

APPENDIX I:

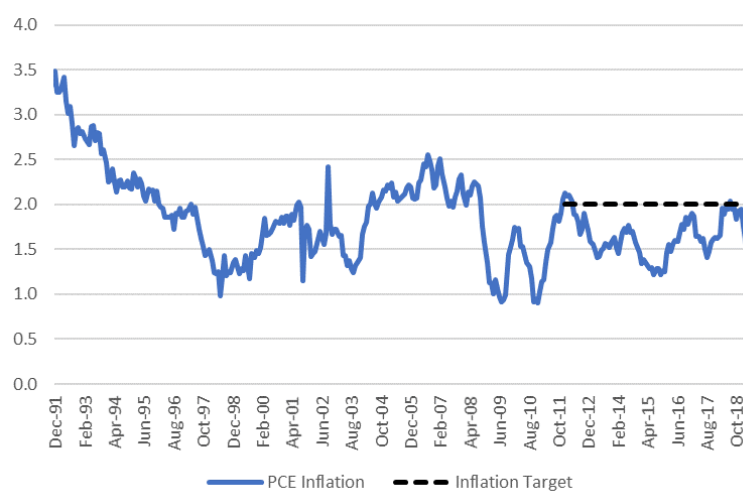
INFLATION PERFORMANCE AND CREDIBILITY IN 6 COUNTRIES¹

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 spread and in various measures of inflation expectations. The 20-year episode of good

¹ For helpful assistance in preparing these narratives we thank Humberto Martinez Beltran and Cesar Tamayo.

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.

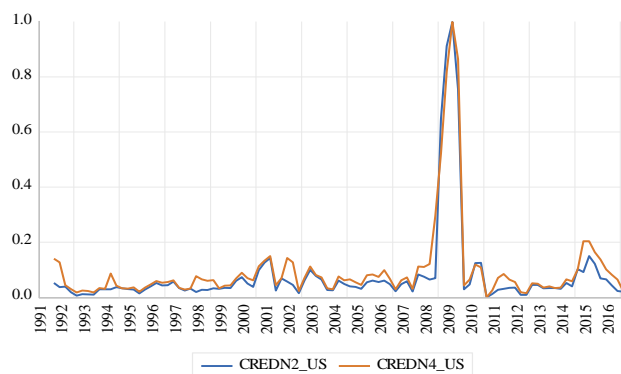
As the unemployment rate continued to fall below the Fed's estimate of the natural rate of unemployment but wage gains remained modest, the Fed argued that the Phillips Curve has flattened, it then lowered its estimate of the natural rate of unemployment.

The Fed continued to raise rates gradually and in October 2017 sets out a strategy on passively unwinding its 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 showed signs of slowing, the Fed began 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 the 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



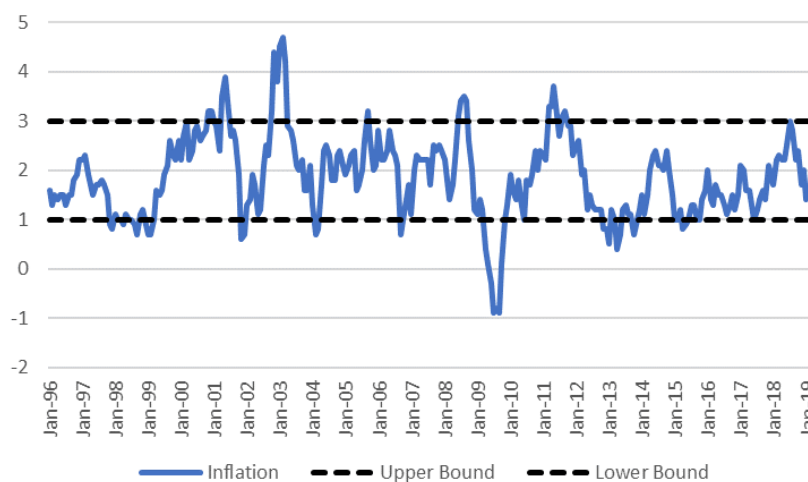
Note: the main body of the text explains how CREDN2 and CREDN4 are estimated.

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.

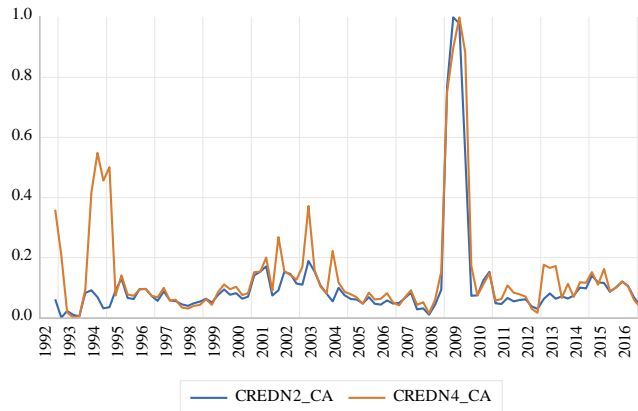
While the BoC has been a leader in promoting the virtues of forward guidance as a useful tool under crisis conditions (Poloz 2014), to good effect, the central bank appears occasionally incapable of providing clarity about when the economy might return to a state that calls for a more 'normal' monetary 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

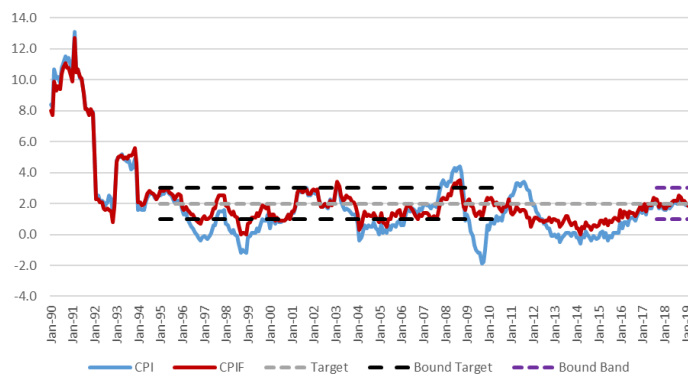


Note: the main body of the text explains how CREDN2 and CREDN4 are estimated.

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 across advanced economies in 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: the 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 shortened the maturities of loans with variable 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 remain 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 was 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 prioritized concerns about financial stability over decisions of monetary policy. This occurred despite the fact that inflation floated around 0% throughout 2013.

Lars 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.

Stefan Ingves (2017), Governor of the SRB since 2006, argued 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 turf 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 of 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”². Consequently, other authorities were created, different from the SRB, responsible to 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.

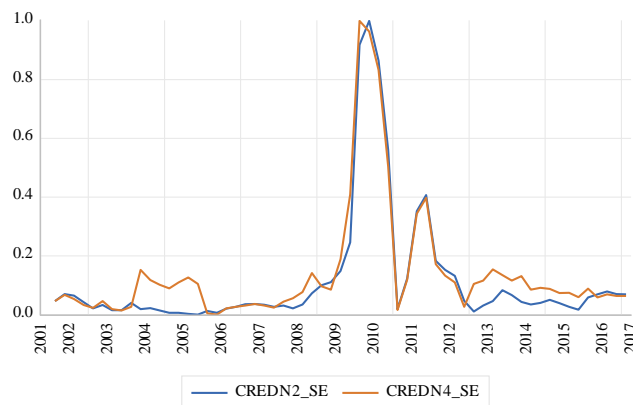
Moreover, the SRB decided to make a third change to its monetary targeting regime in September 2017. The SRB decided to reintroduce the tolerance band of +/- 1% to the inflation target. However, this band is a guide and should not be interpreted as an inflation target range. More importantly, the SRB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

² <http://www.sou.gov.se/finansiella-stabilitetsradet/english-version/>

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, 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



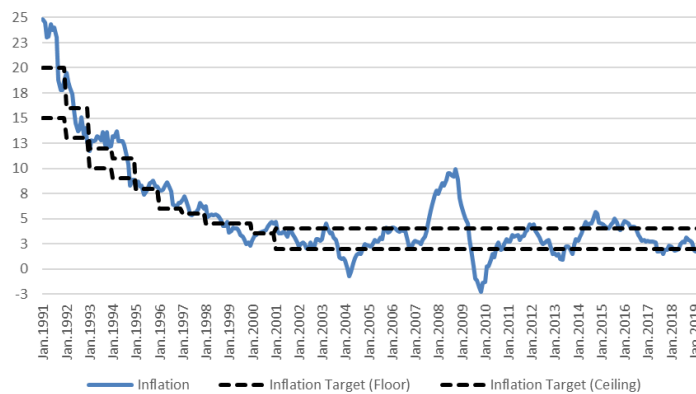
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The credibility measure of the SRB signals two periods when this central bank suffered from a loss in credibility. The first was between 2008 and 2010 which coincides with the GFC. The SRB reduced its policy rate to, almost, zero percent and offered 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 just 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%.

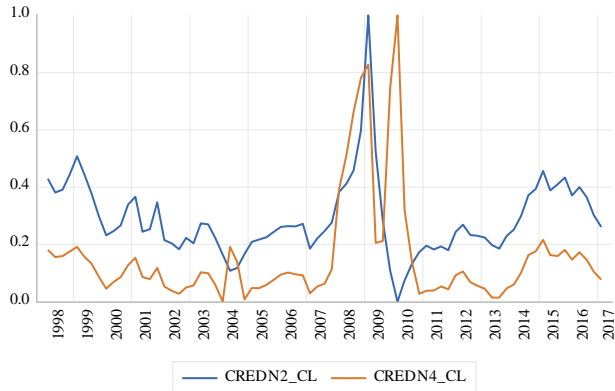
Inflation levels, during 2015, turned out to be more persistent than expected. This persistence was explained by the consistent depreciation of the exchange rate and by a resilient labor market despite the poor performance of the economy. Inflation finished the year, again, above the target range at 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 occurred 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

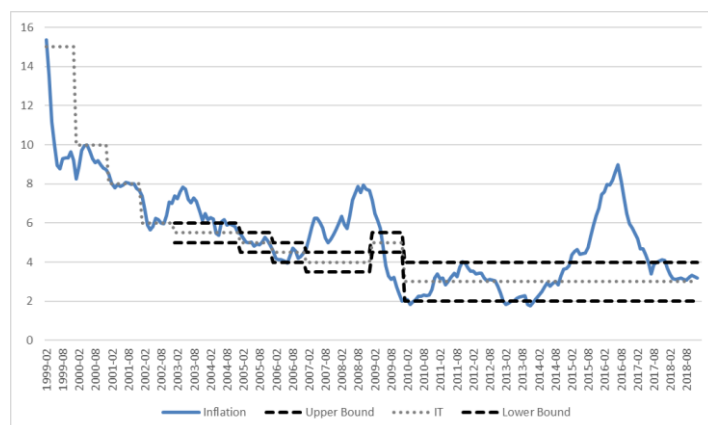


Note: the main body of the text explains how CREDN2 and CREDN4 are estimated.

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.

