INTERNATIONAL MONETARY FUND

Monetary Policy in Disaster-Prone Developing Countries

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2022
APR

WORKING PAPER

IMF Working Paper

African Department and Research Department

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Authorized for distribution by Hans Weisfeld and Chris Papageorgiou
April 2022

ABSTRACT: This paper analyzes monetary policy regimes in emerging and developing economies where climate-related natural disasters are major macroeconomic shocks. A narrative analysis of IMF reports published around the occurrence of natural disasters documents their impact on important macroeconomic variables and monetary policy responses. While countries with at least some degree of monetary policy independence typically react by tightening the monetary policy stance, in a sizable number of cases monetary policy was accommodated. Given the lack of consensus on best practices in these circumstances, a small-open-economy New-Keynesian model with disaster shocks is leveraged to evaluate welfare under alternative monetary policy rules. Results suggest that responding to inflation to an extent sufficient to keep inflation expectations anchored, while allowing temporary deviations from its target is the welfare maximizing policy. Alternative regimes such as strict inflation targeting, exchange rate pegs, or Taylor rules explicitly responding to economic activity or the exchange rate would be welfare-detrimental.

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1 Introduction

Climate-related natural disaster shocks are major determinants of macroeconomic outcomes in disaster-prone Emerging and Developing Economies (EMDEs). The countries at the top of the list by incidence of natural disasters per square kilometer (see Table A.1 in Appendix A and Cantelmo et al., 2019) are mainly small islands located in the Pacific or the Caribbean, or low-income countries. In other words, countries that are either geographically small or have a small economy. Their size and lack of economic diversification makes them more vulnerable to natural disasters, because when disruptive events occur, they typically affect the whole economy, with their damages representing a large fraction of their GDP (approximately 7% of GDP on average versus 0.5% in their peers less exposed to natural disaster, with extreme events causing damages beyond 200% of GDP).

For instance, Belize was hit by hurricane Keith in October 2000 and by hurricane Iris in October 2001. Both hurricanes caused damages of the tune of 30 percent of GDP each, and GDP growth in 2001 and 2002 was about 8 percentage points lower than in the pre-shock year (Figure 1-a). To put things in perspective, at the time of the oil crisis of the early 1970s—often regarded as a typical large exogenous shock in macroeconomics—U.S. GDP growth in 1974 and 1975 was about 6 percent lower than in 1973 (Figure 1-b). This is to say that, in disaster-prone EMDEs, natural disaster shocks are of the same, if not greater, importance as those that are typically regarded as major macroeconomic shocks in larger or richer countries.

It is then no surprise that many central banks respond to these shocks and, in this paper, we show that the monetary policy regime in place makes a sizable difference in terms of welfare. While monetary policy is not a substitute for structural and financial climate adaptation policies, welfare losses from ill-devised monetary policy rules may compound with those deriving from the devastating impacts of disasters. Establishing the adequate monetary policy regime is not a trivial task because, in the aftermath of these events, at least two policy challenges typically arise. The first is that many disaster-prone EMDEs adopt pegs or exchange rate anchors and thus lack full monetary policy independence. The second is that the occurrence of a natural disaster often behaves like a supply shock, generating an increase in inflation and a decrease in GDP (Figure 2). Hence, a trade-off arises between stabilizing inflation and sustaining output. Consequently, the monetary policy response to these events has been rather heterogeneous and there is no consensus on what best practices should be.

This paper focuses on two research questions. The first is: how is monetary policy set in disaster-prone countries? To answer this question, we build stylized facts using a

