.73 <i>.10</i>	1.04 <i>.91</i>	.39 <i>.78</i>	.25 <i>-.02</i>	-.45 <i>-.17</i>	-.04 <i>1.48</i>	1.04 <i>.98</i>	.29 <i>1.35</i>	-.67 <i>.97</i>	.54 <i>NA</i>	.62 <i>.06</i>	.37 <i>NA</i>	.15 <i>NA</i>	.04 <i>NA</i>	.27 <i>.05</i>
02-06	1.41 <i>1.23</i>	1.06 <i>.88</i>	-.67 <i>-.24</i>	.42 <i>-.13</i>	.07 <i>-.08</i>	.16 <i>.99</i>	.71 <i>-.10</i>	.68 <i>.94</i>	-.20 <i>1.24</i>	.39 <i>.93</i>	-.30 <i>-.23</i>	.16 <i>-1.08</i>	.80 <i>1.40</i>	.33 <i>-.25</i>	.47 <i>-.47</i>	1.74 <i>-.17</i>	.76 <i>.51</i>
04-08	-.94 <i>-.71</i>	-.12 <i>.38</i>	.65 <i>1.78</i>	.72 <i>1.05</i>	.66 <i>.66</i>	-.20 <i>.25</i>	.82 <i>.75</i>	.68 <i>-.06</i>	.74 <i>.08</i>	1.46 <i>-.02</i>	.59 <i>2.21</i>	.36 <i>-.60</i>	.17 <i>.18</i>	.10 <i>.21</i>	.61 <i>-.24</i>	.27 <i>.54</i>	.60 <i>1.10</i>
06-10	-.38 <i>-.64</i>	-.09 <i>-.61</i>	-.02 <i>.93</i>	.26 <i>.59</i>	.04 <i>.21</i>	.11 <i>.42</i>	.64 <i>.93</i>	.72 <i>1.23</i>	.79 <i>.94</i>	.41 <i>-.47</i>	.61 <i>1.17</i>	.98 <i>-.18</i>	-.13 <i>-.27</i>	.22 <i>.07</i>	-.38 <i>-.96</i>	-.43 <i>.07</i>	.75 <i>.14</i>
08-12	-.84 <i>-.73</i>	.23 <i>.16</i>	.18 <i>1.04</i>	-.13 <i>-.52</i>	.92 <i>.25</i>	.09 <i>.60</i>	1.07 <i>.48</i>	.91 <i>.58</i>	.71 <i>.80</i>	.60 <i>.16</i>	-.005 <i>1.08</i>	1.25 <i>.99</i>	-.91 <i>-.26</i>	.21 <i>.07</i>	-.59 <i>-.90</i>	-.17 <i>-.40</i>	1.02 <i>.90</i>
10-14	1.69 <i>1.44</i>	-.27 <i>-.33</i>	-.16 <i>-.85</i>	.93 <i>-.12</i>	.10 <i>.54</i>	-.39 <i>-1.10</i>	.43 <i>.23</i>	.45 <i>.43</i>	.39 <i>.73</i>	.07 <i>-.53</i>	-.64 <i>-.24</i>	.10 <i>.20</i>	-.22 <i>-.96</i>	-.17 <i>.02</i>	-.25 <i>-.75</i>	-.71 <i>-.03</i>	-1.01 <i>-.56</i>
12-16	.90 <i>-.28</i>	.67 <i>.30</i>	-.32 <i>1.45</i>	.66 <i>-.28</i>	.85 <i>.99</i>	1.05 <i>.26</i>	.32 <i>-1.04</i>	.16 <i>.19</i>	-.17 <i>-.76</i>	-.01 <i>.37</i>	.42 <i>.63</i>	-.36 <i>-.47</i>	.89 <i>.27</i>	1.11 <i>1.07</i>	-.27 <i>-.54</i>	.59 <i>.45</i>	-.51 <i>-.05</i>
14-18	.43 <i>-.20</i>	-.02 <i>-1.75</i>	-.47 <i>.14</i>	-.09 <i>.66</i>	.81 <i>.37</i>	.37 <i>1.60</i>	.62 <i>.11</i>	-.60 <i>.87</i>	.49 <i>-.33</i>	-.34 <i>.22</i>	.89 <i>.78</i>	.30 <i>.07</i>	.23 <i>.85</i>	.75 <i>.72</i>	-.03 <i>.03</i>	2.08 <i>-.02</i>	.0-.235

NOTE: THE TOP NUMBER IS THE SKEWNESS MEASURE FOR OBSERVED CPI INFLATION; THE NUMBERS IN ITALICS ARE FOR THE AVERAGE OF CONSENSUS AND WEO ONE YEAR AHEAD INFLATION FORECASTS. DATA ARE QUARTERLY FOR ROLLING 5-YEAR SAMPLES.

INFLATION TARGET RANGES AROUND THE WORLD¹¹

¶¶ UPDATED FROM PIERRE L. SIKLOS (2017), *CENTRAL BANKS INTO THE BREACH* (OXFORD: OXFORD UNIVERSITY PRESS).

CO UN TRY	STA RT	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19					
<i>INDUSTRIAL</i>																																				
AU	93.2				2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3			
CA	91.1		2-4	2-4	1.5-3.5	1.5-3.5	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3			
CZ	98.1									5.5-6.5	4-5	3.5-5.5	2-4	3-5	3-5	3-5	2-4	2-4	2-4	2-4	2-4	2-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3			
IL	92.1					8	8-11	8-10	7.5-10	7-10	4	3-4	2.5-3.5	2-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3			
KR	98.2									8-10	2-4	1.5-3.5	2-4	2-4	2-4	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5	2.5-3.5			
NZ	90.1	3-5	2.5-4.5	1.5-3.5	0-2	0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3			
NO	01.1												2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5			
SE	93.1					2	2	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3		
GB	92.4			1-4	1-4	1-4	1-4	1-4	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1-3	1-3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			
<i>EMERGING</i>																																				
BR	99.2										6-10	4-8	2-6	1.5-6.5	1.5-6.5	3-8	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5	2.5-6.5		
CL	90.3				10-11	9-10	7-8	6-7	5-6	4.5	4.3	3.5	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4		
CO	99.3										15	10	8	6	5-6	5.5	4.5-5.5	3-5	3.5-4.5	3.5-4.5	3.5-4.5	3.5-4.5	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4		
HU	01.1												6-8	3.5-5.5	3.5-5.5	2.5-4.5	3-5	2.5-4.5	3	3	3	3	3	3	3	3	3	3	3	3	3	2-4	2-4	2-4	2-4	
IN	15.1																															<6	2-6	2-6	2-6	2-6
ID	00.1												3-5	4-6	9-10	4.5-6.5	4.5-6.5	5-7	7-9	5-7	4-6	3.5-5.5	4-6	4-6	3.5-5.5	3.5-5.5	3.5-5.5	3.5-5.5	3.5-5.5	3.5-5.5	3.5-5.5	3.5-5.5	3.5-5.5	3.5-5.5	3.5-5.5	
MX	99.1														≤13	≤10	≤6.5	≤4.5	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4
PE	02.1													1-4	1-4	1.5-3.5	1.5-3.5	1.5-3.5	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	
PL	98.4														≤9.5	8-8.5	5.4-6.8	6-8	4-6	2-4	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	
PH	02.1																																			
RU	14.1																																			
ZA	00.1																																			
TH*	00.2																																			
TR*	06																																			
<i>QUASI-IT</i>																																				
EZ	99.1																																			
JP§	96.1																																			

¶ DEFINED AS A “LONGER-RUN GOAL” OF MONETARY POLICY. SEE

[HTTP://WWW.FEDERALRESERVE.GOV/MONETARYPOLICY/FILES/FOMC_LONGERRUNGOALS_20160126.PDF](http://www.federalreserve.gov/monetarypolicy/files/FOMC_LONGERRUNGOALS_20160126.PDF).

° PRIOR TO 2010 THE TARGET WAS IN TERMS OF CORE INFLATION. SEE

[HTTPS://WWW.BOT.OR.TH/ENGLISH/MONETARYPOLICY/MONETPOLICYKNOWLEDGE/PAGES/TARGET.ASPX](https://www.bot.or.th/english/monetarypolicy/monetpolicyknowledge/pages/target.aspx).

PANEL UNIT ROOT TESTING: ALL ECONOMIES⁵⁴

NOTE: SEE EARLIER IN THE APPENDIX FOR SERIES NAME

NOMENCLATURE;

Group unit root test: Summary

Series: AR_CA, AU_CA, BR_CA, CA_CA, CL_CA, CN_CA, CO_CA,
CZ_CA, EZ_CA, GB_CA, HU_CA, ID_CA, IL_CA, IN_CA,
JP_CA, KR_CA, MX_CA, MY_CA, NO_CA, NZ_CA, PE_CA,
PH_CA, PL_CA, RU_CA, SE_CA, TH_CA, TR_CA, US_CA,
ZA_CA

Sample: 1980Q1 2018Q3

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 13

Newey-West automatic bandwidth selection and Parzen kernel

Method	Statistic	Prob.**	Cross- sections	Obs
<u>Null: Unit root (assumes common unit root process)</u>				
Levin, Lin & Chu t*	2.06373	0.9805	29	3426
<u>Null: Unit root (assumes individual unit root process)</u>				
Im, Pesaran and Shin W-stat	-1.67498	0.0470	29	3426
ADF - Fisher Chi-square	81.6997	0.0219	29	3426
PP - Fisher Chi-square	210.148	0.0000	29	3582

** Probabilities for Fisher tests are computed using an asymptotic Chi-sq...
distribution. All other tests assume asymptotic normality.

⁵⁴ The separate cases for AE and EME economies is available on request.

Series: AR_DPNFAGDP, AU_DPNFAGDP, BR_DPNFAGDP,
 CA_DPNFAGDP, CL_DPNFAGDP, CN_DPNFAGDP,
 CO_DPNFAGDP, CZ_DPNFAGDP, EZ_DPNFAGDP,
 GB_DPNFAGDP, HU_DPNFAGDP, ID_DPNFAGDP,
 IL_DPNFAGDP, IN_DPNFAGDP, JP_DPNFAGDP,
 KR_DPNFAGDP, MX_DPNFAGDP, MY_DPNFAGDP,
 NO_DPNFAGDP, NZ_DPNFAGDP, PL_DPNFAGDP,
 RU_DPNFAGDP, SE_DPNFAGDP, TH_DPNFAGDP,
 TR_DPNFAGDP, US_DPNFAGDP, ZA_DPNFAGDP

Date: 06/17/19 Time: 08:57

Sample: 1980Q1 2018Q3

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 7

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-30.2175	0.0000	27	2673
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-29.8090	0.0000	27	2673
ADF - Fisher Chi-square	804.665	0.0000	27	2673
PP - Fisher Chi-square	1091.77	0.0000	27	2694

** Probabilities for Fisher tests are computed using an asymptotic Chi-sq...
 distribution. All other tests assume asymptotic normality.