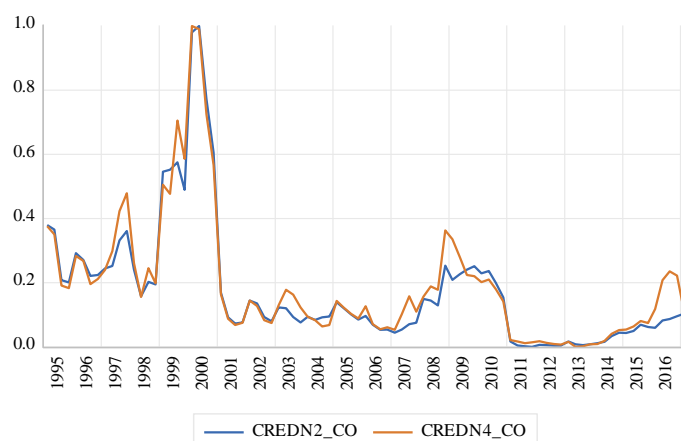
In 2018, inflation, at 3.2%, finished the year within the target inflation rate for the first time in three years. The policy rate was further reduced 50 basis points at the beginning of the year due to a lackluster performance of the economy. It has remained at 4.25% since then, a point that is considered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

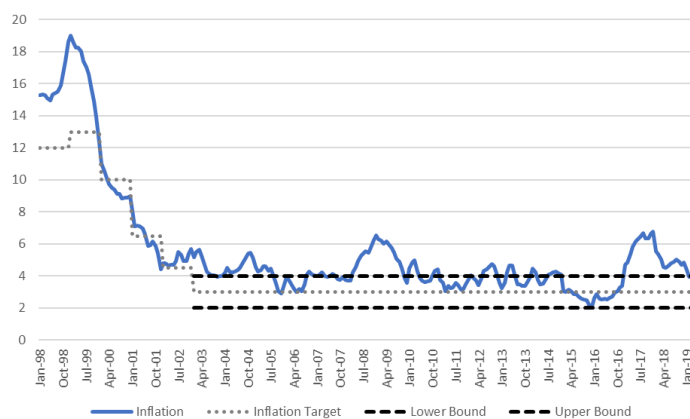
And the third period started in 2014 and continues to the present. This period is marked by the extreme drop in the price of oil that started mid 2014 which had severe effects on the Colombian economy. Oil represented more than 50% of exports, around 25% of

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.

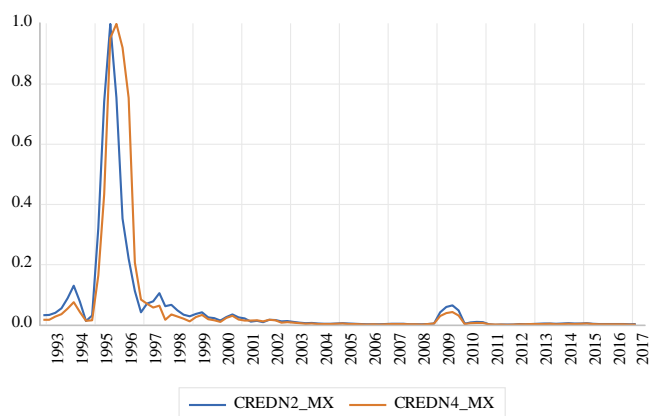
In 2009, the Mexican economy suffered a contraction of 6.5%, similar to the one experienced in 1995 during the Tequila Crisis (6.2%). This poor performance was a direct consequence of a weak demand for Mexican manufactured goods, specially from the US. Additionally, the domestic economy also was negatively 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 by 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	BIS	

	GDP <i>GOV_CREDIT</i>		
CRPS	TOTAL CREDIT TO PRIVATE NON-FINANCIAL SECTOR AS PERCENTAGE OF GDP <i>PRIVATE_CREDIT</i>	BIS	
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 <i>OR</i> 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_EXCHRAT E</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</i> <i>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_GROWTH</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 KRIPPNER'S ESTIMATES	WU AND XIA, 2016 KRIPPNER FROM RBNZ WEBSITE	HTTPS://SITES.GOOGLE.COM/VIEW/JINGCYNTHIAWU/SHADOW-RATES; HTTPS://WWW.RBNZ.GOV.T.NZ/RESEARCH-AND-PUBLICATIONS/RESEARCH-PROGRAMME/ADDITIONAL-RESEARCH/MEASURES-OF-THE-STANCE-OF-UNITED-STATES-MONETARY-

			<u>POLICY/COMPARISON-OF-INTERNATIONAL-MONETARY-POLICY-MEASURES</u>
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 <i>-.54</i>	-.60 <i>-1.05</i>	.49 <i>.84</i>	-.60 <i>-.18</i>	.16 <i>-.92</i>	.20 <i>.09</i>	.21 <i>-.82</i>	.42 <i>.56</i>	.40 <i>.51</i>	-.12 <i>.20</i>	-.32 <i>-.52</i>	.05 <i>.40</i>
10-14	-.48 <i>-1.01</i>	.39 <i>-.26</i>	.31 <i>-.17</i>	-.32 <i>-.53</i>	.12 <i>-.59</i>	1.22 <i>.41</i>	.38 <i>-.05</i>	-.15 <i>-.36</i>	1.32 <i>.87</i>	.74 <i>-.59</i>	1.06 <i>-1.11</i>	.06 <i>.23</i>
12-16	.43 <i>-.32</i>	.73 <i>.51</i>	.97 <i>.32</i>	.67 <i>.17</i>	.01 <i>.03</i>	1.02 <i>.56</i>	1.30 <i>.36</i>	-.005 <i>-.43</i>	.16 <i>-.12</i>	.98 <i>.96</i>	-.37 <i>-.28</i>	-.05 <i>-.31</i>
14-18	.86 <i>.08</i>	.48 <i>.15</i>	.40 <i>1.40</i>	.38 <i>.03</i>	.49 <i>.66</i>	1.01 <i>.48</i>	.42 <i>.63</i>	.68 <i>1.15</i>	.83 <i>.05</i>	.08 <i>.24</i>	-.44 <i>.03</i>	-.19 <i>-.30</i>

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 <i>1.84</i>	-.33 <i>.92</i>	.37 <i>.84</i>	.28 <i>1.50</i>	1.08 <i>.27</i>	.41 <i>.61</i>	1.20 <i>.72</i>	1.47 <i>.13</i>	.26 <i>-.21</i>	1.18 <i>.62</i>	.26 <i>.16</i>	.67 <i>NA</i>	-.13 <i>.20</i>	1.50 <i>NA</i>	1.45 <i>NA</i>	-.73 <i>NA</i>	.46 <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	-09	-02	.26	.04	.11	.64	.72	.79	.41	.61	.98	-13	.22	-38	-43	.75
	<i>-.64</i>	<i>-.61</i>	<i>.93</i>	<i>.59</i>	<i>.21</i>	<i>.42</i>	<i>.93</i>	<i>1.23</i>	<i>.94</i>	<i>-.47</i>	<i>1.17</i>	<i>-.18</i>	<i>-.27</i>	<i>.07</i>	<i>-.96</i>	<i>.07</i>	<i>.14</i>
08-12	-84	.23	.18	-.13	.92	.09	1.07	.91	.71	.60	-.005	1.25	-.91	.21	-.59	-.17	1.02
	<i>-.73</i>	<i>.16</i>	<i>1.04</i>	<i>-.52</i>	<i>.25</i>	<i>.60</i>	<i>.48</i>	<i>.58</i>	<i>.80</i>	<i>.16</i>	<i>1.08</i>	<i>.99</i>	<i>-.26</i>	<i>.07</i>	<i>-.90</i>	<i>-.40</i>	<i>.90</i>
10-14	1.69	-.27	-.16	.93	.10	-.39	.43	.45	.39	.07	-.64	.10	-.22	-.17	-.25	-.71	-1.01
	<i>1.44</i>	<i>-.33</i>	<i>-.85</i>	<i>-.12</i>	<i>.54</i>	<i>-1.10</i>	<i>.23</i>	<i>.43</i>	<i>.73</i>	<i>-.53</i>	<i>-.24</i>	<i>.20</i>	<i>-.96</i>	<i>.02</i>	<i>-.75</i>	<i>-.03</i>	<i>-.56</i>
12-16	.90	.67	-.32	.66	.85	1.05	.32	.16	-.17	-.01	.42	-.36	.89	1.11	-.27	.59	-.51
	<i>-.28</i>	<i>.30</i>	<i>1.45</i>	<i>-.28</i>	<i>.99</i>	<i>.26</i>	<i>-1.04</i>	<i>.19</i>	<i>-.76</i>	<i>.37</i>	<i>.63</i>	<i>-.47</i>	<i>.27</i>	<i>1.07</i>	<i>-.54</i>	<i>.45</i>	<i>-.05</i>
14-18	.43	-.02	-.47	-.09	.81	.37	.62	-.60	.49	-.34	.89	.30	.23	.75	-.03	2.08	.0-.235
	<i>-.20</i>	<i>-1.75</i>	<i>.14</i>	<i>.66</i>	<i>.37</i>	<i>1.60</i>	<i>.11</i>	<i>.87</i>	<i>-.33</i>	<i>.22</i>	<i>.78</i>	<i>.07</i>	<i>.85</i>	<i>.72</i>	<i>.03</i>	<i>-.02</i>	

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	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	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	3-6	3-6	2.75-5.75
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	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	4.5-5.5	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	
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	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	3-5	3-5	3-5	3-5
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
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
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
PH	02.1											5-6	4-5	5-6	4-5	4-5	3-5	3-5	2.5-4.5	3.5-5.5	3-5	3-5	3-5	3-5	3-5	2-4	2-4	2-4	2-4
RU	14.1																							5	4.5	4	4	4	4
ZA	00.1									3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6
TH ^o	00.2									0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5	0.5-3.5
TR*	06											35	20	12	8	3-7	4	4	7.5	4.6-8.5	3.5-7.5	3-7	3-7	3-7	3-7	3-7	3-7	3-7	3-7
<i>QUASI-IT</i>																													
EZ	99.1									≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2	≤2
JP§	96.1														0	0	0	0	0	0	0	0	2	2	2	2	2	2	2
US¶	12.1																					2	2	2	2	2	2	2	

NOTE: DATA WERE COLLECTED FROM INDIVIDUAL CENTRAL BANK WEB SITES THROUGH THE BIS'S CENTRAL BANK HUB ([WWW.BIS.ORG/CENTRAL BANK HUB OVERVIEW.HTM](http://WWW.BIS.ORG/CENTRAL_BANK_HUB_OVERVIEW.HTM)). INDIVIDUAL STUDIES REVIEWING THE EXPERIENCE TO DATE WITH INFLATION TARGETING AND PUBLISHED BY SEVERAL OF THE CENTRAL BANKS WERE ALSO CONSULTED. OCCASIONALLY, SOME INCONSISTENCIES WERE FOUND IN THE REPORTING OF TARGET RANGES PARTLY BECAUSE THE TARGET RANGE WAS CHANGED MID-YEAR FROM TIME TO TIME (E.G., BRAZIL) OR FOR REASONS THAT ARE NOT CLEAR. THE SHADED AREA HIGHLIGHTS CHANGES TO THE INFLATION TARGET AFTER THE FIRST THREE YEARS OF AN INFLATION TARGET. *BIS: TURKEY INFLATION TARGETING ADOPTION YEAR: 2006. NOTE THAT THERE WAS AN

IMPLICIT INFLATION TARGETING REGIME BETWEEN 2002 AND 2005.³ **MANY MID-YEAR CHANGES PRIOR TO 2011, INCLUDING INSTANCES OF MORE THAN ONE TARGET RANGE.⁴

ESTONIA (2011), LATVIA (2014), LITHUANIA (2015), SLOVAK R. (2009), AND SLOVENIA (2007) JOINED THE EUROZONE IN THE YEARS INDICATED IN PARENTHESIS. IN BOLD ARE THE CEE ECONOMIES THAT CONTINUE TO TARGET INFLATION IN CONSUMER PRICES.