Figure 1: Change in Annual GDP Growth Rate in the Aftermath of a Large Macroeconomic Shock
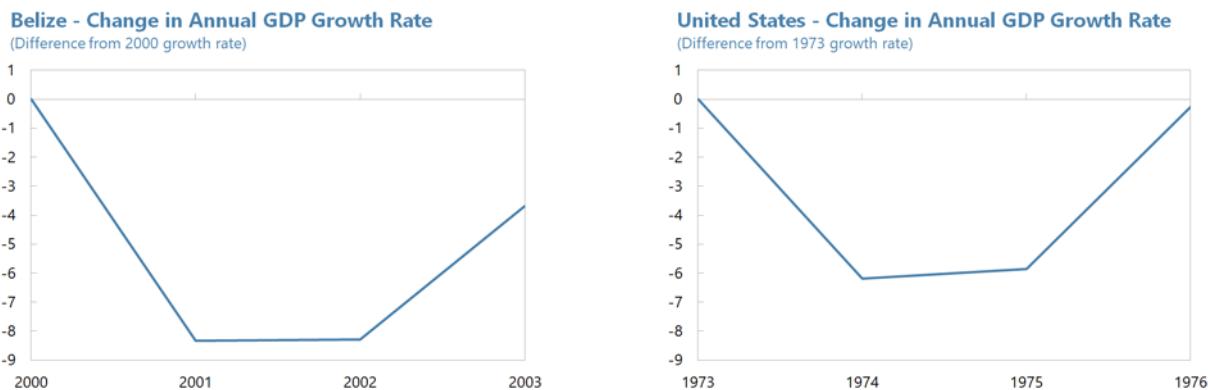
(a) Change in Annual GDP Growth Rate in Belize After Hurricane Keith (2000)

(b) Change in Annual GDP Growth Rate in the United States After the 1973 Oil Crisis

Source: IMF International Financial Statistics.

narrative analysis of IMF staff reports on disaster-prone EMDEs over the past 20 years, published around the occurrence of natural disasters. Issues covered in the analysis include features that might change over time, such as the exchange rate regime and monetary policy independence; changes on key macroeconomic variables, such as GDP and inflation, in the aftermath of disasters; monetary policy responses; and the IMF evaluation and advice on these policy actions.

The second question is: what should be the optimal policy rule? To provide an answer, we use a well-established New-Keynesian model augmented with features capturing important aspects of disaster-prone EMDEs. In particular, we take the rather standard model in Fernández-Villaverde and Levintal (2018), in which disaster shocks affect the capital stock and productivity and we use the same solution method—Taylor projection—which proves to be accurate and tractable in a stochastic environment with large shocks. We extend this framework along three dimensions: (1) we allow the effect of disasters in productivity to have both a permanent and a temporary component as in Gourio (2012), in line with empirical findings, and to affect export demand, so as to capture the experience of many disaster-prone EMDEs; (2) we introduce a small-economy set-up along the lines of Gali and Monacelli (2005) as, again, this is an important aspect of disaster-prone EMDEs; and (3) we consider an array of alternative Taylor-type interest rate rules capturing several possible monetary policy regimes and evaluate the associated welfare outcomes.

The main results can be summarized as follows. The narrative analysis suggests that natural disasters are typically followed by a decline in output and often by an increase in

Figure 2: Distribution of Changes in Key Macroeconomic Variables in the Aftermath of Natural Disasters in Disaster-Prone Countries

(a) Change in Real GDP Growth   (b) Change in CPI Inflation   (c) Change in Real Money Growth
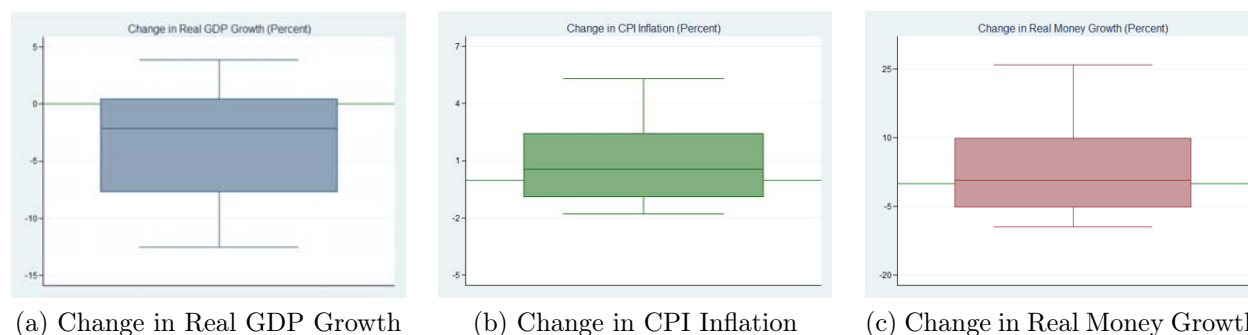
Sources: IMF World Economic Outlook Database and authors' calculations.
The horizontal line inside each box represents the median; the upper and lower edges of each box show the top and bottom quartiles, respectively; and the top and bottom markers denote the maximum and the minimum, respectively. The sample is restricted to cases that suffered a cumulative loss of at least 5 percent of GDP in a given year.