Pool unit root test: Summary

Series: AR_RESG, AU_RESG, BR_RESG, CA_RESG, CL_RESG, CN_RESG, CO_RESG, CZ_RESG, EZ_RESG, GB_RESG, HU_RESG, ID_RESG, IL_RESG, IN_RESG, JP_RESG, KR_RESG, MX_RESG, MY_RESG, NO_RESG, NZ_RESG, PE_RESG, PH_RESG, PL_RESG, RU_RESG, SE_RESG, TH_RESG, TR_RESG, US_RESG, ZA_RESG

Date: 06/22/19 Time: 09:52

Sample: 1980Q1 2018Q3

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 11

Newey-West automatic bandwidth selection and Parzen kernel

Method	Statistic	Prob.**	Cross-sections	Obs
<u>Null: Unit root (assumes common unit root process)</u>				
Levin, Lin & Chu t*	-8.47546	0.0000	29	3787
<u>Null: Unit root (assumes individual unit root process)</u>				
Im, Pesaran and Shin W-stat	-16.2073	0.0000	29	3787
ADF - Fisher Chi-square	428.555	0.0000	29	3787
PP - Fisher Chi-square	425.590	0.0000	29	3938

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Group unit root test: Summary

Series: AR_RGDPG, AU_RGDPG, BR_RGDPG, CA_RGDPG,
 CL_RGDPG, CN_RGDPG, CO_RGDPG, CZ_RGDPG,
 EZ_RGDPG, GB_RGDPG, HU_RGDPG, ID_RGDPG, IL_RGDPG,
 IN_RGDPG, JP_RGDPG, KR_RGDPG, MX_RGDPG,
 MY_RGDPG, NO_RGDPG, NZ_RGDPG, PE_RGDPG,
 PH_RGDPG, PL_RGDPG, RU_RGDPG, SE_RGDPG, TH_RGDPG,
 TR_RGDPG, US_RGDPG, ZA_RGDPG

Date: 06/14/19 Time: 09:55

Sample: 1980Q1 2018Q3

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 13

Newey-West automatic bandwidth selection and Parzen kernel

Method	Statistic	Prob.**	Cross- sections	Obs
<u>Null: Unit root (assumes common unit root process)</u>				
Levin, Lin & Chu t*	-4.07648	0.0000	29	3208
<u>Null: Unit root (assumes individual unit root process)</u>				
Im, Pesaran and Shin W-stat	-12.6160	0.0000	29	3208
ADF - Fisher Chi-square	294.862	0.0000	29	3208
PP - Fisher Chi-square	268.312	0.0000	29	3320

** Probabilities for Fisher tests are computed using an asymptotic Chi-sq...
 distribution. All other tests assume asymptotic normality.

Group unit root test: Summary

Series: AR_MN_YFCAST, AU_MN_YFCAST, BR_MN_YFCAST, CA_MN_YFCAST, CL_MN_YFCAST, CN_MN_YFCAST, CO_MN_YFCAST, CZ_MN_YFCAST, EZ_MN_YFCAST, GB_MN_YFCAST, HU_MN_YFCAST, ID_MN_YFCAST, IL_MN_YFCAST, IN_MN_YFCAST, JP_MN_YFCAST, KR_MN_YFCAST, MX_MN_YFCAST, MY_MN_YFCAST, NO_MN_YFCAST, NZ_MN_YFCAST, PE_MN_YFCAST, PH_MN_YFCAST, PL_MN_YFCAST, RU_MN_YFCAST, SE_MN_YFCAST, TH_MN_YFCAST, TR_MN_YFCAST, US_MN_YFCAST, ZA_MN_YFCAST

Date: 06/14/19 Time: 09:54

Sample: 1980Q1 2018Q3

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 9

Newey-West automatic bandwidth selection and Parzen kernel

Method	Statistic	Prob.**	Cross-sections	Obs
<u>Null: Unit root (assumes common unit root process)</u>				
Levin, Lin & Chu t*	-1.85224	0.0320	29	2398
<u>Null: Unit root (assumes individual unit root process)</u>				
Im, Pesaran and Shin W-stat	-8.79516	0.0000	29	2398
ADF - Fisher Chi-square	200.775	0.0000	29	2398
PP - Fisher Chi-square	163.081	0.0000	29	2462

** Probabilities for Fisher tests are computed using an asymptotic Chi-sq... distribution. All other tests assume asymptotic normality.

Group unit root test: Summary

Series: AU_HPG, BR_HPG, CA_HPG, CL_HPG, CN_HPG, CO_HPG,
 CZ_HPG, EZ_HPG, GB_HPG, HU_HPG, ID_HPG, IL_HPG,
 IN_HPG, JP_HPG, KR_HPG, MX_HPG, MY_HPG, NO_HPG,
 NZ_HPG, PE_HPG, PH_HPG, PL_HPG, RU_HPG, SE_HPG,
 TH_HPG, TR_HPG, US_HPG, ZA_HPG

Date: 06/17/19 Time: 08:56

Sample: 1980Q1 2018Q3

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 10

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.02963	0.4882	28	2333
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.03216	0.0000	28	2333
ADF - Fisher Chi-square	142.780	0.0000	28	2333
PP - Fisher Chi-square	154.585	0.0000	28	2433

** Probabilities for Fisher tests are computed using an asymptotic Chi-sq...
 distribution. All other tests assume asymptotic normality.

Group unit root test: Summary

Series: AR_INF, AU_INF, BR_INF, CA_INF, CL_INF, CN_INF,
 CO_INF, CZ_INF, EZ_INF, GB_INF, HU_INF, ID_INF, IL_INF,
 IN_INF, JP_INF, KR_INF, MX_INF, MY_INF, NO_INF, NZ_INF,
 PE_INF, PH_INF, PL_INF, RU_INF, SE_INF, TH_INF, TR_INF,
 US_INF, ZA_INF

Date: 06/14/19 Time: 09:51

Sample: 1980Q1 2018Q3

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 1 to 12

Newey-West automatic bandwidth selection and Parzen kernel

Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.40044	0.0003	29	3796
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-9.39432	0.0000	29	3796
ADF - Fisher Chi-square	231.123	0.0000	29	3796
PP - Fisher Chi-square	324.086	0.0000	29	3930

** Probabilities for Fisher tests are computed using an asymptotic Chi-sq...
 distribution. All other tests assume asymptotic normality.

Group unit root test: Summary

Series: AR_MN_PFCAST, AU_MN_PFCAST, BR_MN_PFCAST,
 CA_MN_PFCAST, CL_MN_PFCAST, CN_MN_PFCAST,
 CO_MN_PFCAST, CZ_MN_PFCAST, EZ_MN_PFCAST,
 GB_MN_PFCAST, HU_MN_PFCAST, ID_MN_PFCAST,
 IL_MN_PFCAST, IN_MN_PFCAST, JP_MN_PFCAST,
 KR_MN_PFCAST, MX_MN_PFCAST, MY_MN_PFCAST,
 NO_MN_PFCAST, NZ_MN_PFCAST, PE_MN_PFCAST,
 PH_MN_PFCAST, PL_MN_PFCAST, RU_MN_PFCAST,
 SE_MN_PFCAST, TH_MN_PFCAST, TR_MN_PFCAST,
 US_MN_PFCAST, ZA_MN_PFCAST

Date: 06/14/19 Time: 09:54

Sample: 1980Q1 2018Q3

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 10

Newey-West automatic bandwidth selection and Parzen kernel

Method	Statistic	Prob.**	Cross- sections	Obs
<u>Null: Unit root (assumes common unit root process)</u>				
Levin, Lin & Chu t*	-4.33171	0.0000	29	2449
<u>Null: Unit root (assumes individual unit root process)</u>				
Im, Pesaran and Shin W-stat	-8.23704	0.0000	29	2449
ADF - Fisher Chi-square	216.276	0.0000	29	2449
PP - Fisher Chi-square	241.318	0.0000	29	2536

** Probabilities for Fisher tests are computed using an asymptotic Chi-sq...
 distribution. All other tests assume asymptotic normality.

Group unit root test: Summary

Series: AR_INTDIFF, AU_INTDIFF, BR_INTDIFF, CA_INTDIFF, CL_INTDIFF, CN_INTDIFF, CO_INTDIFF, CZ_INTDIFF, EZ_INTDIFF, GB_INTDIFF, HU_INTDIFF, ID_INTDIFF, IL_INTDIFF, IN_INTDIFF, JP_INTDIFF, KR_INTDIFF, MX_INTDIFF, MY_INTDIFF, NO_INTDIFF, NZ_INTDIFF, PE_INTDIFF, PH_INTDIFF, PL_INTDIFF, RU_INTDIFF, SE_INTDIFF, TH_INTDIFF, TR_INTDIFF, ZA_INTDIFF

Date: 06/14/19 Time: 09:59

Sample: 1980Q1 2018Q3

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 3

Newey-West automatic bandwidth selection and Parzen kernel

Method	Statistic	Prob.**	Cross-sections	Obs
<u>Null: Unit root (assumes common unit root process)</u>				
Levin, Lin & Chu t*	-4.32479	0.0000	28	3320
<u>Null: Unit root (assumes individual unit root process)</u>				
Im, Pesaran and Shin W-stat	-8.86450	0.0000	28	3320
ADF - Fisher Chi-square	199.394	0.0000	28	3320
PP - Fisher Chi-square	209.822	0.0000	28	3362

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Group unit root test: Summary

Series: AR_PR, AU_PR, BR_PR, CA_PR, CL_PR, CN_PR, CO_PR,
CZ_PR, EZ_PR, EZ_SHADOW_PR, GB_PR, GB_SHADOW_PR,
HU_PR, ID_PR, IL_PR, IN_PR, JP_PR, JP_SHADOW_PR, KR_PR,
MX_PR, MY_PR, NO_PR, NZ_PR, PE_PR, PH_PR, PL_PR,
RU_PR, SE_PR, TH_PR, TR_PR, US_PR, US_SHADOW_PR,
ZA_PR

Date: 06/14/19 Time: 09:56

Sample: 1980Q1 2018Q3

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 7

Newey-West automatic bandwidth selection and Parzen kernel

Method	Statistic	Prob.**	Cross- sections	Obs
<u>Null: Unit root (assumes common unit root process)</u>				
Levin, Lin & Chu t*	-6.81423	0.0000	33	3259
<u>Null: Unit root (assumes individual unit root process)</u>				
Im, Pesaran and Shin W-stat	-5.84355	0.0000	33	3259
ADF - Fisher Chi-square	169.358	0.0000	33	3259
PP - Fisher Chi-square	250.454	0.0000	33	3325

** Probabilities for Fisher tests are computed using an asymptotic Chi-sq...
distribution. All other tests assume asymptotic normality.

Group unit root test: Summary

Series: AR_REERG, AU_REERG, BR_REERG, CA_REERG, CL_RE...
CN_REERG, CO_REERG, CZ_REERG, EZ_REERG, GB_REERG,
HU_REERG, ID_REERG, IL_REERG, IN_REERG, JP_REERG,
KR_REERG, MX_REERG, MY_REERG, NO_REERG, NZ_RE...
PE_REERG, PH_REERG, PL_REERG, RU_REERG, SE_REERG,
TH_REERG, TR_REERG, US_REERG, ZA_REERG

Date: 06/17/19 Time: 08:57

Sample: 1980Q1 2018Q3

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 1 to 8

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross- sections	Obs
<u>Null: Unit root (assumes common unit root process)</u>				
Levin, Lin & Chu t*	3.97402	1.0000	29	2747
<u>Null: Unit root (assumes individual unit root process)</u>				
Im, Pesaran and Shin W-stat	-13.0755	0.0000	29	2747
ADF - Fisher Chi-square	308.666	0.0000	29	2747
PP - Fisher Chi-square	314.578	0.0000	29	2874

** Probabilities for Fisher tests are computed using an asymptotic Chi-sq...
distribution. All other tests assume asymptotic normality.