ECONOMIES INCLUDED ADVANCED AND EMERGING GROUPS FOLLOW THE IMF'S WORLD ECONOMIC OUTLOOK'S DEFINITION.

§ SEE BANK OF JAPAN, "THE BANK'S THINKING ON PRICE STABILITY," BANK OF JAPAN QUARTERLY BULLETIN, 14 (2), 2006, PP. 65–90 (AVAILABLE AT [HTTP://WWW.BOJ.OR.JP//EN/TYPE/RELEASE/ZUIJI_NEW/MPO0603A.HTM](http://www.boj.or.jp/en/type/release/zuiji_new/mpo0603a.htm)), AND SINCE 2013, SEE [HTTP://WWW.BOJ.OR.JP/EN/MOPO/OUTLINE/QQE.HTM/](http://www.boj.or.jp/en/mopo/outline/qqe.htm/).

§§ "THE MONETARY POLICY STRATEGY ALREADY IN FORCE SINCE 2000 CONSISTS OF THE FOLLOWING ...ELEMENTS: A DEFINITION OF PRICE STABILITY [USED IN THE TABLE ABOVE], A MEDIUM-TERM INFLATION FORECAST...". SEE [HTTP://WWW.SNB.CH/EN/IABOUT/MONPOL/ID/MONPOL_STRAT#T7](http://www.snb.ch/en/iabout/monpol/id/monpol_strat#t7).

¶ 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).

³ Implicit inflation targeting can be defined as a period under which inflation targets are announced to the public, but not the regime and its details as such. It involves country acting as if inflation targeting were in place without a formal adoption of the regime. Typically, the central bank would also have other intermediate targets, as Turkey did between 2002-2005 in the form of monetary targets. For further details see <http://www.tcmb.gov.tr/wps/wcm/connect/5cbc48e5-979d-4be3-8bae-7e5a9267ed84/WP0603.pdf?MOD=AJPERES&CACHEID=5cbc48e5-979d-4be3-8bae-7e5a9267ed84>

⁴ As reported in Inflation Outlook and Analysis Reports. http://www.bog.gov.gh/index.php?option=com_content&view=article&id=174&Itemid=121.

PANEL UNIT ROOT TESTING: ALL ECONOMIES⁵

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.

⁵ 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
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.32479	0.0000	28	3320
Null: Unit root (assumes individual unit root process)				
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-sq...
 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 ⁶
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

⁶ 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.

RU	.61
SE	.82
TH	.80
TR	.63
US	.62
ZA	.80

Updating CBI from 2011-2017

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.

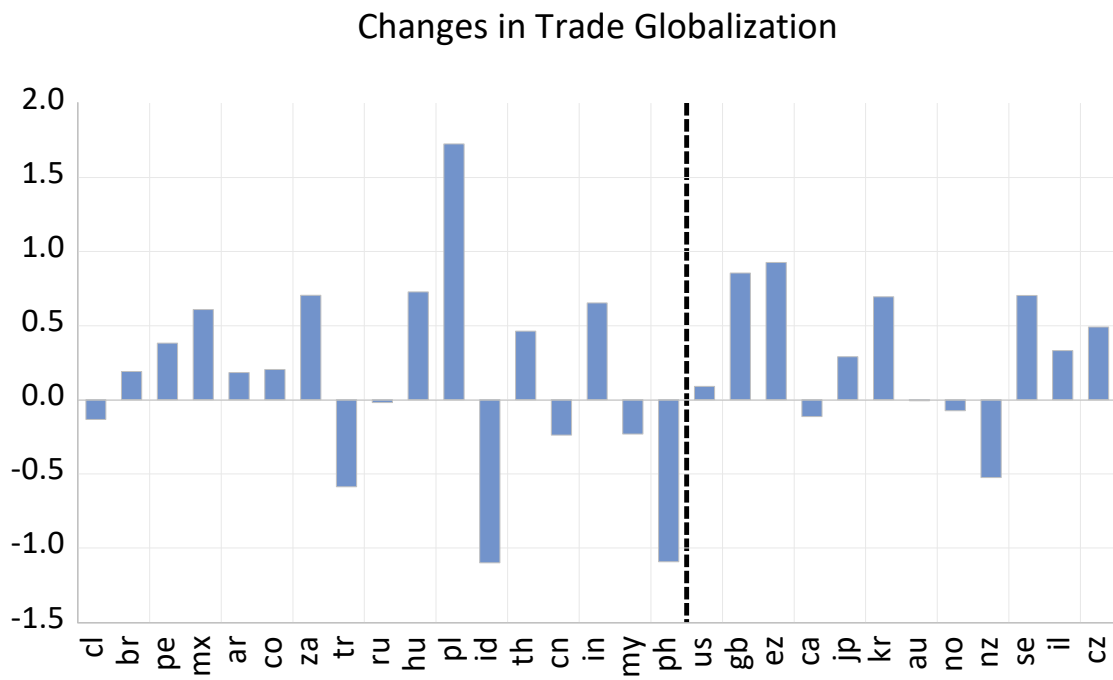
Proportion of Total Variation Explained by the First Principal Component

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.

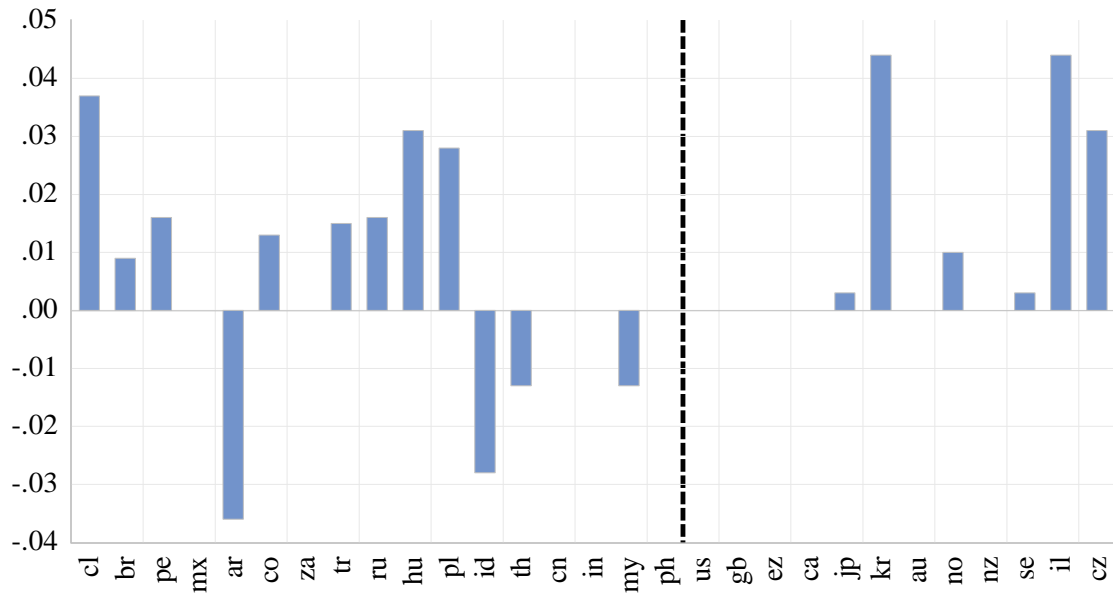
HU	.60	.78	1.	TH	.72	.94	.79
ID	.63	1.	.54	TR	.67	1.	1.
IL	.79	1.	.64	US	.75	.74	1.
IN	.60	1.	1.	ZA	.60	.90	.80

See text for estimation method and details.