inflation. If there is at least some degree of monetary policy independence, central banks generally change their monetary policy stance in the aftermath of disasters. While monetary policy is commonly tightened, there is a sizable minority of cases in which it is accommodated. Policy appraisals and advice by IMF staff have also been mixed, possibly underscoring that while tightening is a direct consequence of concerns toward inflation and currency depreciations, stimulating economic activity might have been prioritized in certain cases. The model analysis demonstrates that, from a welfare standpoint, a flexible inflation targeting regime—whereby inflation can depart temporarily from target—is superior both to extreme regimes, such as strict inflation targeting or hard pegs, and to hybrid regimes in which monetary policy reacts also to output and the exchange rate, besides inflation.Under flexible inflation targeting, welfare is maximized by keeping the interest rate response at the lowest level needed to keep inflation expectations anchored while minimizing the impact on real activity. This is consistent with existing theoretical prescriptions according to both standard New-Keynesian models (see e.g. Kollmann, 2002 and Giannoni, 2014) and models with extreme events (Keen and Pakko, 2011 and Kim and Ruge-Murcia, 2019).

This paper is related to four main strands of the literature. The first strand is the growing body of empirical studies on the economic impacts of climate change and natural disasters (e.g., IPCC, 2018; Hsiang and Jina, 2014; Burke et al., 2015; IMF, 2017; Nordhaus, 2019; Kamber et al., 2013; Cashin et al., 2017; De Winne and Peersman, 2021; Kabundi et al., 2022, among many others). Our paper contributes to this research area with our novel narrative analysis on the monetary policy responses to disaster shocks. The second strand includes

macroeconomic models with disaster shocks (Barro, 2006; Gabaix, 2012; Gourio, 2012; Isoré and Szczerbowicz, 2017; Fernández-Villaverde and Levintal, 2018). As discussed, our model builds on this literature by extending the model of Fernández-Villaverde and Levintal (2018) with features of disaster-prone EMDEs that are key for the analysis of monetary policy. The third strand comprises macroeconomic models for disaster-prone developing economies (Adam and Bevan, 2020; Isoré, 2018; Marto et al., 2018; Cantelmo et al., 2019). Ours, however, is the first study that analyzes monetary policy regimes in these countries. The fourth strand comprises both empirical and theoretical contributions on monetary policy in the presence of natural disaster shocks (Keen and Pakko, 2011; Fratzscher et al., 2020; Klomp, 2020; Jorda et al., 2020; McKibbin et al., 2021; Cantelmo, 2022). Our novel angle is the welfare-based ranking of alternative monetary policy rules capturing the experience of disaster-prone EMDEs.

Investigating monetary policy in the presence of weather shocks could not be more central in a global context where climate change is projected to make natural disasters even more frequent and severe (IPCC, 2018). For example, the frequency of hurricanes of category 4 or greater, are expected to increase by 39-87% over the 21st century (Knutson et al. 2013). In addition, with a few notable exceptions discussed above, the macroeconomic literature on climate-related disaster shocks has investigated important policy aspects (including investment in resilient infrastructure, pre-disaster and post-disaster donor support and insurance) from a fiscal viewpoint, almost neglecting the monetary policy angle. With the COVID-19 pandemic that left many disaster-prone countries, especially those dependent on tourism, with alarmingly high amounts of public debt and very limited fiscal space, it is even more important that monetary policy is conducted in a welfare-maximizing manner.

The remainder of the paper is structured as follows. Section 2 outlines the design of the narrative analysis and summarizes its main findings. Sections 3 and 4 present the model and its calibration, respectively. Section 5 discusses the model results, including welfare outcomes associated with alternative monetary policy rules. Section 6 provides a sensitivity analysis of the findings. Finally, Section 7 concludes. A thorough documentation of the narrative analysis is appended to the paper.