Group unit root test: Summary

Series: AU_YC, CA_YC, CH_YC, CO_YC, CZ_YC, DE_YC, EZ_YC,
FR_YC, GB_YC, HU_YC, IL_YC, IN_YC, IT_YC, JP_YC,
KR_YC, MX_YC, MY_YC, NO_YC, NZ_YC, PL_YC, RU_YC,
SE_YC, TH_YC, US_YC, ZA_YC

Date: 06/14/19 Time: 10:00

Sample: 1980Q1 2018Q3

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 3

Newey-West automatic bandwidth selection and Parzen kernel

Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.18962	0.0000	25	2742
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-11.6017	0.0000	25	2742
ADF - Fisher Chi-square	248.964	0.0000	25	2742
PP - Fisher Chi-square	233.578	0.0000	25	2764

** Probabilities for Fisher tests are computed using an asymptotic Chi-sq...
distribution. All other tests assume asymptotic normality.

Persistence in $(\pi_t - \pi_{t+1}^e)$: AR(1) Model Coefficient Estimate (All are statistically significant at least at the 5% level of significance)

ISO code	Point Estimate ⁵⁵
AR	.65
AU	.68
BR	.79
CA	.58
CL	.82
CN	.81
CO	.87
CZ	.80
EZ	.77
GB	.87
HU	.82
ID	.58
IL	.82
IN	.52
JP	.55
KR	.71
MX	.74
MY	.72
NO	.61
NZ	.71
PE	.87
PH	.78
PL	.85
RU	.61
SE	.82
TH	.80
TR	.63
US	.62
ZA	.80

Updating CBI from 2011-2017

⁵⁵ For full available sample. See the main paper for details. A separate set of estimates was generated for the 2008Q4-2018Q3 period as reported in the main paper.

Dependent Variable: ?_CBI
Method: Pooled Least Squares

Date: 05/16/19 Time: 14:24
Sample (adjusted): 1998 2017

Included observations: 20 after adjustments

Cross-sections included: 28
Total pool (balanced) observations: 560

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.312237	0.014193	21.99883	0.0000
POLITY2_?	0.009652	0.001359	7.104535	0.0000
SFI_?	-0.001573	0.001616	-0.973534	0.3307

CBI from Dincer & Eichengreen (2014) goes to 2010.

Using a panel (with fixed effects) CBI was Projected to 2017 using the Polity IV and state fragility (SFI) indicators from <http://www.systemicpeace.org/polityproject.html>

NOTE: SFI was dropped in the final analysis; other drivers (e.g., dummy for GFC, and interaction effects with some of the other Institutional variables (e.g., CBT, ERR) were also considered without much improvement. Only the Polity IV adjusted for each economy for the Fixed effects was retained.

Mean Number of Financial Crises Over 3 Periods: pre-GFC (1950-1986), post-GFC (2007-2018), overlapping period (1998-2016)

ISO code	1950-2006	2007-2018	1998-2016	ISO code	1950-2006	2007-2018	1998-2016
CL	.88-5	.25	.11	US	.23	1-2	.37-4
BR	1.21-4	.25	.37-4	GB	.23	1-2	.26
PE	1.30-2	0	.16	EZ	1.86	7-1	3.23
MX	.54-9	.25	.32-5	CA	.05	.25	.11
AR	1.42-1	.25	1	JP	.28	0	0
CO	.58-8	0	.37-4	KR	.42-10	.25	.37-4
ZA	.33	.25	.26	AU	.17	.25	.16
TR	.74-6	.25	.47-3	NO	.18	.25	.11
RU	1.27-3	.75-4	.68-2	NZ	.16	.25	.11
HU	.58-8	.75-4	.26	SE	.16	.25	.16
PL	1	.25	.16	IL	.38	1.25	.32-5

ID	.65-7	.25	.79-1	CZ*			
TH	.33	0	.32-5	* No data			
CN	.23	0	.16				
IN	.33	.25	.16				
MY	.18	0	.16				
PH	.54-9	0	.32-5				

Ranking from highest to lowest incidence. Top 10 shown.

Proportion of Total Variation Explained by the First Principal Component

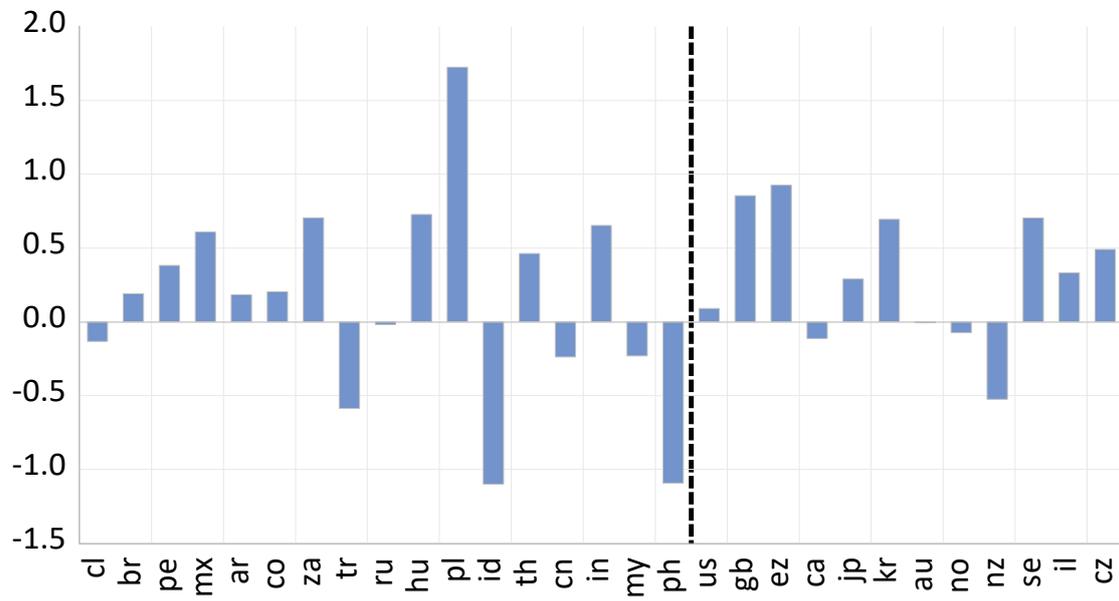
ISO code	Real factor	Trade factor	Financial factor	ISO code	Real factor	Trade factor	Financial factor
AR	.73	1.	1.	JP	.72	1.	.61
AU	.78	.75	.56	KR	.77	.74	.66
BR	.67	1.	.69	MX	1.	1.	.60
CA	1.	.82	.82	MY	.73	1.	.51
CL	.66	1.	.93	NO	.56	1.	1.
CN	1.	1.	.85	NZ	1.	.86	.67
CO	1.	1.	.72	PE	.66	1.	1.
CZ	.56	.65	.85	PL	.56	1.	.77
EZ	.64	1.	.67	RU	.58	1.	.88
GB	.62	1.	.78	SE	.56	1.	1.

HU	.60	.78	1.	TH	.72	.94	.79
ID	.63	1.	.54	TR	.67	1.	1.
IL	.79	1.	.64	US	.75	.74	1.
IN	.60	1.	1.	ZA	.60	.90	.80

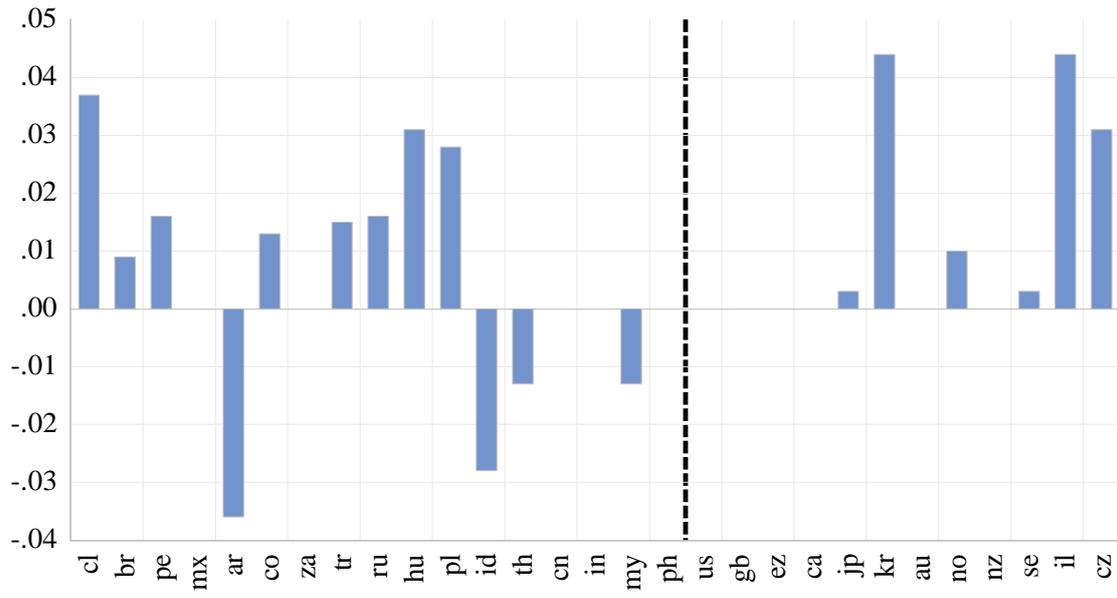
See text for estimation method and details.