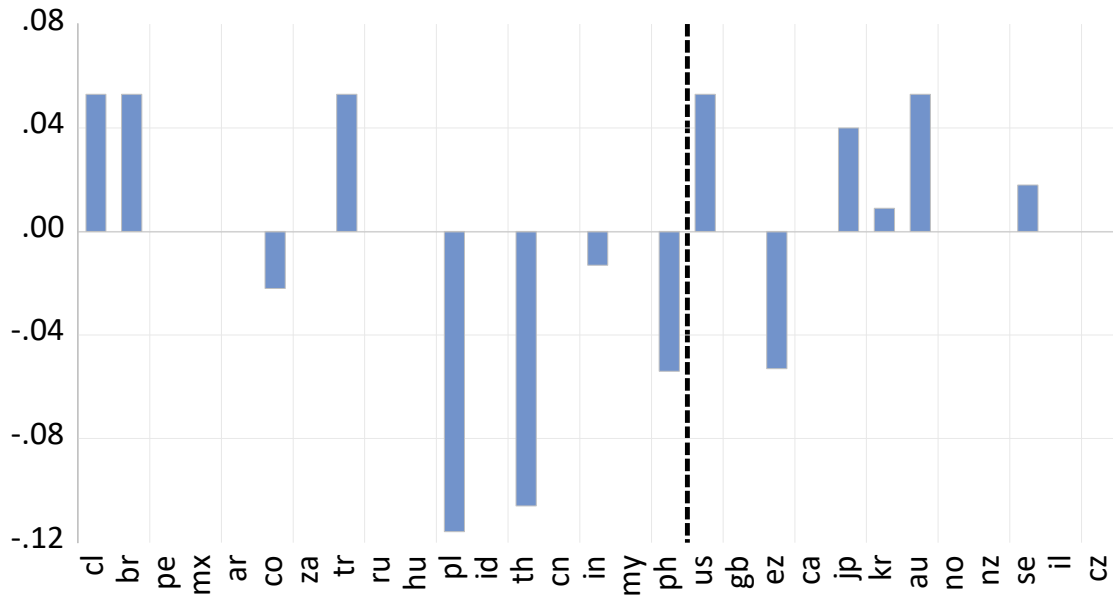
Other Institutional Change Indicators



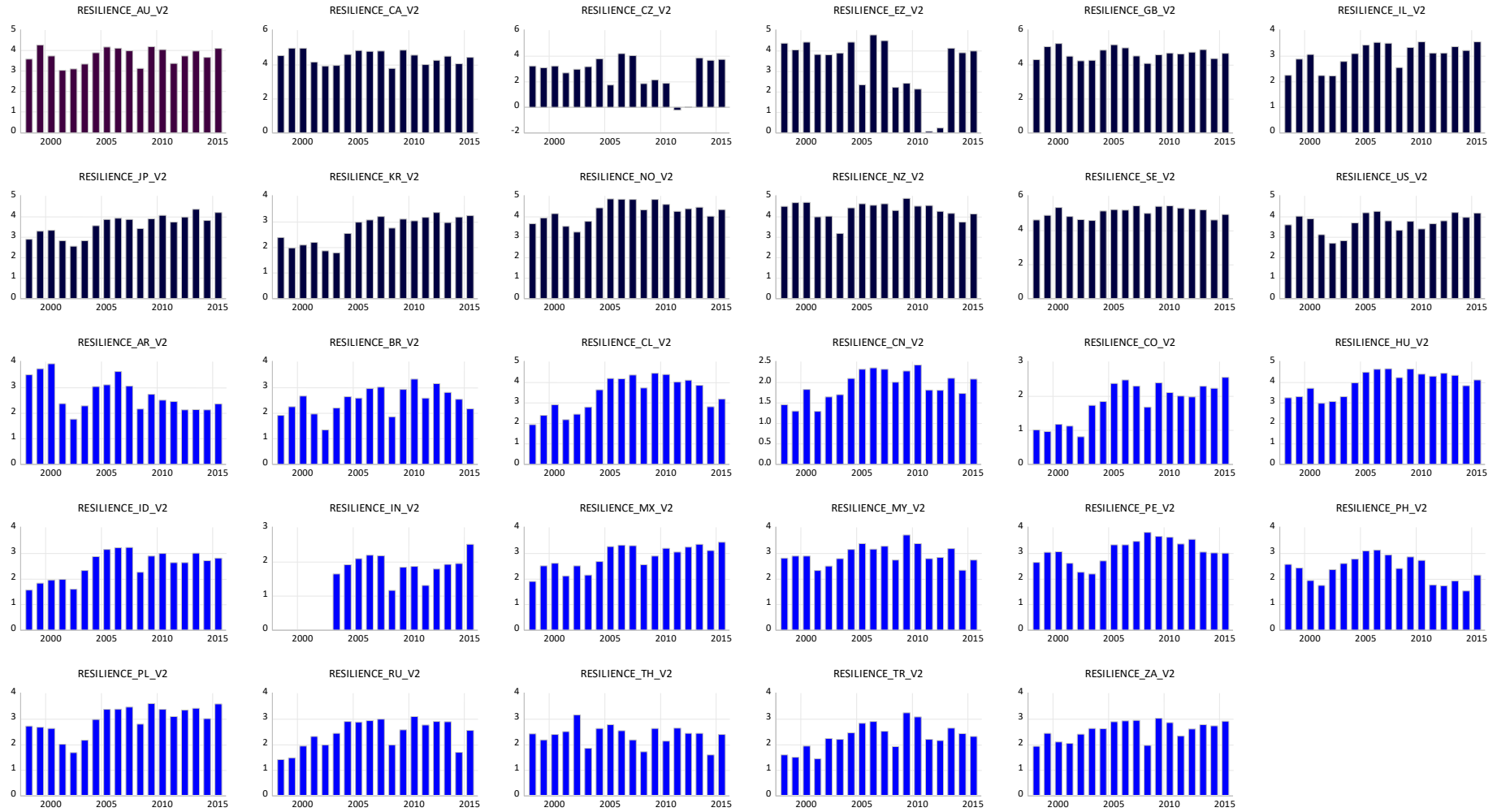
Changes in Capital Account Openness



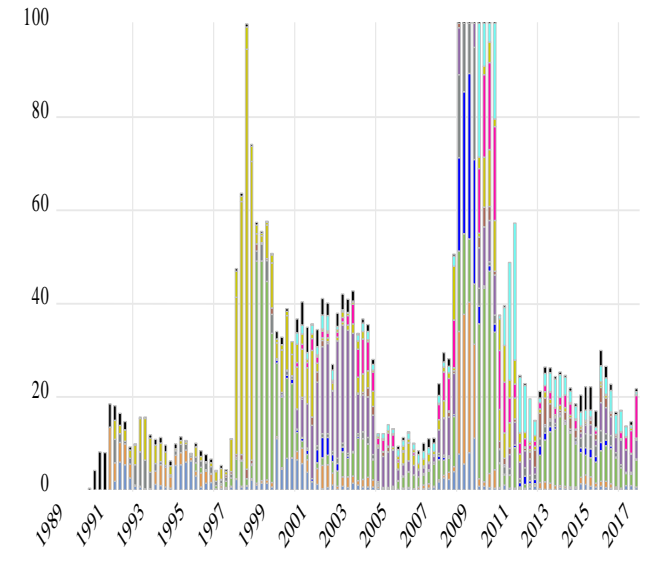
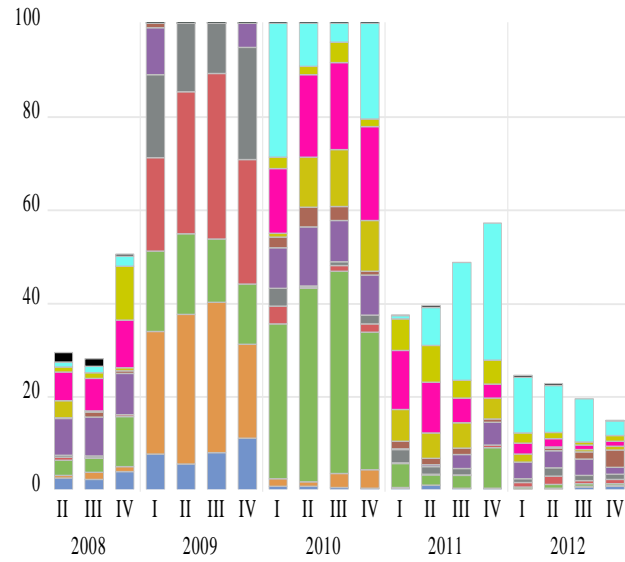
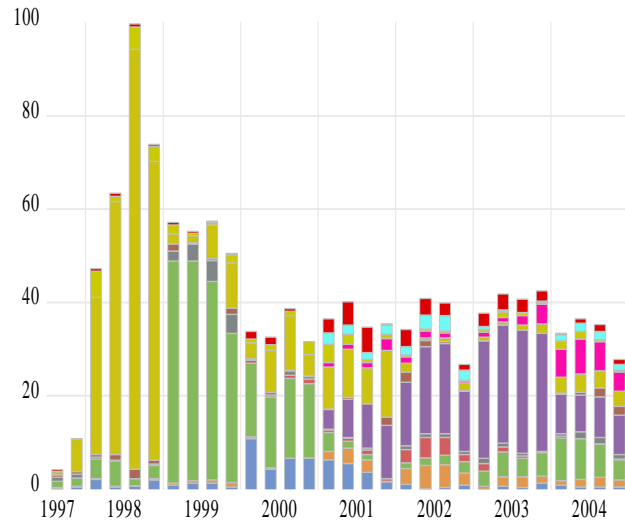
Changes in Exchange Rate Regimes



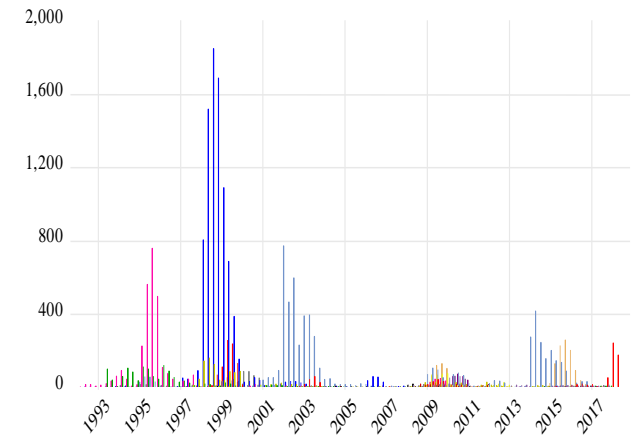
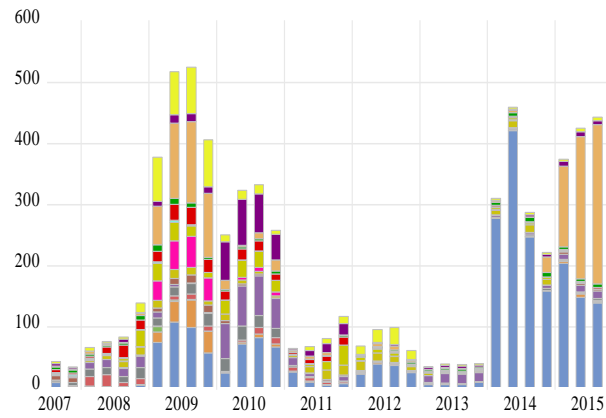
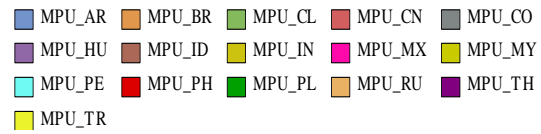
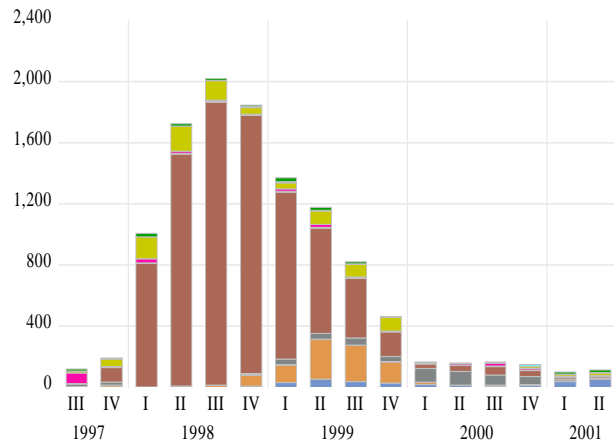
Individual Estimates of Resilience