2   Narrative Analysis

In this section, we describe the methodology and report the findings of a narrative analysis on the response of monetary authorities following the occurrence of a climate-related natural disaster. We obtain the relevant information from IMF staff reports prepared after the

so-called "Article IV" consultations in the year of, and one year following, the occurrence of a disaster, covering the macroeconomic and inflation performance in the aftermath of climate-related disasters, and IMF's evaluations and advice on the monetary policy stance.[1]

We focus on disaster-years where annual damages were at least 1 percent of GDP, subject to staff report availability. For countries in currency unions (such as the Eastern Caribbean Currency Union), we cross-reference Article IV staff reports of the IMF mission to the union's central bank. Our final sample consists of 34 disaster-years, that occurred in 16 disaster-prone countries from 1999 to 2017. Table 1 shows the complete list of countries and disasters used in our dataset, as well as the annual damages (as a percentage of GDP).

2.1   Methodology

The narrative analysis covers the macroeconomic and monetary policy performance of countries after the disaster, as well as the monetary policy tools that might have been mobilized to mitigate the negative impact that disasters had on the economy. The assessment is conducted by recording the nature of the mobilized monetary policy tools, whether policy was accommodative or tight, the appraisal of the monetary policy stance by IMF staff and/or Board of Directors, and the IMF's advice on the monetary policy stance for the near future.

Table 2 shows the complete set of questions answered to construct our dataset. Some questions relate to structural features that might change over time, such as the exchange rate regime and monetary policy independence. For example, El Salvador had its own legal tender when Hurricane Mitch struck in October 1998, but did not possess this feature when Hurricane Adrian struck in May 2005, because effective January 1, 2001, the U.S. dollar became its legal tender. Other questions are on the changes in key macroeconomic variables such as the GDP growth rate and the inflation rate, in the aftermath of the disaster. Others relate to the monetary policy response in countries where the monetary policy regime allows to mobilize it. In this respect, we classify as "independent" a monetary policy regime in which a country has full control on their monetary policy; "not independent" a regime of an economy that does not have its own legal tender or it has a hard peg; and "mixed" a

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[1]After downloading all the relevant archived IMF staff reports (pairs of disaster occurrences-countries), we read the documents to answer the survey questions covered in Subsection 2.1. Article IV consultations are part of the IMF's country surveillance, an ongoing process that culminates in regular (usually annual) comprehensive consultations with individual member countries. These consultations are known as Article IV consultations because they are required by Article IV of the IMF's Articles of Agreement. During an Article IV consultation, an IMF team of economists visits a country to assess economic and financial developments and discusses the country's economic and financial policies with government and central bank officials. Due to staff report availability, in a few cases we base our answers on consultations occurred two (El Salvador, 2011; Micronesia, 2015 and Solomon Islands, 2014) and three years (Samoa, 2012) after the disaster.

Table 1: List of Disasters Used in the Narrative Analysis and Corresponding Year of IMF Article IV Staff Report

Country	Year of Disaster	Year of IMF Article IV Staff Report	Cumulative Damages (% of GDP)	Disaster Type
Belize	2000	2001	33.25	Storm
Belize	2001	2002	28.67	Storm
Belize	2007	2008	1.15	Storm
Dominica****	2015	2016*	90.24	Storm
Dominica	2017	2018*	260	Storm
Dominican Republic	1998	1999	9.14	Flood
El Salvador	1998	1999	5.10	Drought, Storm
El Salvador	2005	2006	2.42	Storm
El Salvador	2009	2010	5.49	Drought†, Storm
El Salvador	2011	2013	4.93	Flood
Fiji	2003	2004	1.30	Storm
Fiji	2009	2009	1.97	Flood, Storm†
Fiji	2010	2010	1.26	Storm
Fiji	2012	2013	2.45	Flood, Storm†
Fiji	2016	2017	12.86	Storm
Grenada	1999	2000	1.14	Storm
Grenada	2004	2005*	148.41	Storm
Haiti	1998	1999	4.83	Storm
Haiti	2004	2005	1.44	Storm
Haiti	2012	2012	3.22	Flood‡, Storm
Jamaica	2004	2005	8.82	Storm
Jamaica	2007	2008	2.34	Storm
Jamaica	2010	2011	1.14	Storm
Marshall Islands	2015	2016	2.72	Drought
Mauritius	2002	2003	1.03	Storm
Micronesia, Fed. States of	2015	2017**	3.49	Storm
Moldova	2000	2001	2.45	Drought‡, Storm
Moldova	2007	2007	9.22	Drought
Samoa	2012	2015	16.60	Storm
Solomon Islands	2014	2016	2.04	Flood
Sri Lanka	2016	2017	1.49	Drought†, Flood
St. Vincent and the Grenadines	2002	2002***	2.38	Storm
St. Vincent and the Grenadines	2010	2011*	3.67	Storm
St. Vincent and the Grenadines	2013	2014	14.98	Flood