Other Institutional Change Indicators

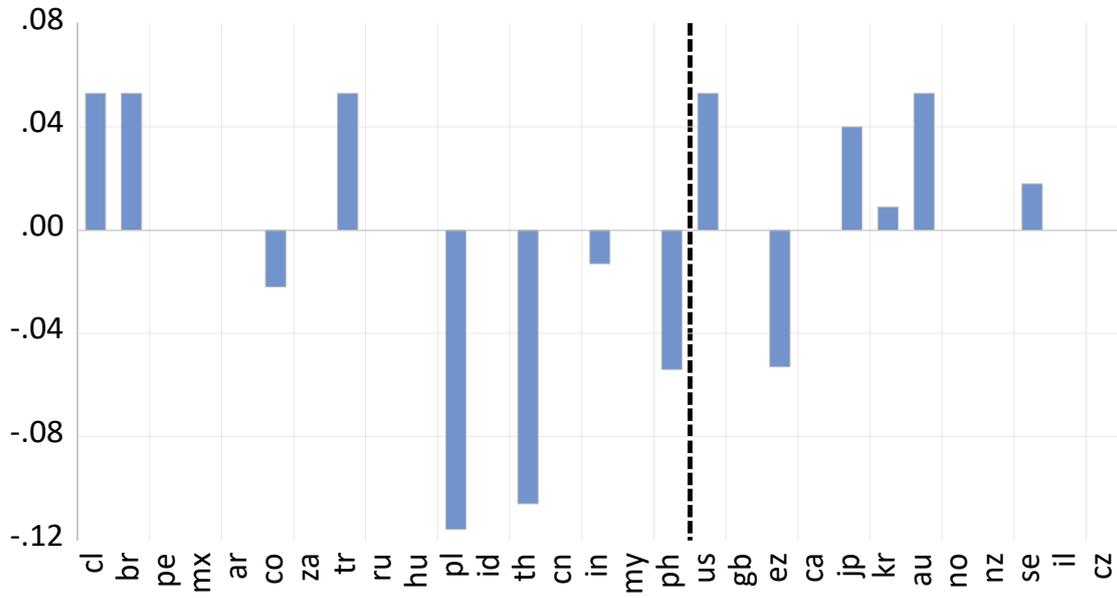
Changes in Trade Globalization



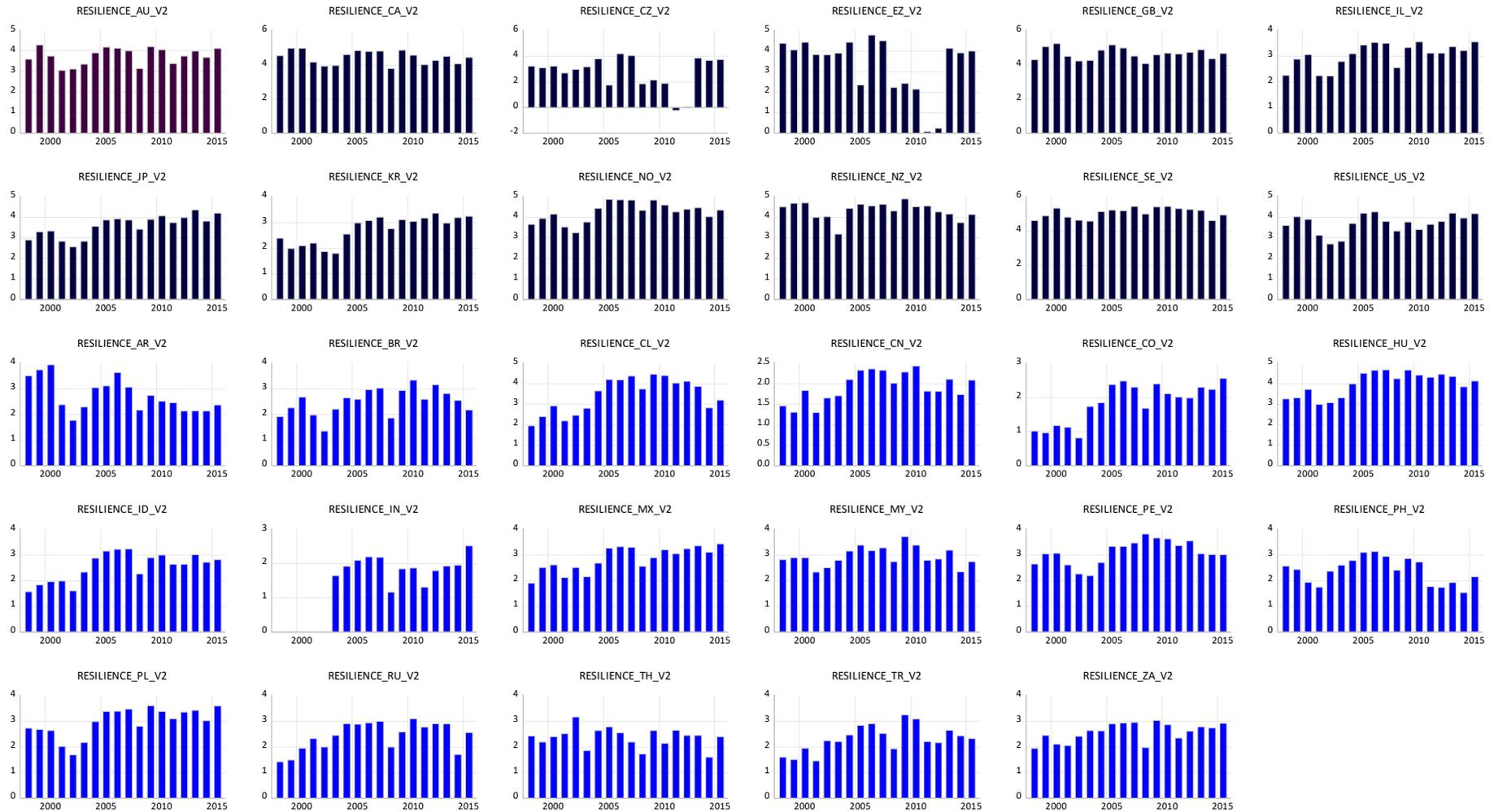
Changes in Capital Account Openness



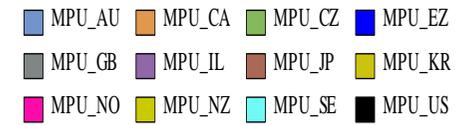
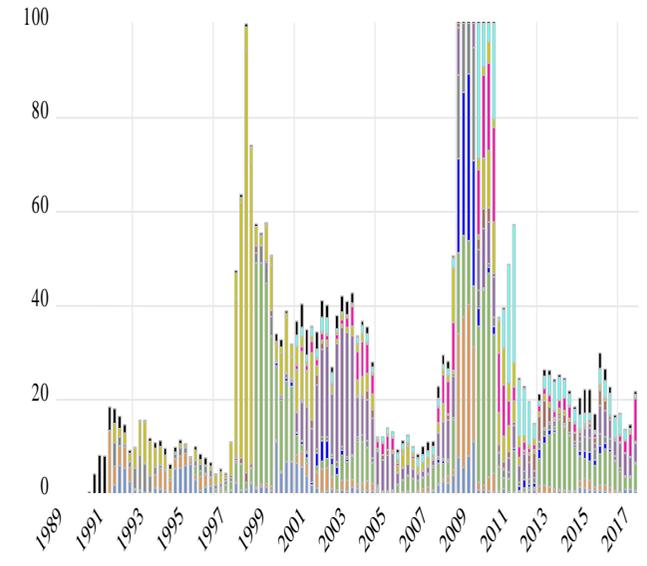
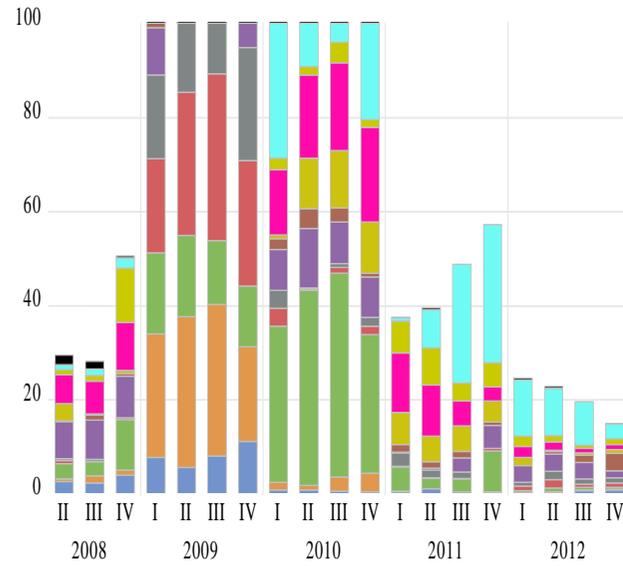
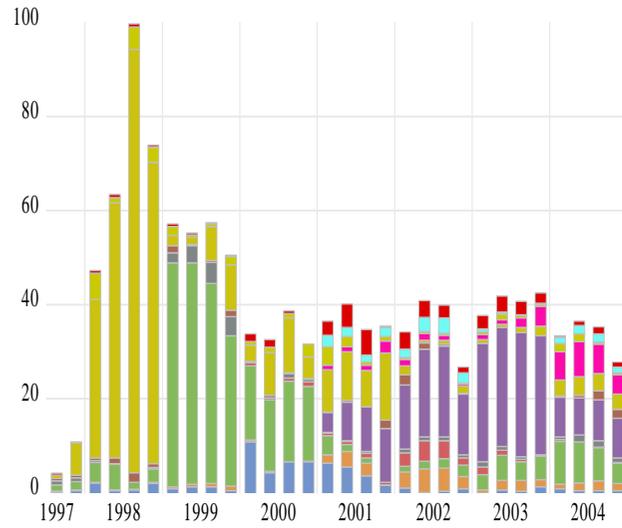
Changes in Exchange Rate Regimes



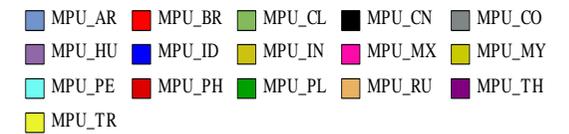
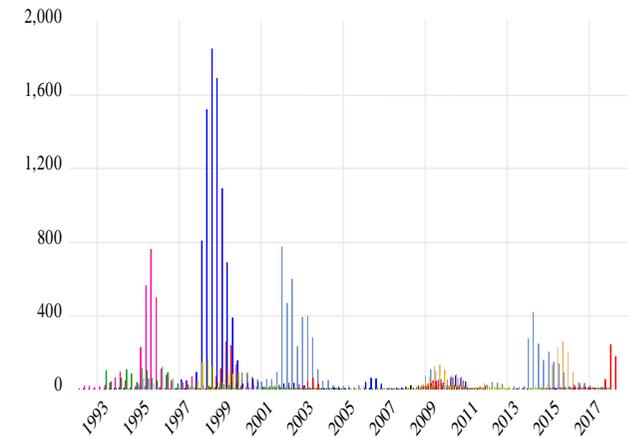
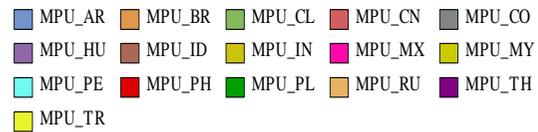
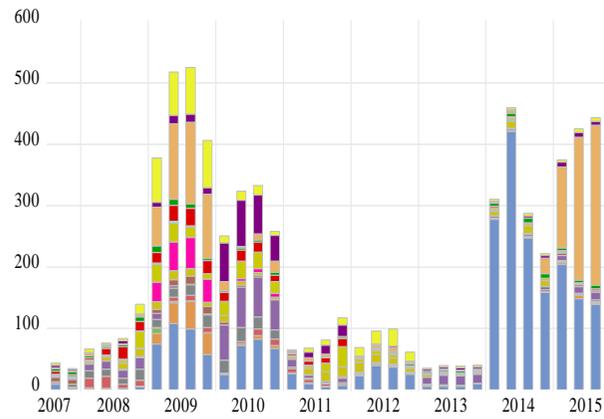
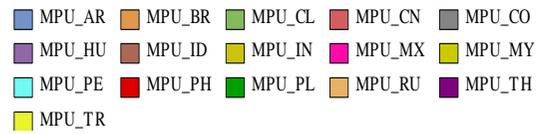
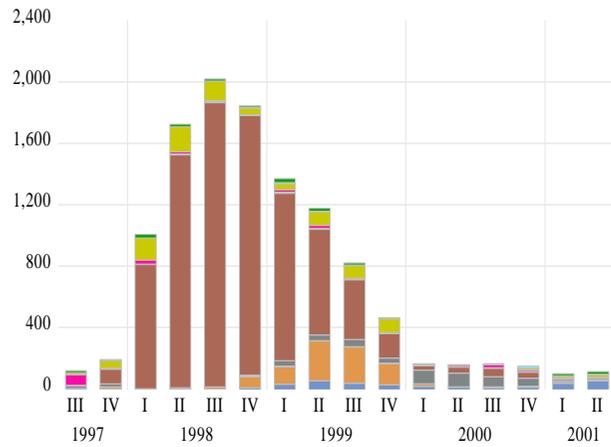
Individual Estimates of Resilience