Monetary Policy Uncertainty: AE

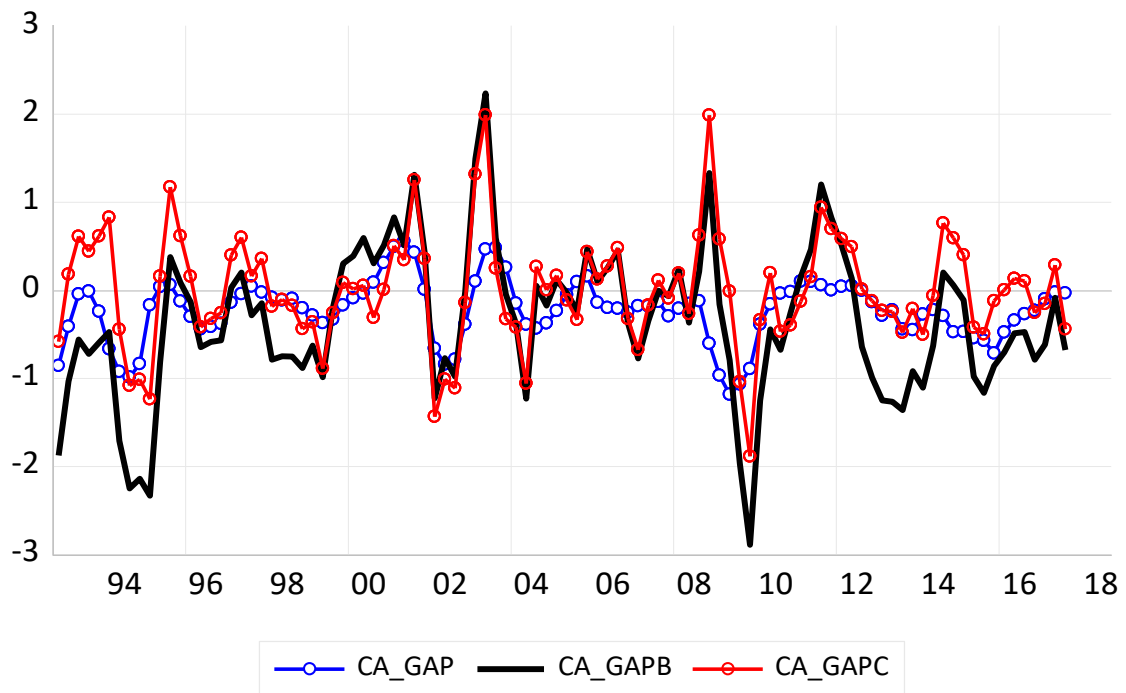


Monetary Policy: EME

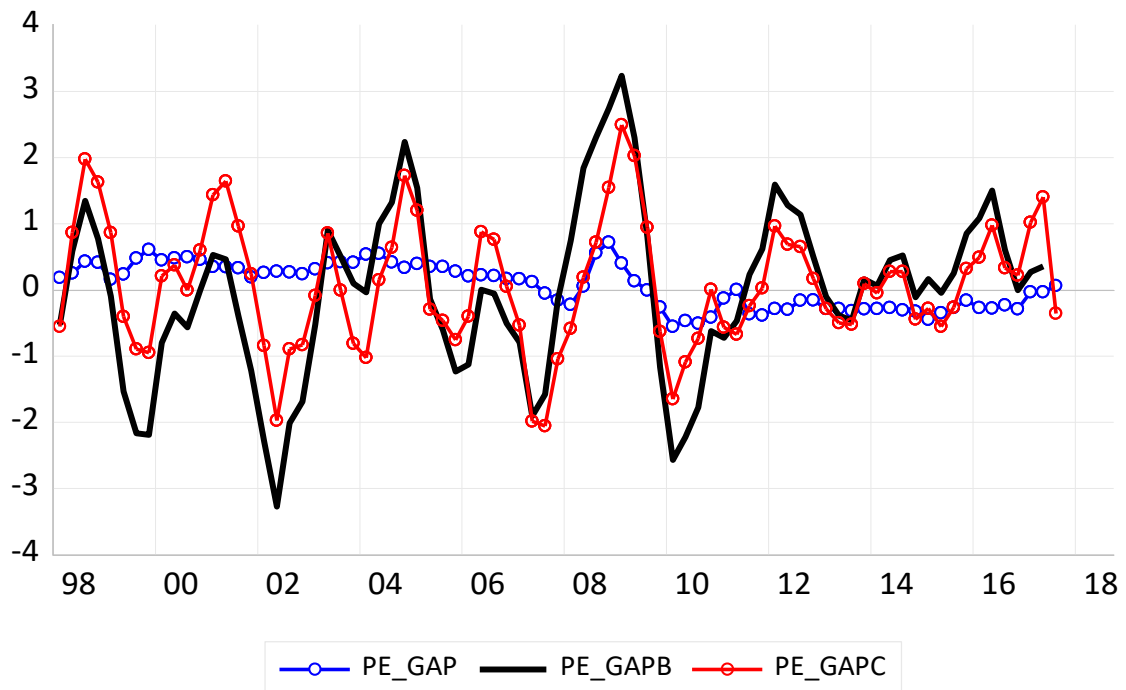


Selected Output Gap Estimates Comparisons

CANADA

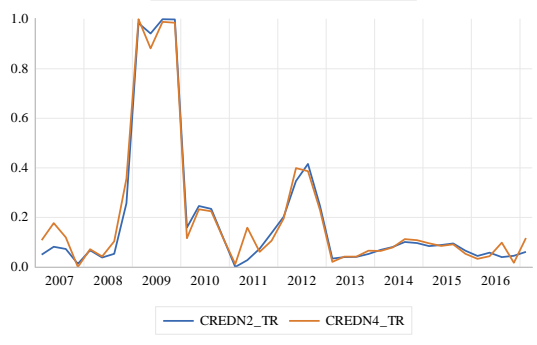
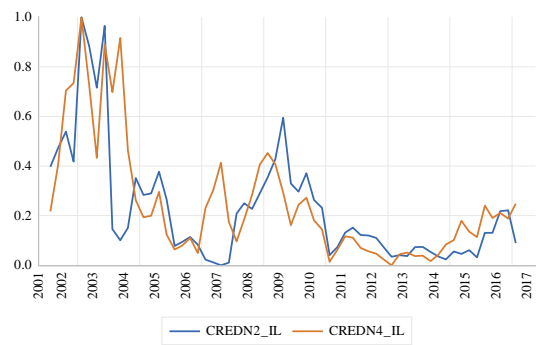
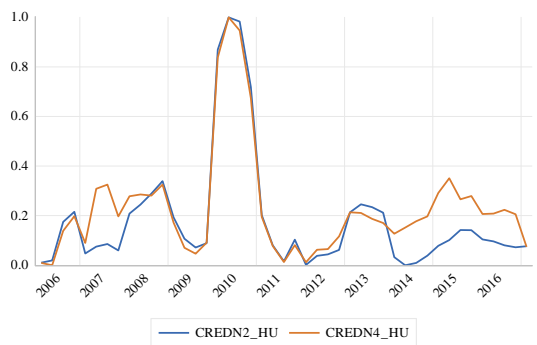
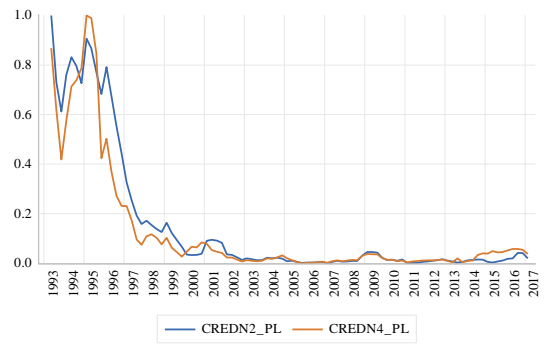
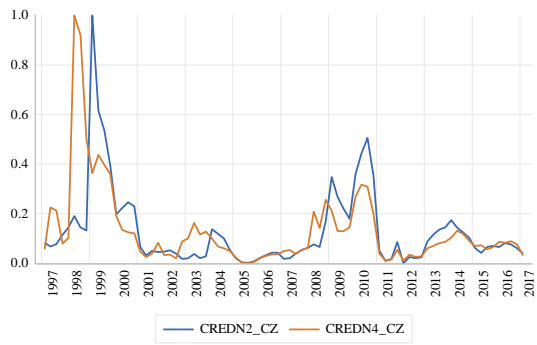


PERU

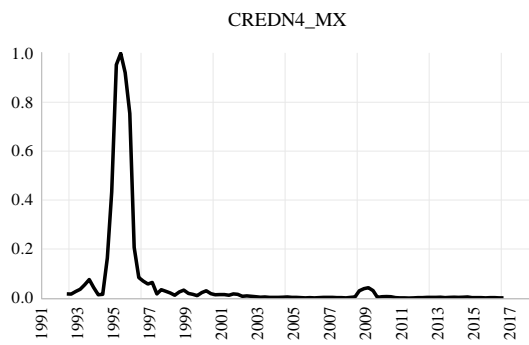
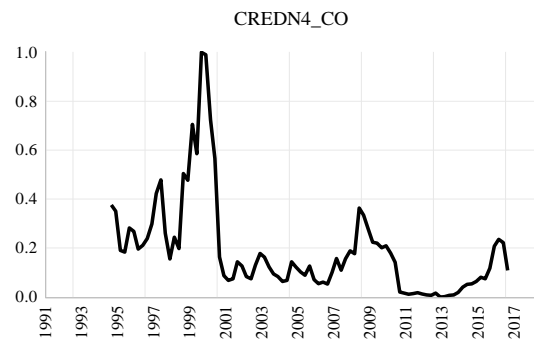
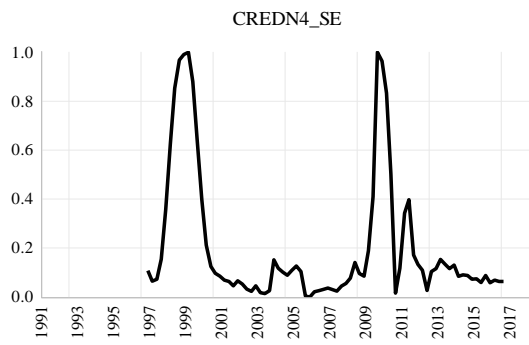
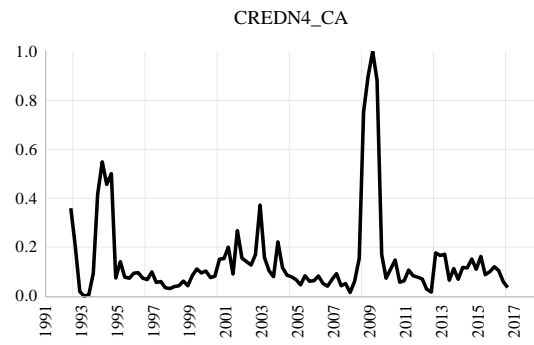
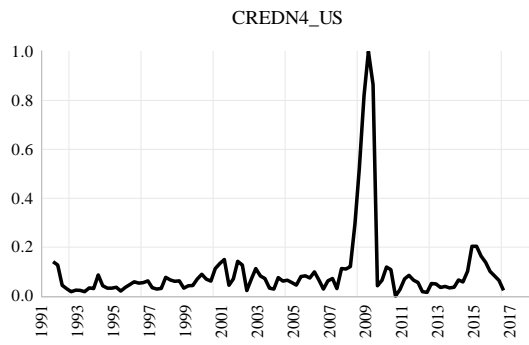


Note: See main body of the paper for the details but the the graphs refer to the first term in equation (1) measured 3 different ways.