Source: EM-DAT (EM-DAT: The Emergency Events Database - Universite Catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium.) and Cantelmo et al. (2019).

Notes:*Authors combined Article IV staff reports for the country in question, as well as the ECCU (Eastern Caribbean Currency Union). Both Article IVs are dated at the same year.

**Authors combined Article IV staff reports for the country in question, as well as the ECCU (Eastern Caribbean Currency Union). The ECCU Article IV is dated a year before the country one.

***Authors combined Article IV staff reports for the country in question, as well as the ECCU (Eastern Caribbean Currency Union). The ECCU Article IV is dated a year after the country one.

****Dominica received IMF support (Catastrophe Containment and Relief Trust) under the financial instruments designed for these circumstances, in 2015. The Catastrophe Containment and Relief Trust (CCRT) allows the IMF to provide grants for debt relief for the poorest and most vulnerable countries hit by catastrophic natural disasters or public health disasters. The relief on debt service payments frees up additional resources to meet exceptional balance of payments needs created by the disaster and for containment and recovery. Established in February 2015 during the Ebola outbreak and modified in March 2020 in response to the COVID-19 pandemic.

† This disaster led to damages <1% of GDP, while the other disaster let to damages >1% of GDP. Cumulative damages encompass both disasters.

‡The magnitude of the damages for this particular disaster is unreported, therefore they are excluded from the cumulative damages.

Table 2: Questions Posed to Conduct the Narrative Analysis

#	Question	Possible answers
1	Does the country have its own legal tender?	Y-N
2	Is its currency pegged to some other currency or basket of currencies?	Y-N
3	Can we characterize monetary policy as independent?	Y-N-Mixed
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y-N-NA
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y-N-NA
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation-Depreciation-No change
7	Were there any challenges for maintaining the peg? (peg countries)	Y-N-NA
8	Were reserves impacted negatively?	Y-N-NA
9	Was monetary policy tightened, accommodated or unchanged?	Accommodated-Tightened-Unchanged
10	What was the monetary policy tool authorities used?	Open question
11	Did IMF agree with the authorities' policy action?	Y-N-Neutral
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Accommodate-Tighten-Neutral

regime where, although there is peg or exchange rate anchor, limited capital mobility still allows room for monetary policy. The final set of questions is on the IMF evaluation of these policy actions, and on its advice on future adjustments. The answers to these questions are especially important, because both in the literature and in policy circles, there is no consensus about how monetary policy should be conducted in the aftermath of a disaster.

Table 3 illustrates how the questions are answered using the example of Hurricane Iris that hit Belize on October 4, 2001. In Appendix B we document the whole process by reporting quotes extracted from the relevant IMF Article IV staff reports, for all disaster-country observations. This procedure enables us to construct a complete dataset of qualitative data.

2.2 Results

The main findings of the narrative analysis are summarized in Figures 3 to 5. Figure 3 illustrates the results on the economic performance shortly after a natural disaster occurrence, as well as some features of the affected countries. Figure 4 summarizes the monetary policy stance adopted and Figure 5 presents the IMF staff appraisal and advise on monetary policy. In most cases, GDP growth declined and, often, inflation increased. Most disasters occurred in countries with at least partial control of their monetary policy, as only 12 percent of cases refer to disasters occurred in countries with dollarized economies. In addition, in

Table 3: Example of Narrative Analysis Documentation: Belize, 2001

#	Question	Answer	Quotes from the 2002 Article IV Staff Report
...			
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...Real GDP growth declined from 11 percent in 2000 to 5 percent in 2001, as a result of several hurricanes...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...However, on the positive side, inflation remained very low at an annual rate of $1\frac{1}{4}$ percent...
...			
7	Were there any challenges for maintaining the peg? (peg countries)	Y	...The authorities agreed that current policies were unsustainable and that policy corrections were necessary to prevent severe balance of payments difficulties and maintain the exchange rate peg...
...			
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...Given their resolute commitment to the official peg to the US$, the authorities recently acted on staff advice to mop up this liquidity...