Monetary Policy Uncertainty: AE

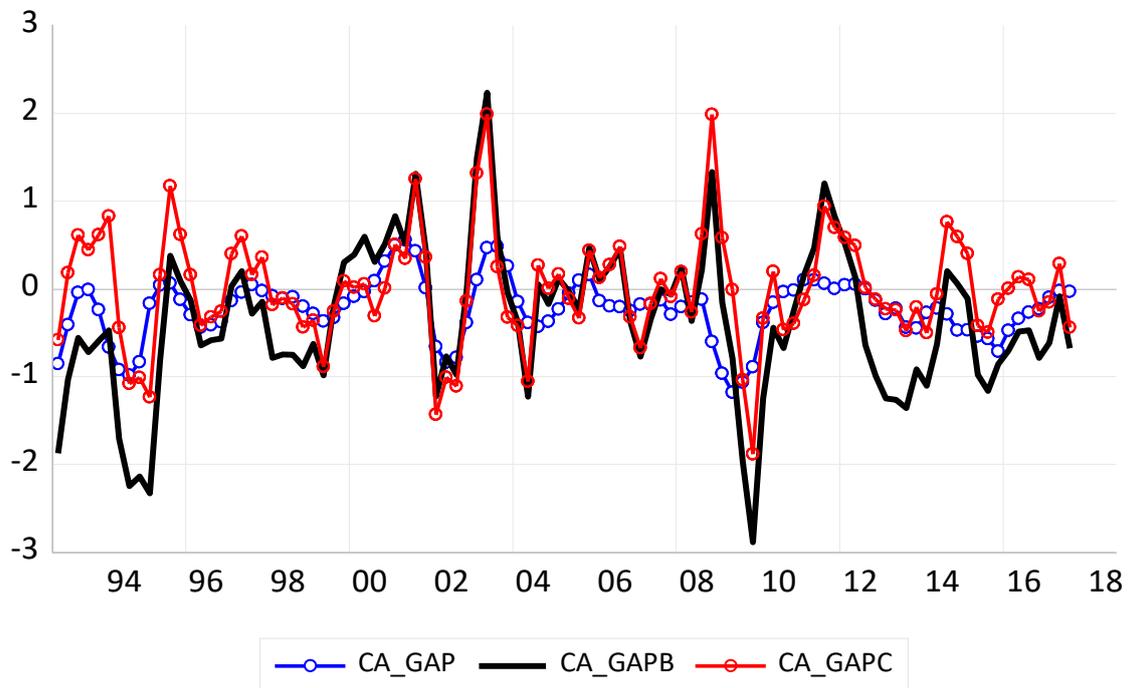


Monetary Policy: EME

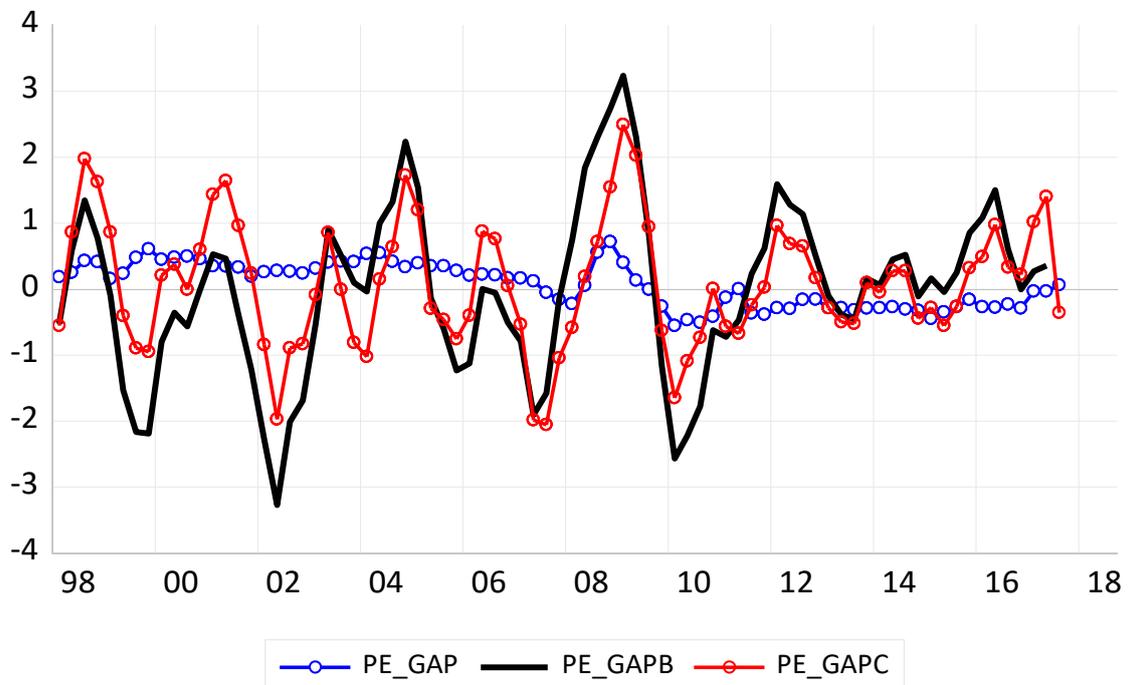


Selected Output Gap Estimates Comparisons

CANADA

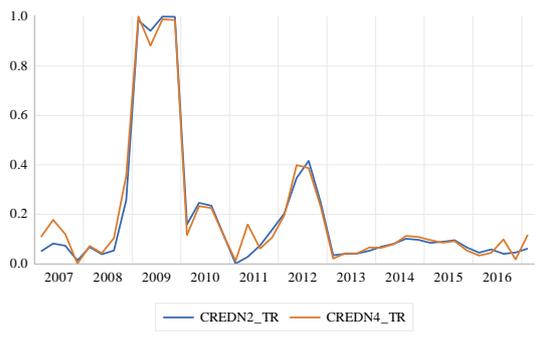
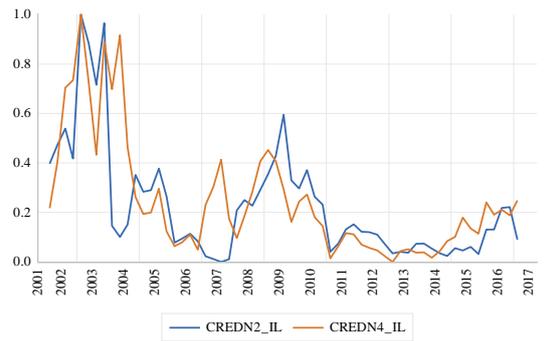
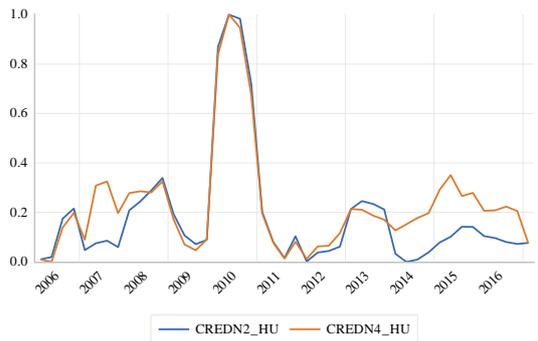
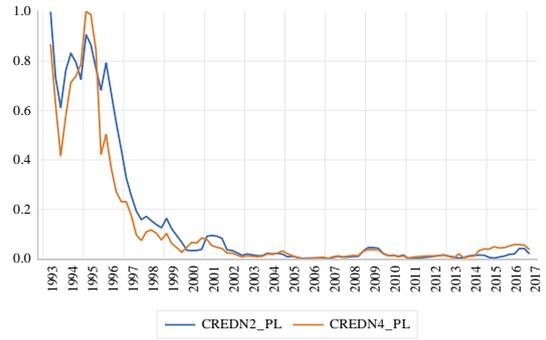
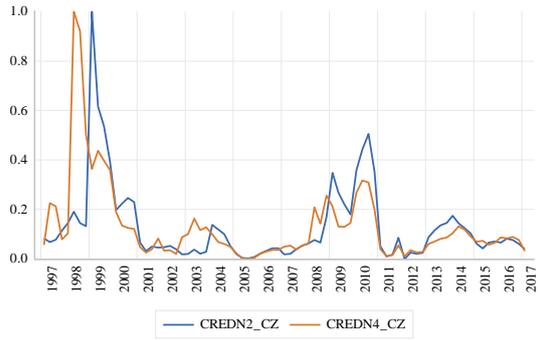


PERU

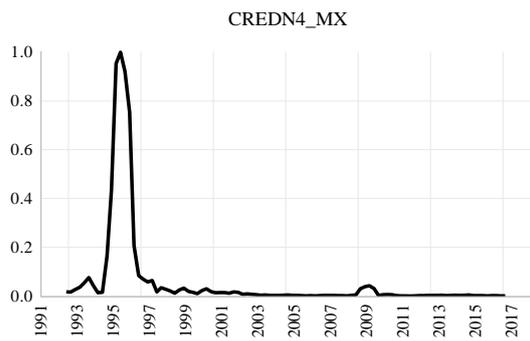
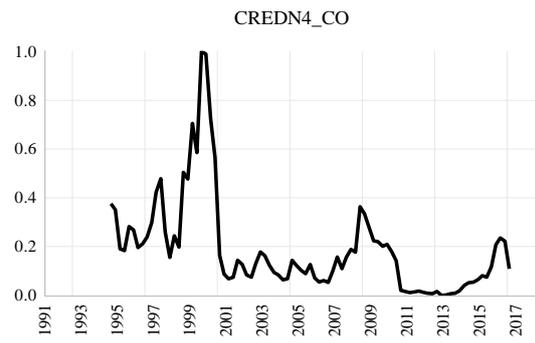
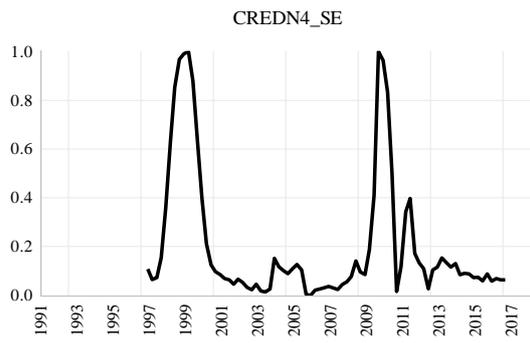
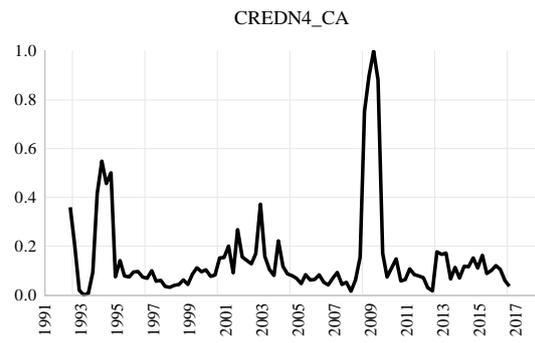
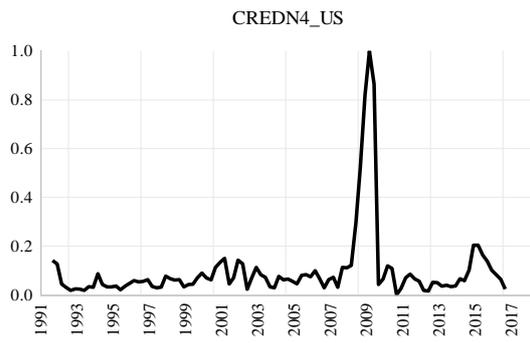


Note: See main body of the paper for the details but the the graphs refer to the first term in equation (1) measured 3 different ways.