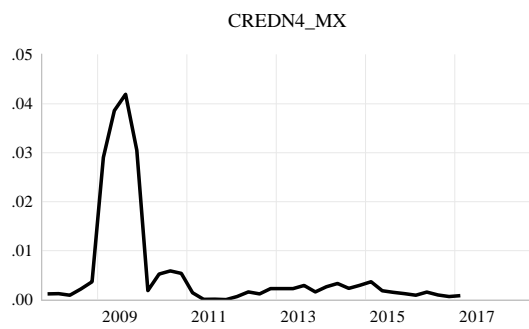
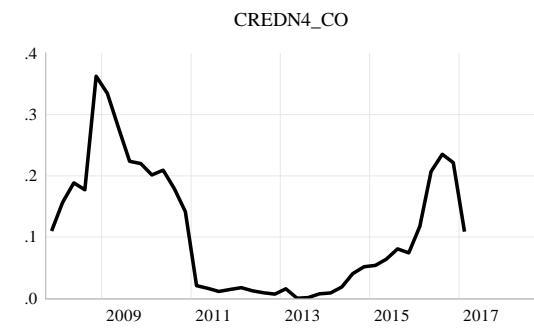
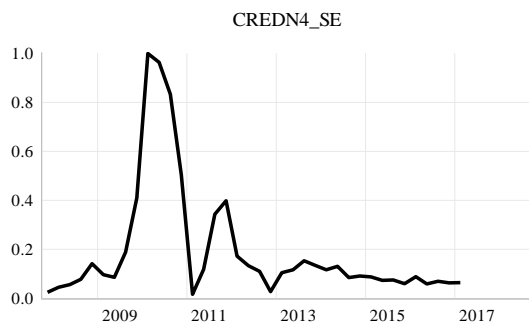
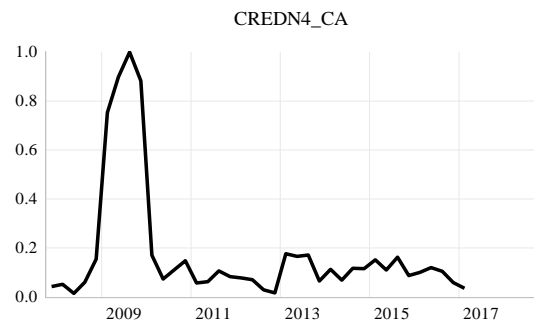
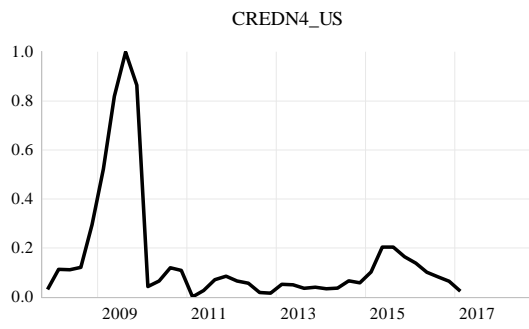
Additional Credibility Estimates



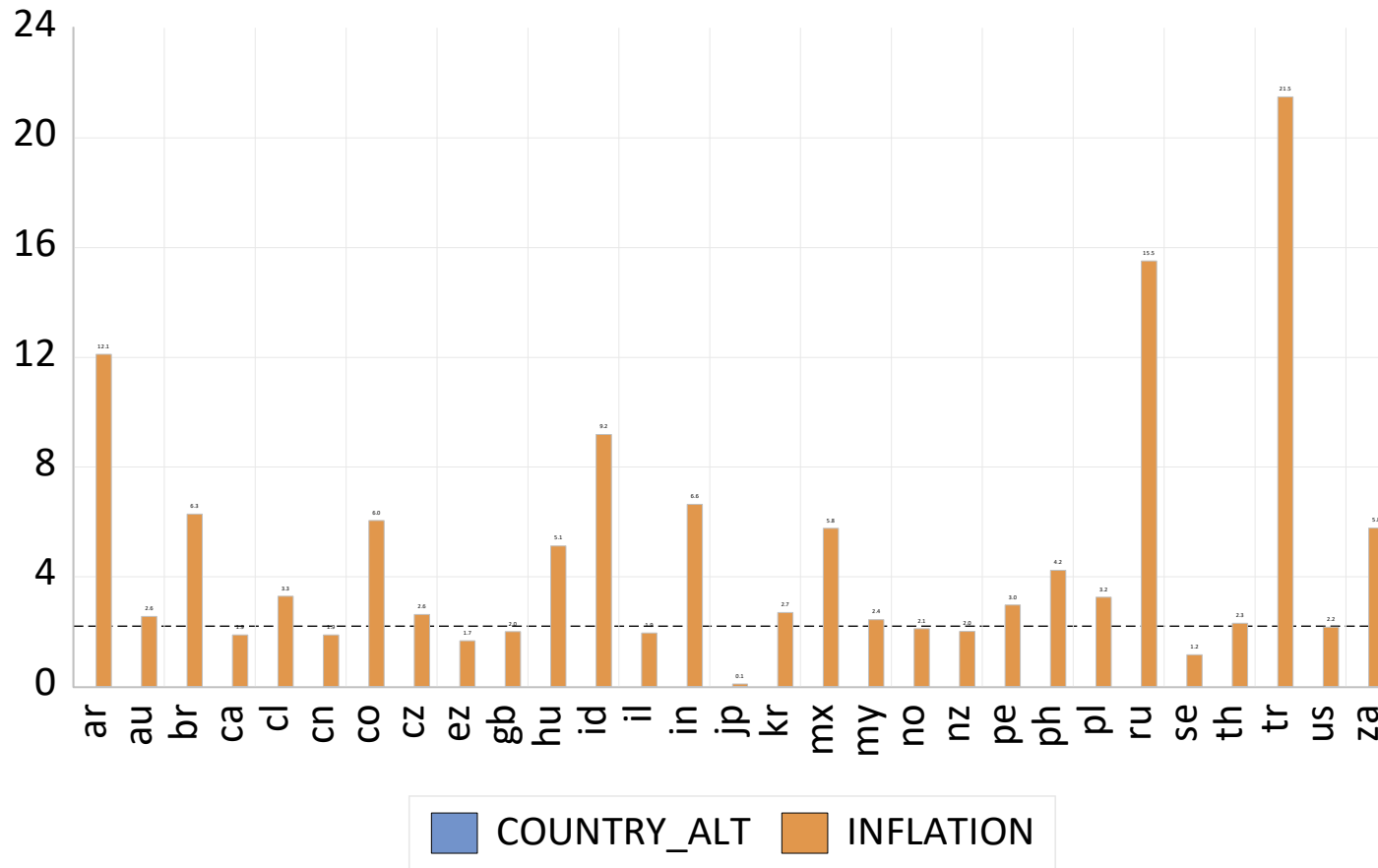
Case Studies of CB Credibility: Full Sample



Case Studies of CB Credibility: GFC and Beyond



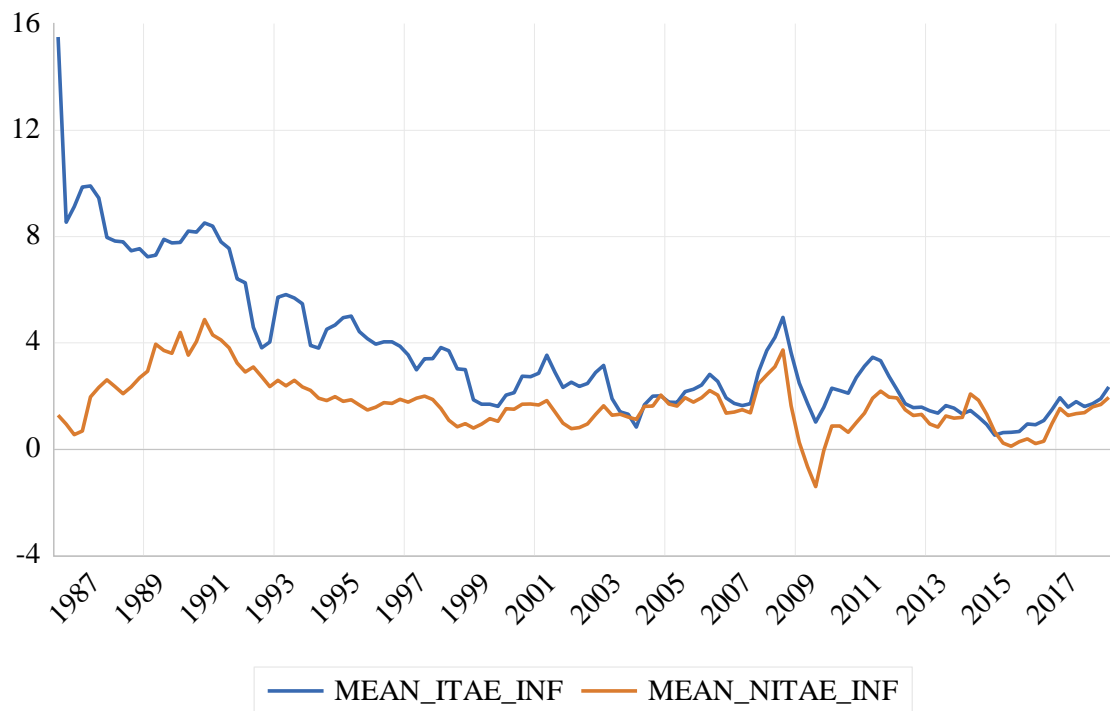
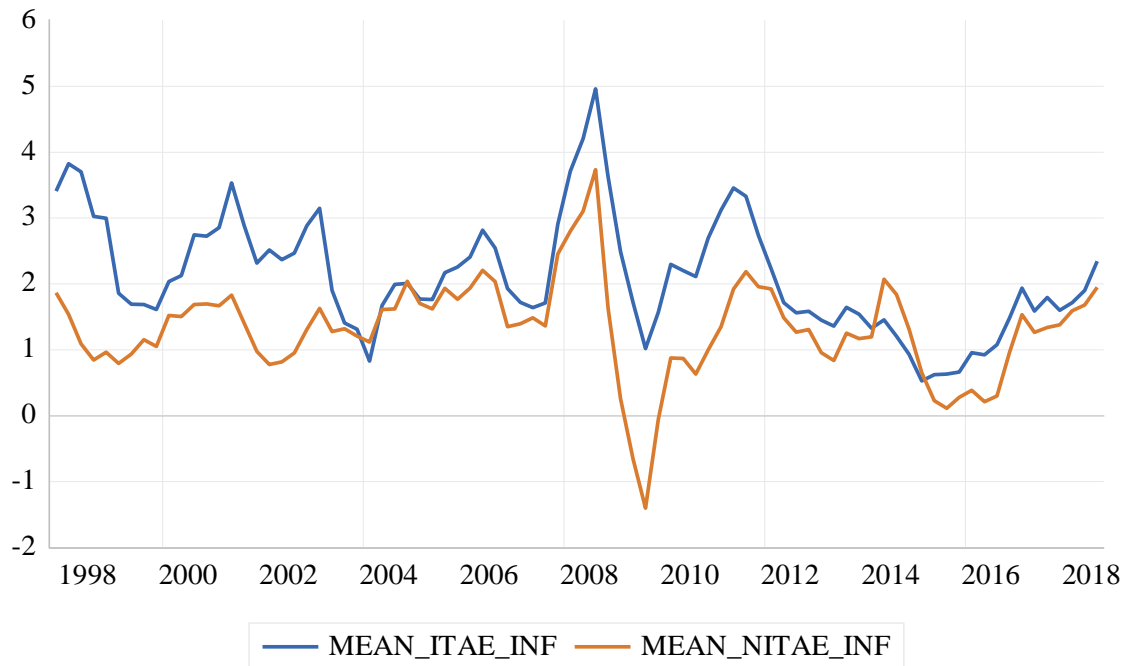
Inflation: The General Story