Sources: Authors and 2002 Article IV IMF Staff Report for Belize.

non-peg countries the impact on the exchange rate was mixed, while in the other countries, the sustainability of the peg was often discussed.

Figure 4 summarizes the monetary policy stance adopted in the aftermath of disasters, in countries where monetary policy could be mobilized. The monetary policy stance was changed in virtually all cases where there was room for maneuver. This finding highlights the perceived importance of monetary policy as a tool for mitigating the adverse effects of natural disasters. When changed, the monetary policy stance was tightened in slightly more than half of the cases (almost 56 percent of disasters), and accommodated in the remaining cases, signaling heterogeneous importance attributed to inflation and exchange rate considerations on one hand, and to output losses on the other. The main monetary policy tool utilized in the aftermath of disasters was the interest rate, but there were several cases where other policy tools, such as the money supply, where mobilized.

Figure 5 presents the IMF appraisal and advice on monetary policy.[2] IMF staff and/or

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[2] The results of this narrative analysis were discussed with IMF mission chiefs and desk economists covering about a third of the countries in our sample. These teams found that the findings are generally in line with their experience in the field, and stressed the monetary policy dilemmas often posed by natural disasters. Some teams noted the omission of the fiscal response or donor support in our study, as well as the exclusion of lower impact disasters (with damages smaller than 1 percent of GDP) in the sample, which might compound and affect macroeconomic outcomes due to their high frequency. On the former, Cantelmo et al. (2019) conducted earlier research, hence it was a deliberate choice of focusing this paper on the understudied issue of monetary policy responses in disaster-prone countries. On the latter, the inclusion of higher frequency/lower impact disasters in the narrative analysis would prove unfeasible, as these largely

Figure 3: Narrative Analysis: Impact of Natural Disasters and Features of Affected Countries
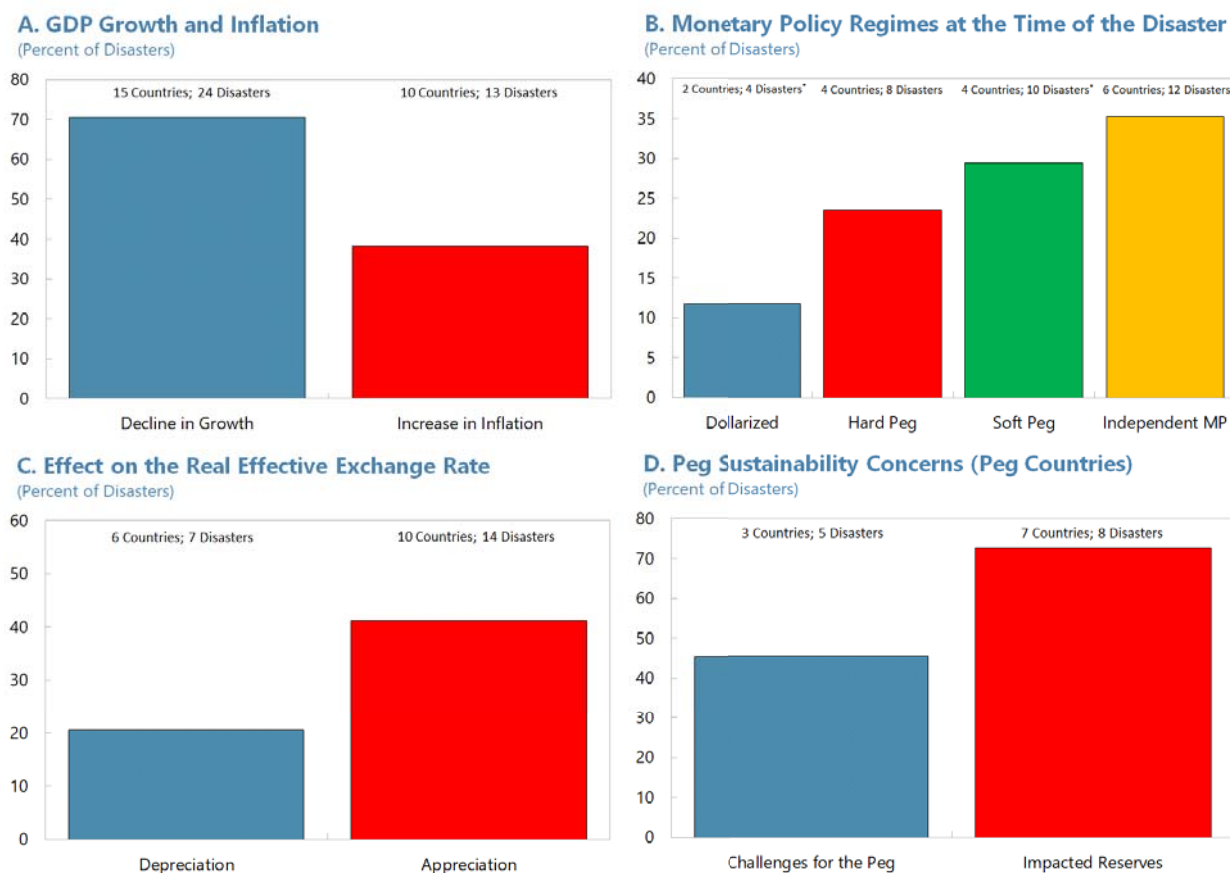
A. GDP Growth and Inflation
(Percent of Disasters)