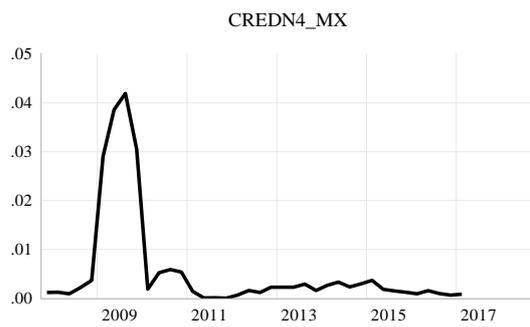
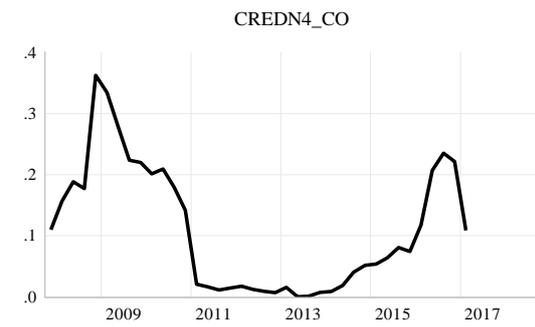
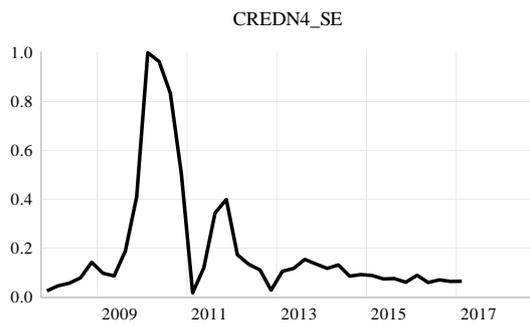
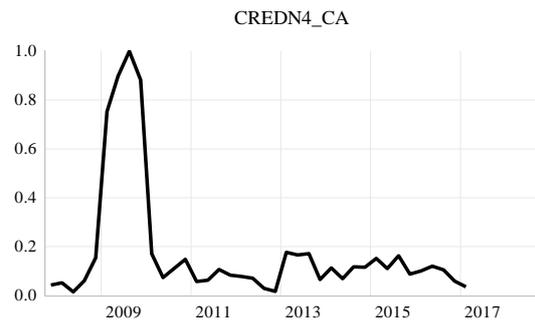
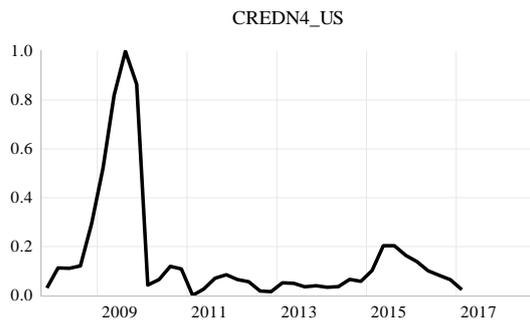
Additional Credibility Estimates



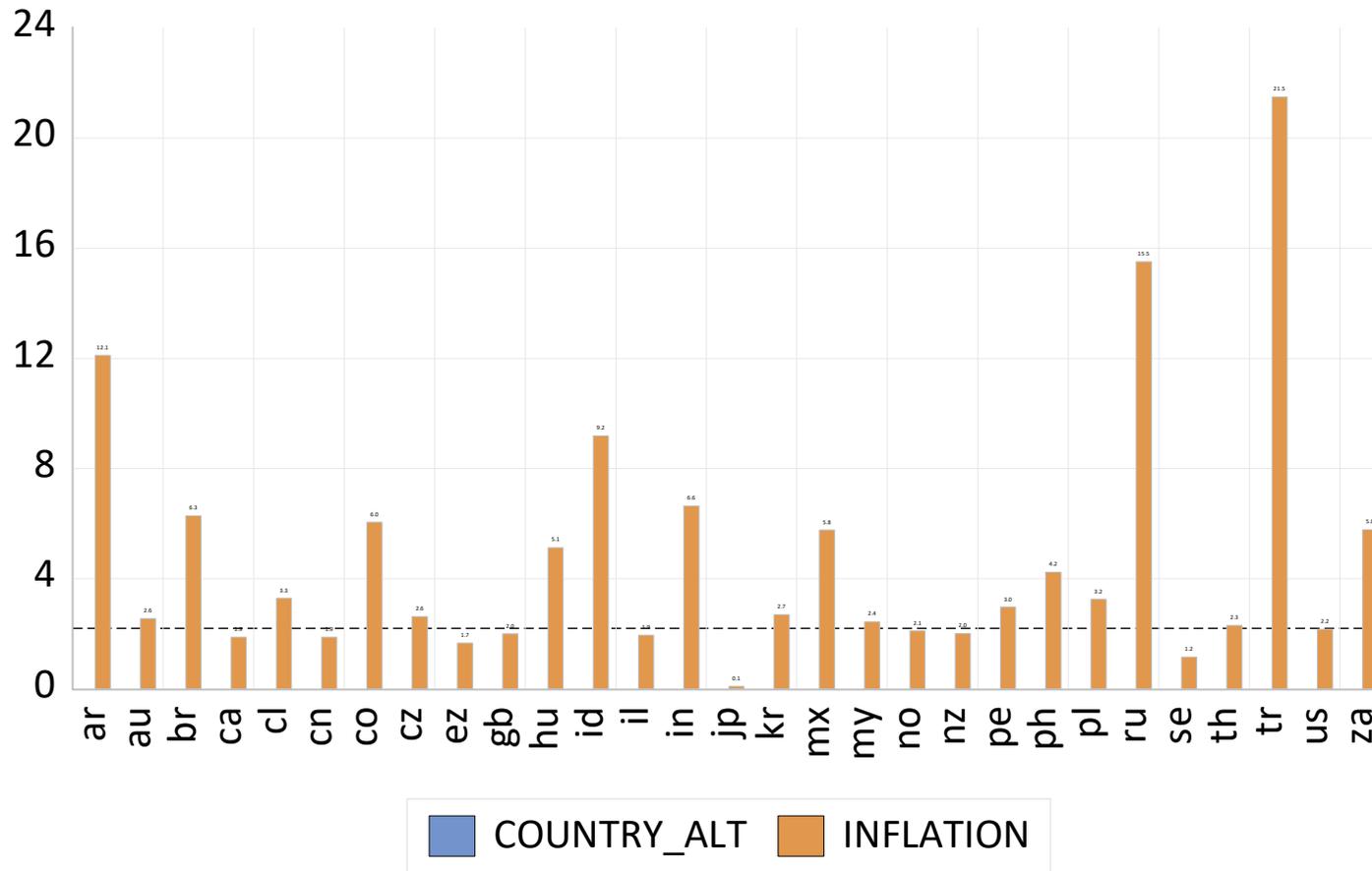
Case Studies of CB Credibility: Full Sample



Case Studies of CB Credibility: GFC and Beyond



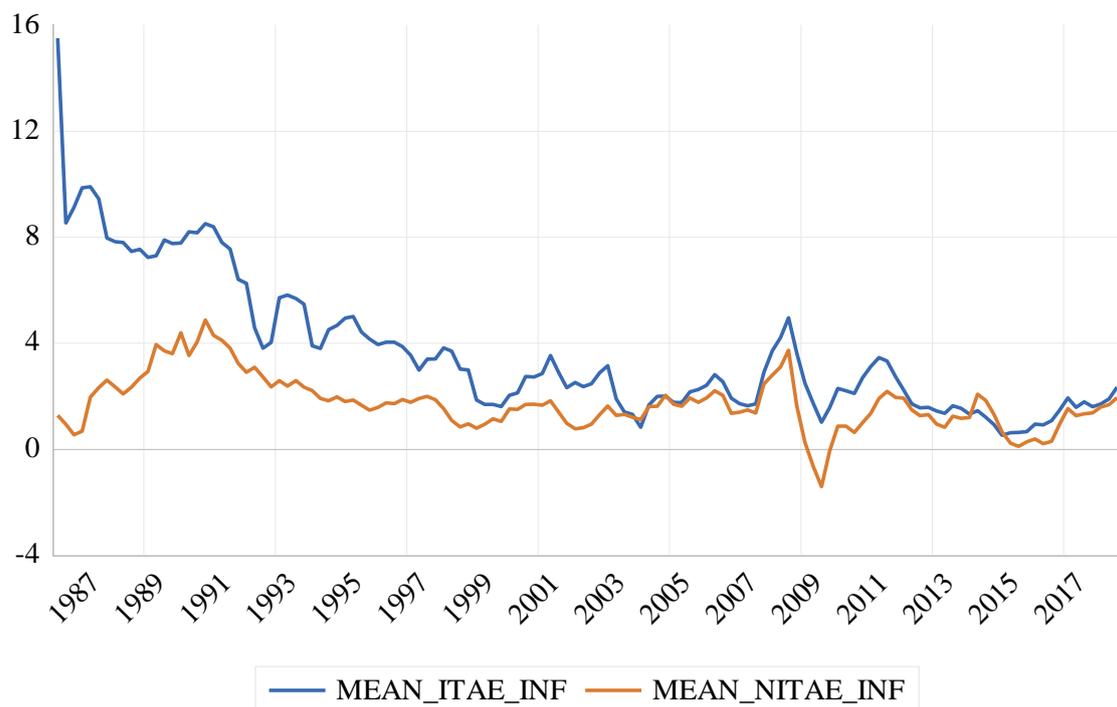
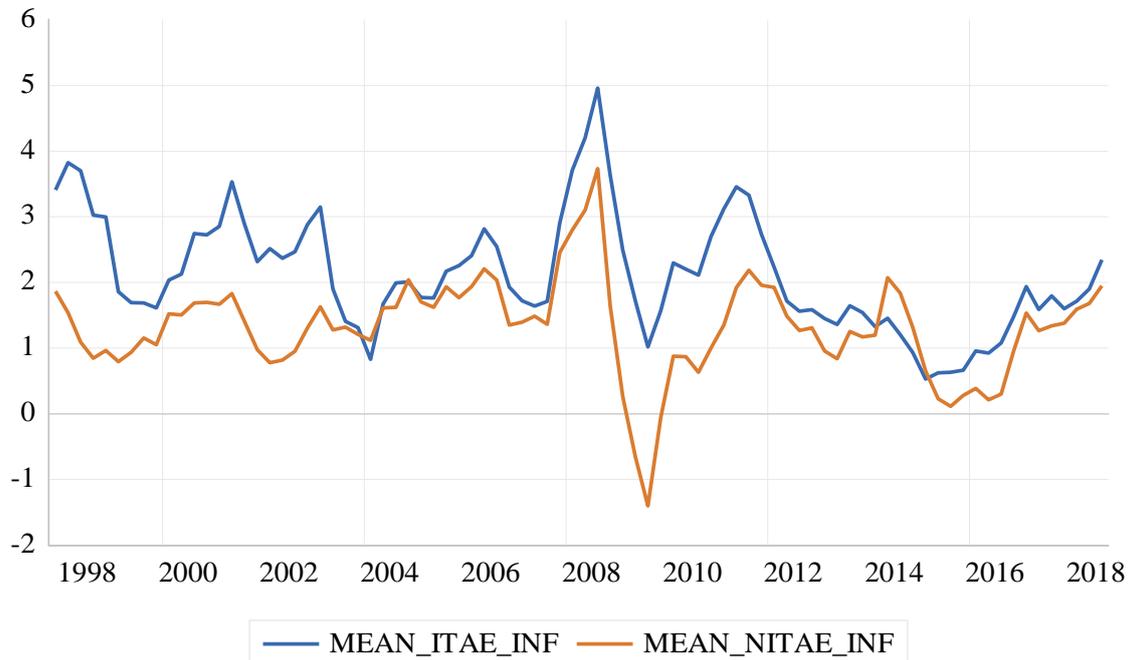
Inflation: The General Story