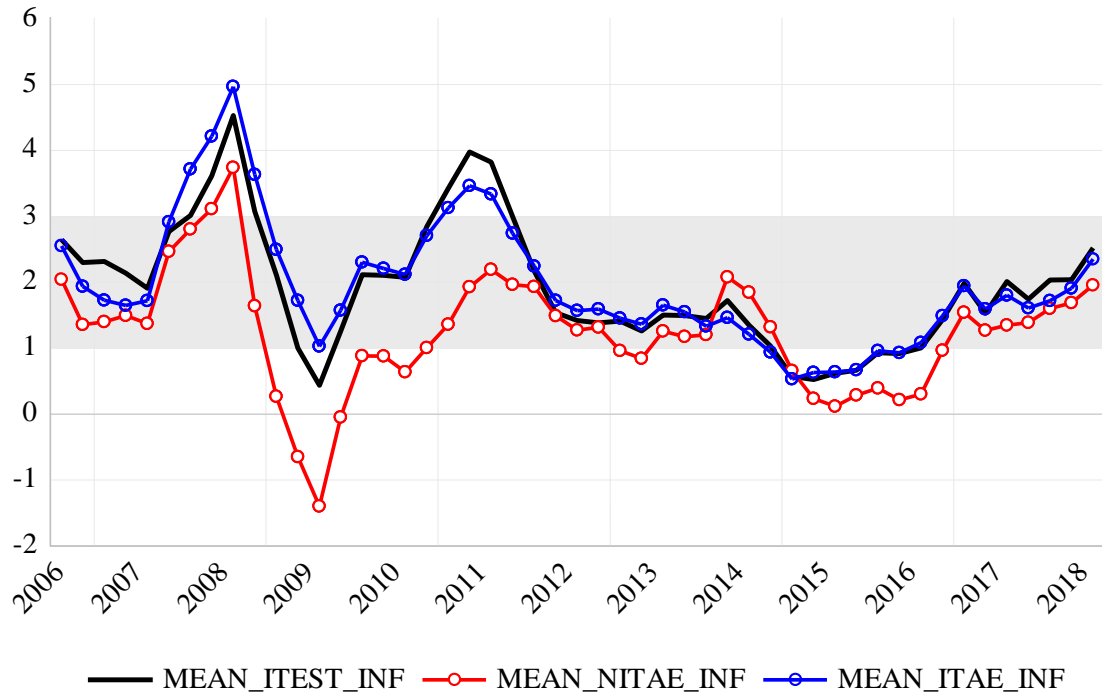


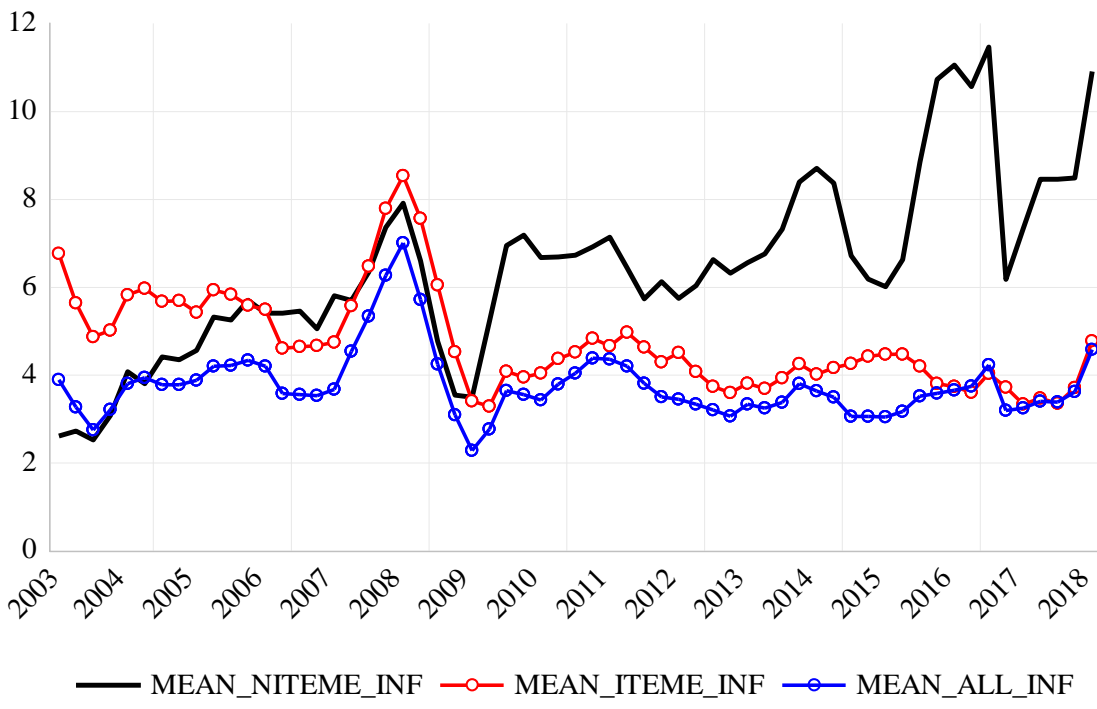
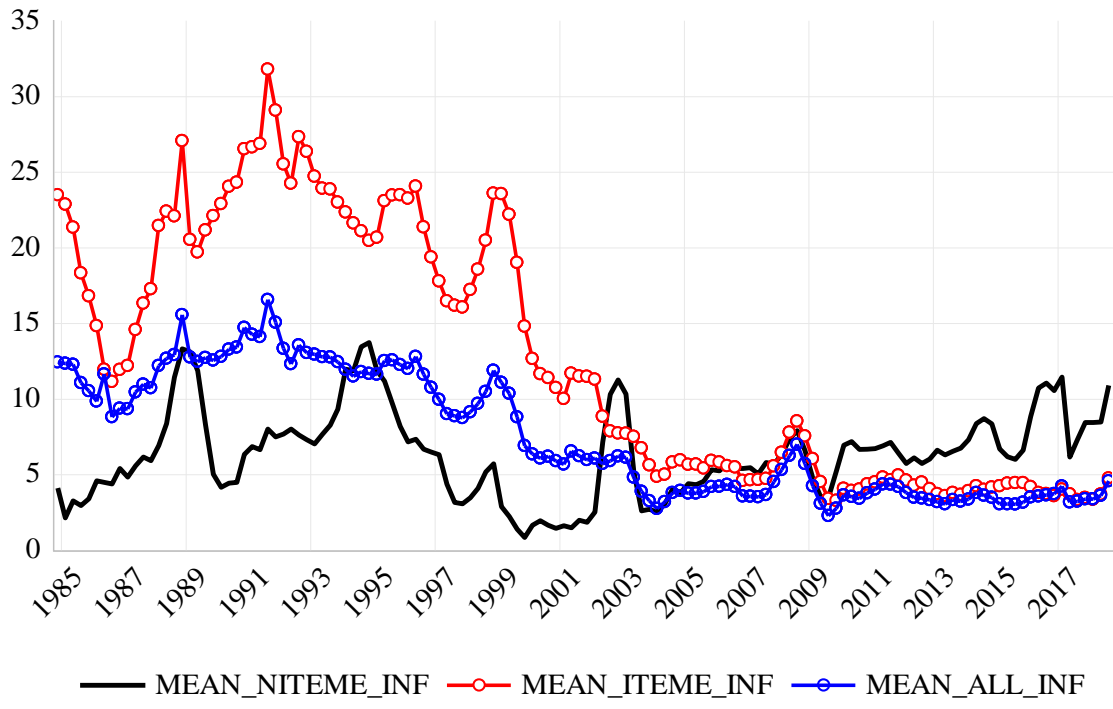
Note: mean CPI inflation, 1999Q1-2018Q3. Dashed horizontal line is US inflation. Mean inflation values shown above each bar.

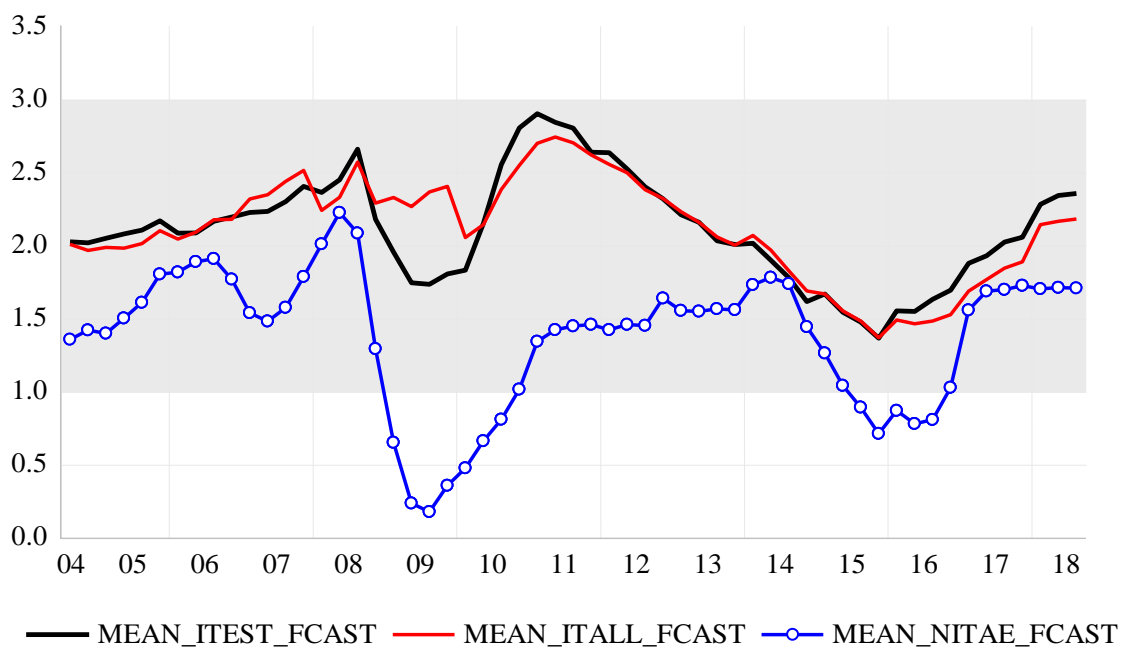
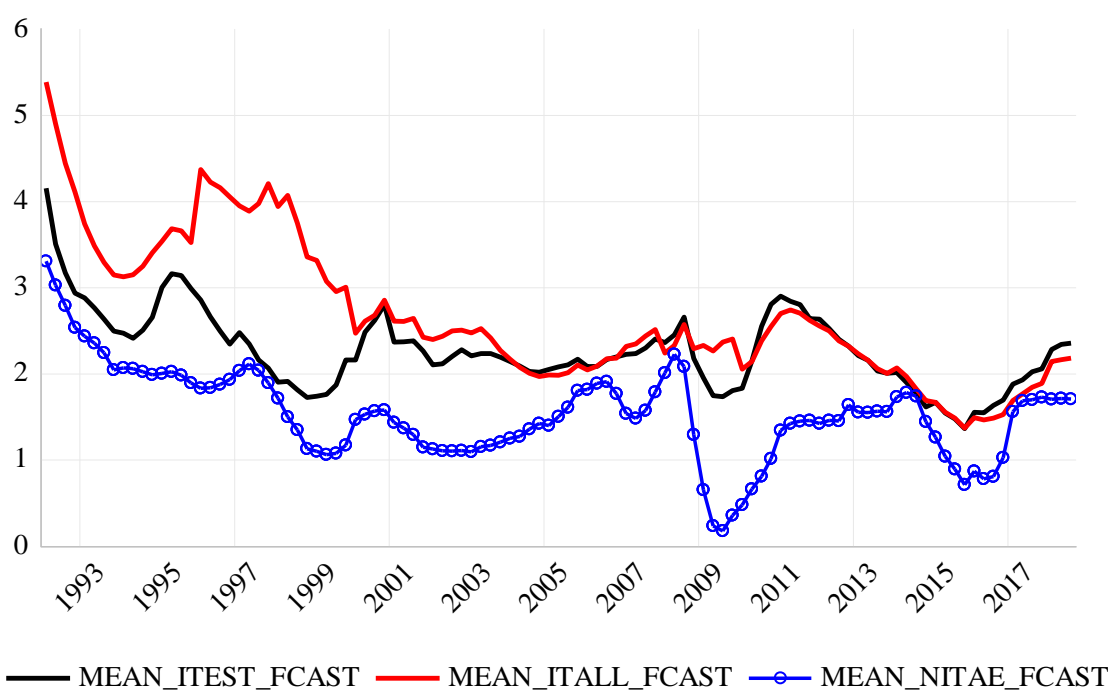
A Few Additional Stylized Facts: Mean Inflation Rates in AE, EME, IT and NIT Economies

Economies

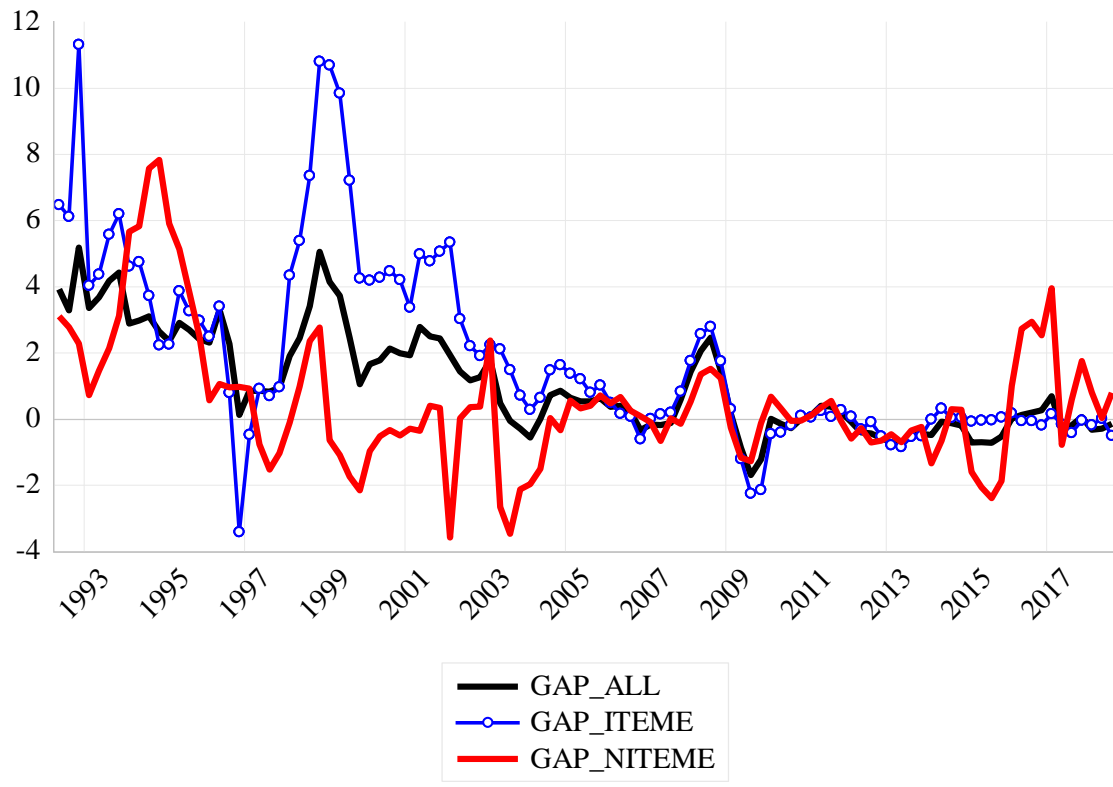
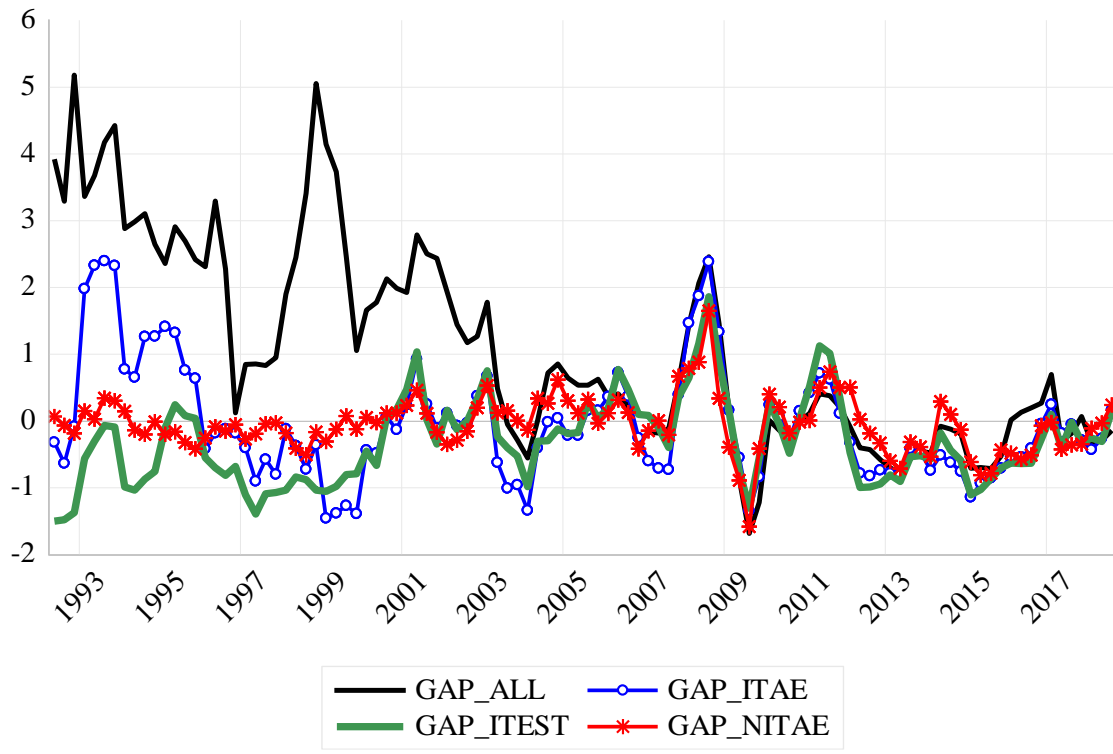








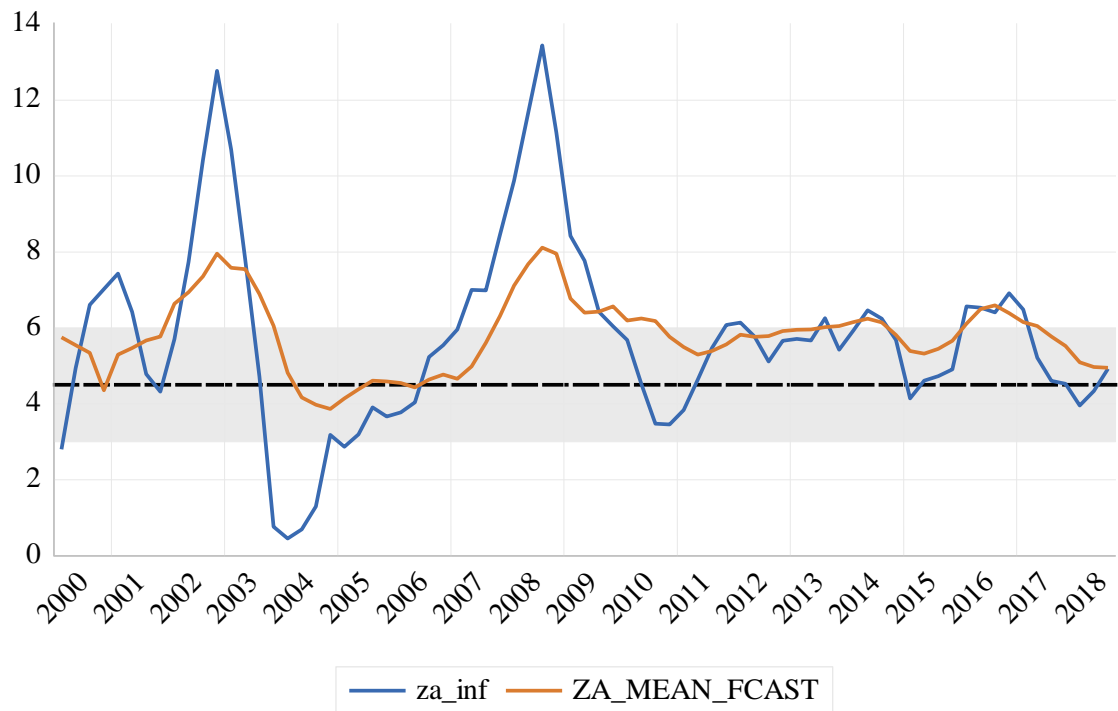
Note: Shaded area is the 1-3% target band.



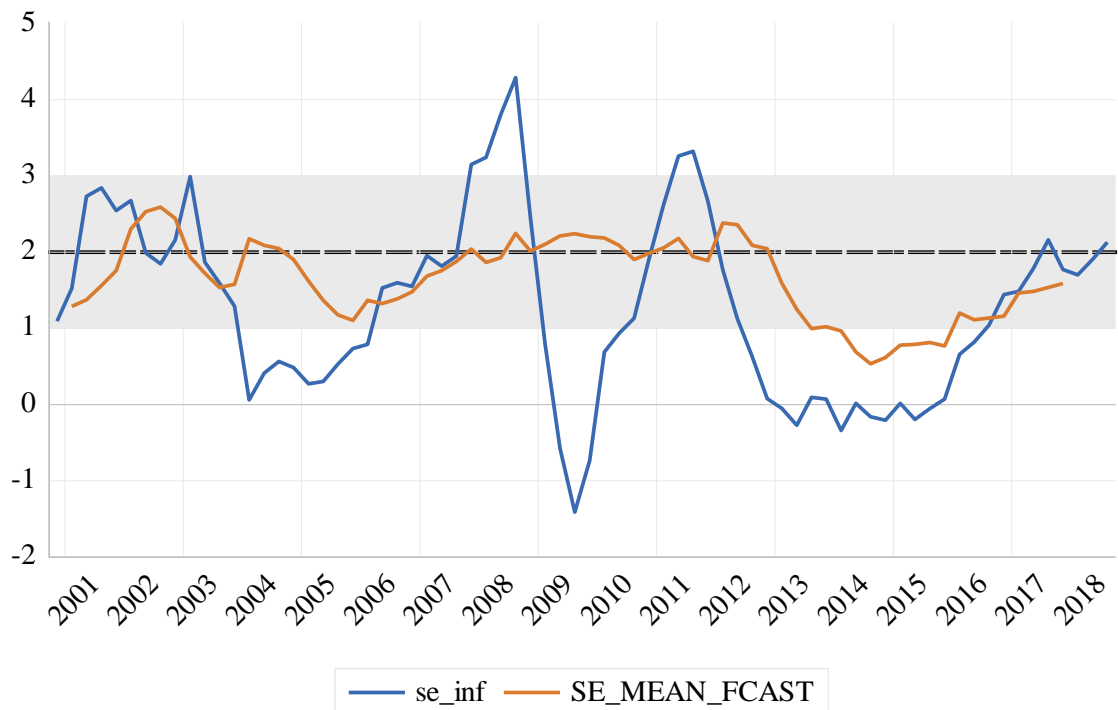
Note: GAP is the difference between observed and expected inflation as described in the main paper.

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

South Africa



Sweden



The U.S. as a Benchmark