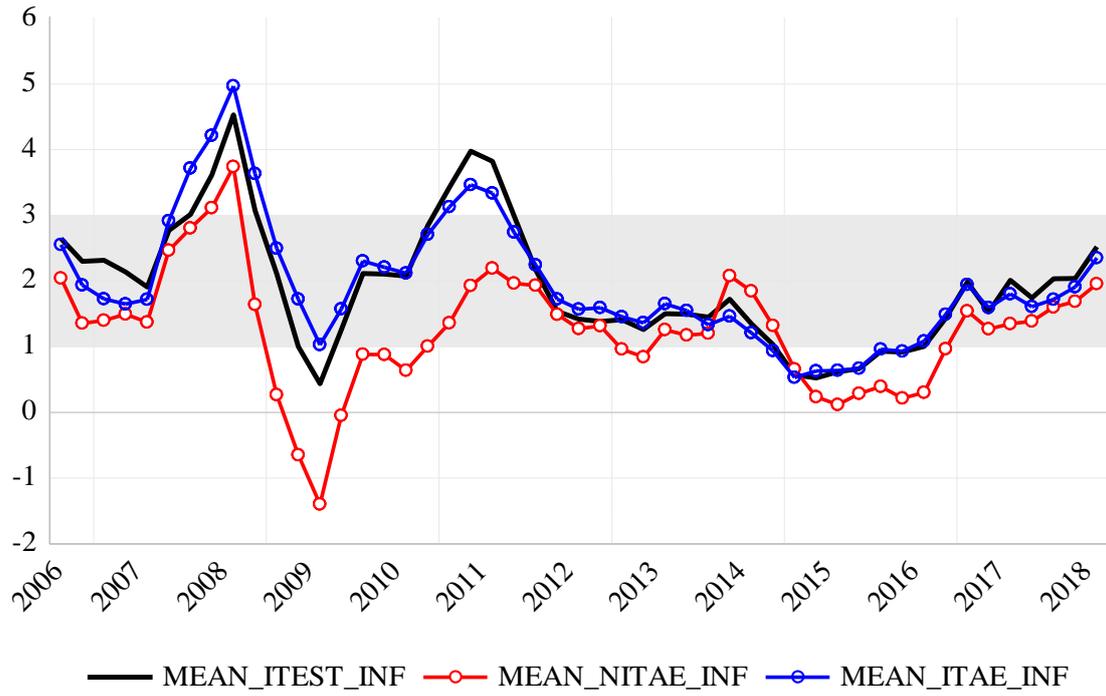


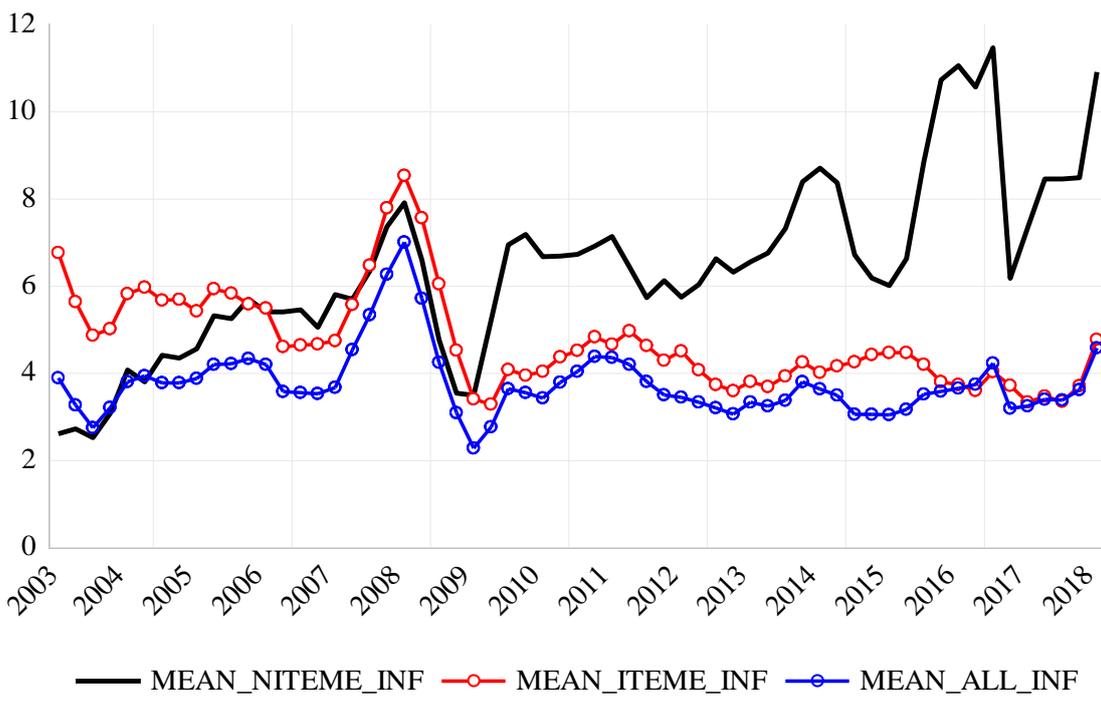
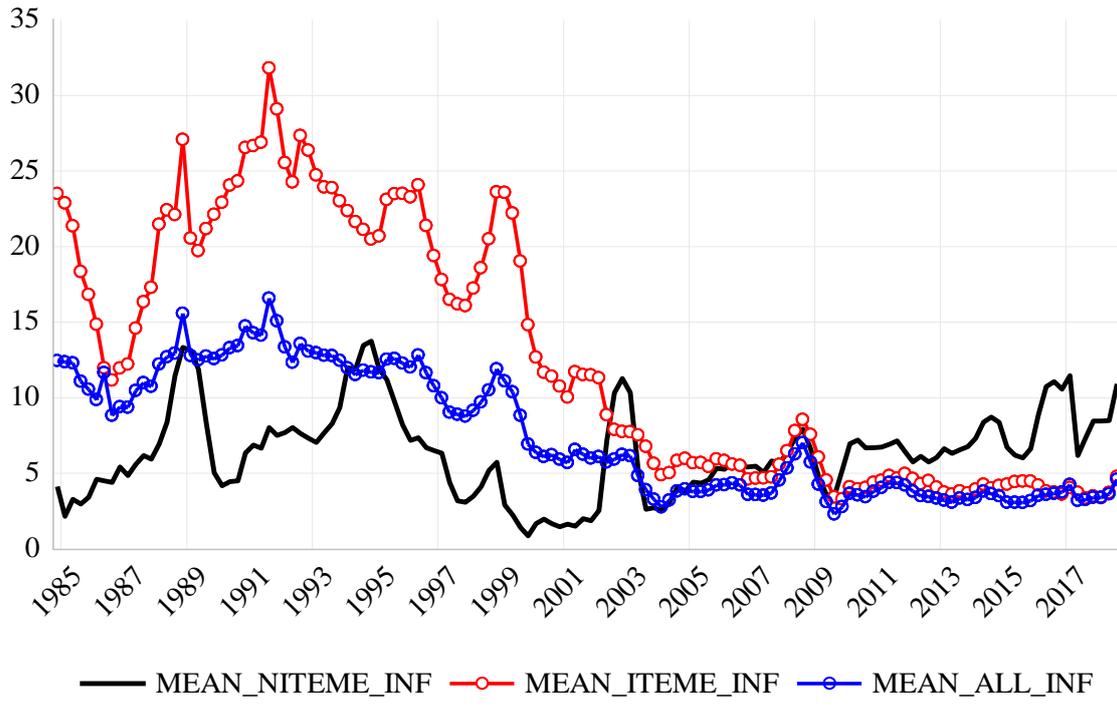
Note: mean CPI inflation, 1999Q1-2018Q3. Dashed horizontal line is US inflation. Mean inflation values shown above each bar.

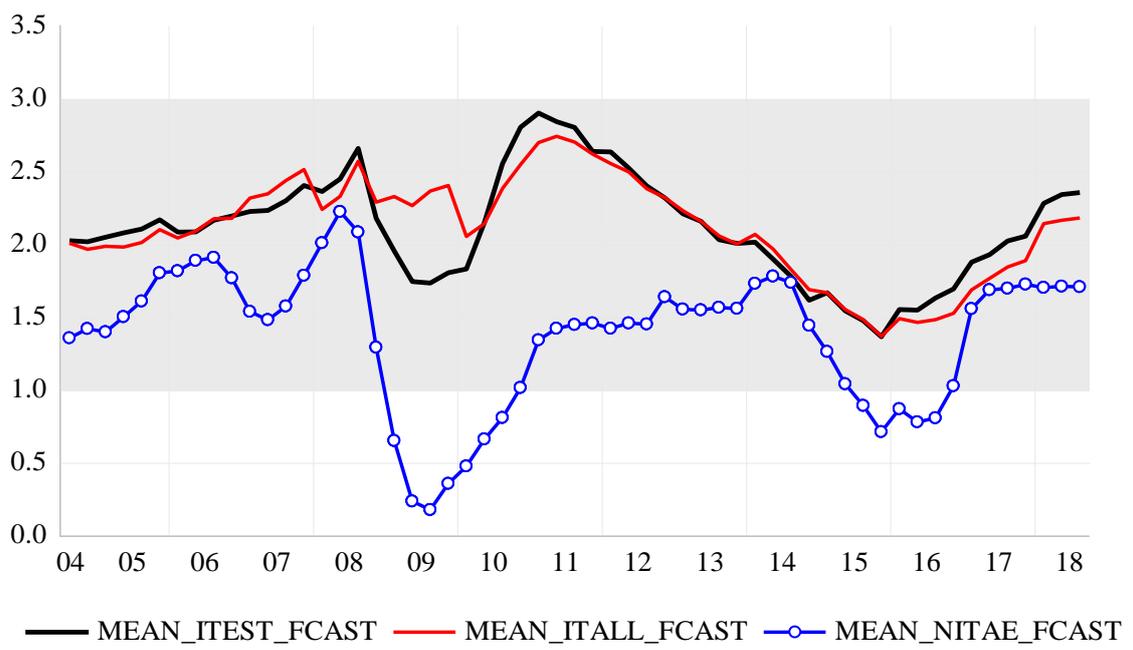
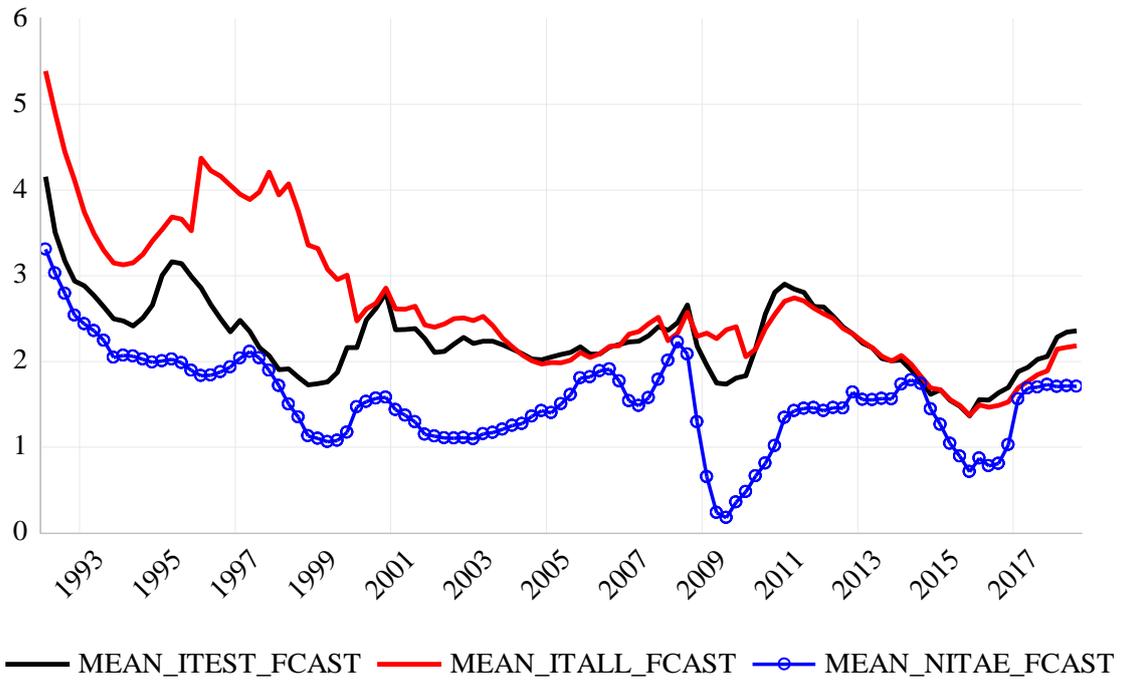
A Few Additional Stylized Facts: Mean Inflation Rates in AE, EME, IT and NIT Economies

Economies

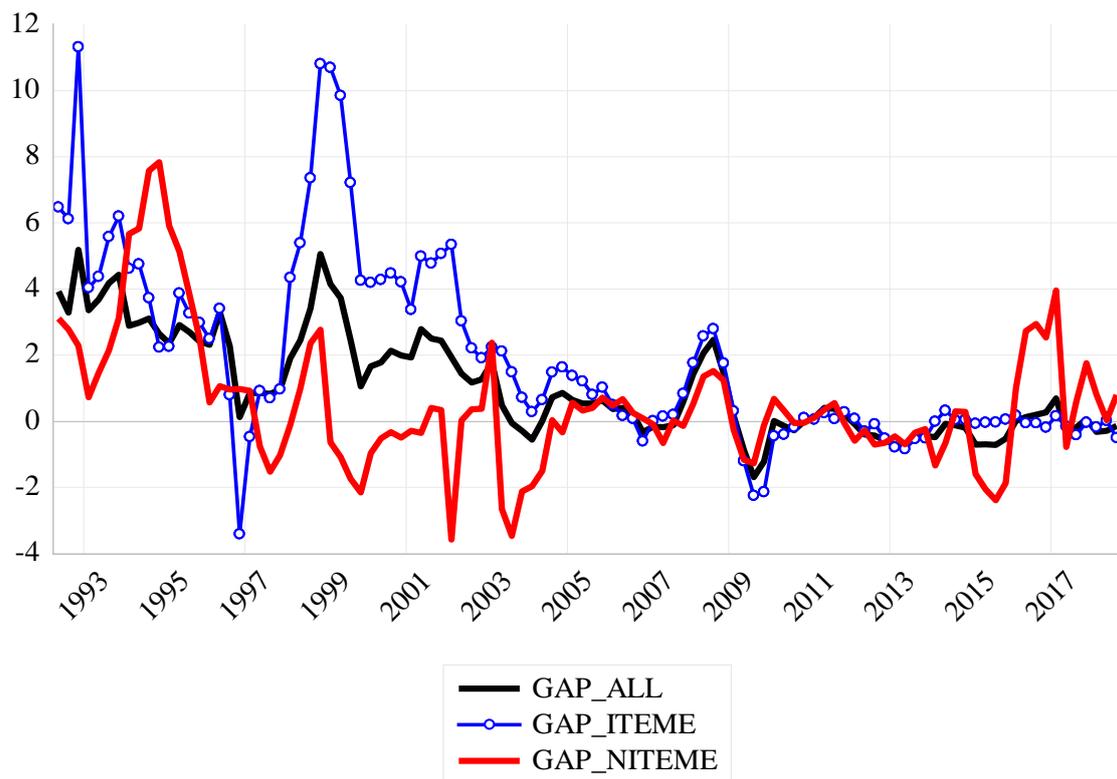
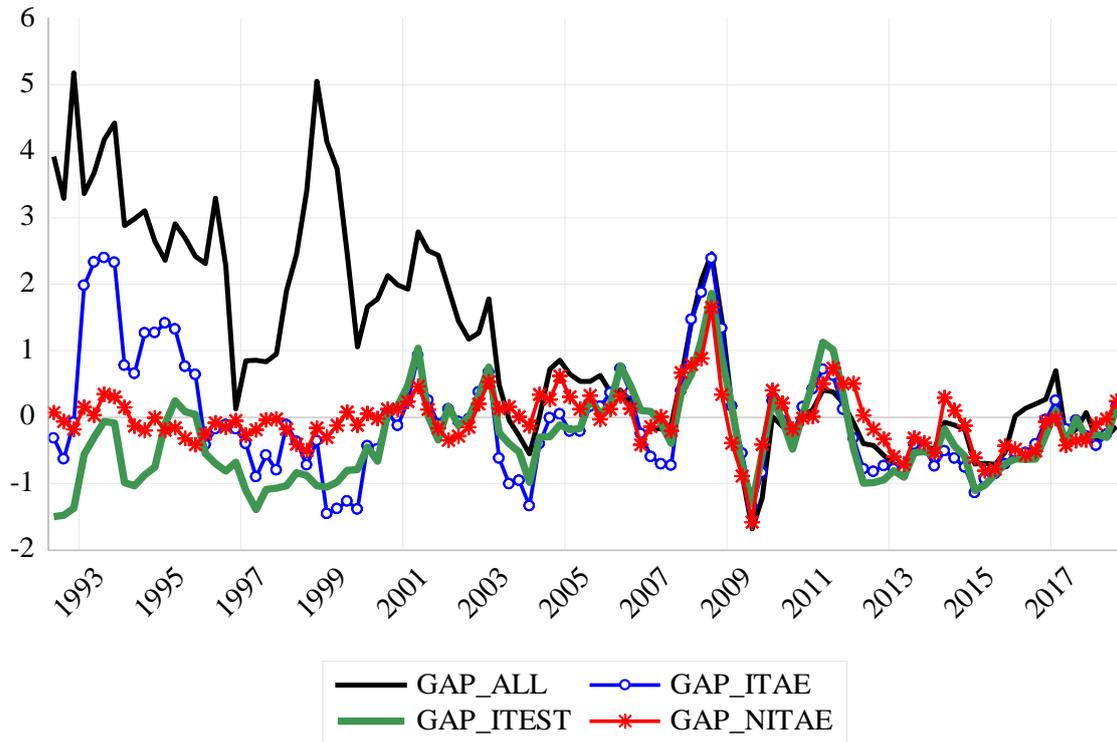








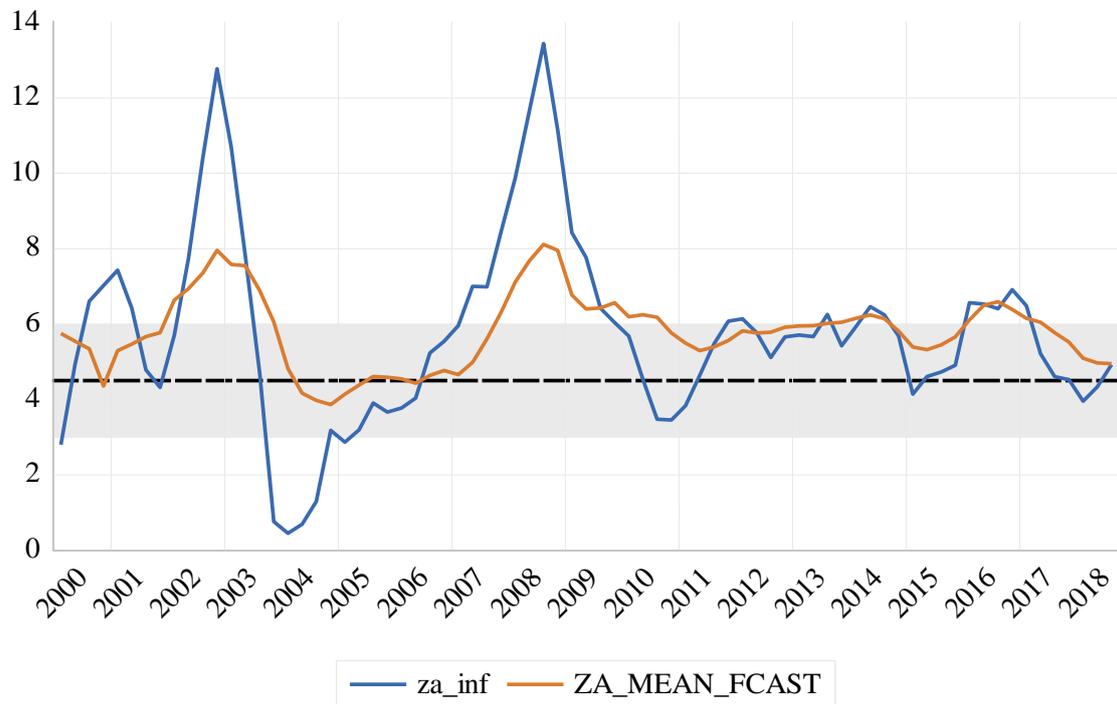
Note: Shaded area is the 1-3% target band.



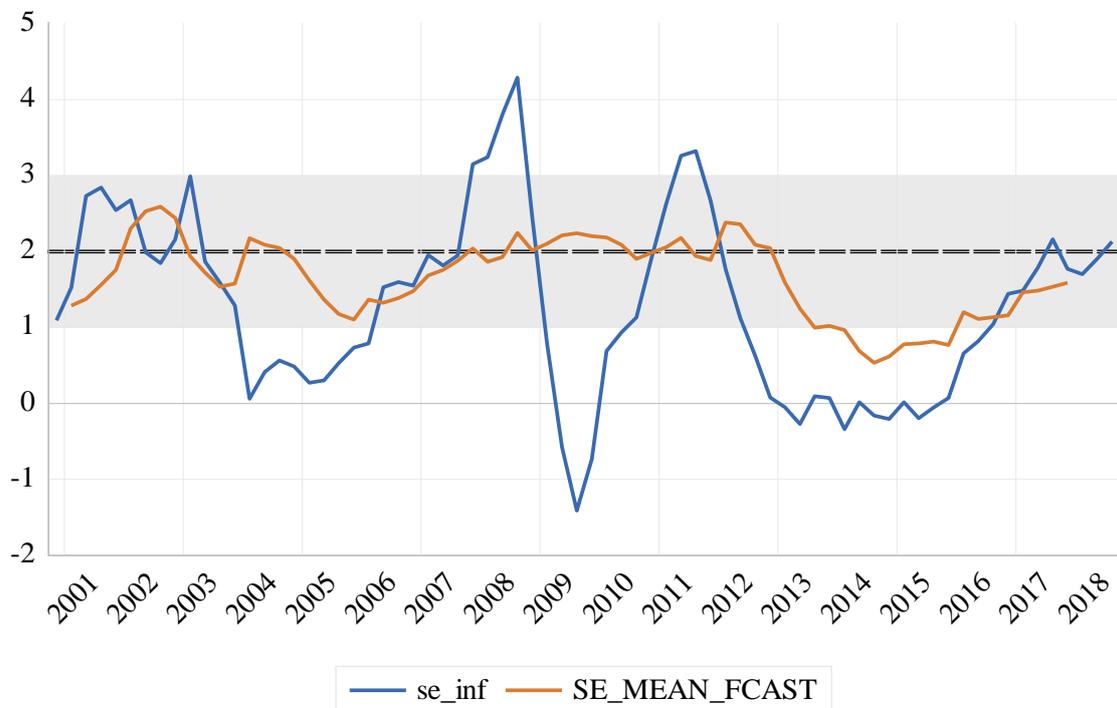
Note: GAP is the difference between observed and expected inflation as described in the main paper.

Two Case Studies: Inflation at the Top and Bottom of the Inflation Bands

South Africa



Sweden



The U.S. as a Benchmark