B. Monetary Policy Regimes at the Time of the Disaster
(Percent of Disasters)

C. Effect on the Real Effective Exchange Rate
(Percent of Disasters)

D. Peg Sustainability Concerns (Peg Countries)
(Percent of Disasters)

Sources: IMF staff reports and authors' calculations.
Notes: Estimates are based on a narrative analysis of IMF staff reports on disaster-prone developing countries over the period 1999 to 2017. The analysis is restricted to weather-related natural disasters with associated damages of at least 1% of GDP (according to the EMDAT database), subject to IMF staff report availability. These criteria lead to a sample of 34 incidents that occurred in 16 countries. Please note that if we were to consider also non pegged countries, the percentage of countries that experienced an impact on their reserves would go down to 35 percent. Answers referring to Panel B come from crossing the answers to questions 1, 2 and 3. The characterization of monetary policy as being independent does not take possible fiscal dominance into account.
*El Salvador switched regimes in 2001 as U.S. Dollar replaced the local Colón as the legal tender.

directors always agreed with authorities when they adopted a tight monetary policy stance, but also with loosening in a number of cases (about half of instances in which authorities adopted a loose monetary policy stance). A tight monetary policy stance is a natural consequence of concerns toward spikes in inflation and sharp exchange rate movements. However,

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go unreported in IMF staff reports, and a change of the monetary policy stance typically requires events of greater magnitude.

Figure 4: Narrative Analysis: Monetary Policy Stance

A. Change of Monetary Policy Stance
(Percent of Disasters)

10 Countries; 19 Disasters   6 Countries; 12 Disasters   3 Countries; 3 Disasters

Change in MP stance   MP Stance Unchanged due to Constraints   MP Stance Unchanged by Choice

B. Monetary Policy Response (When MP Stance Was Changed)
(Percent of Disasters)

7 Countries; 9 Disasters   8 Countries; 10 Disasters

Accommodative   Tightened

C. Monetary Policy Tools (When MP Stance Was Changed)
(Percent of Disasters)

8 Countries; 13 Disasters   3 Countries; 3 Disasters   2 Countries; 3 Disasters

Interest Rate   Money Growth   Other Tools

Sources: IMF staff reports and authors' calculations.
Notes: Estimates are based on a narrative analysis of IMF staff reports on disaster-prone developing countries over the period 1999 to 2017. The analysis is restricted to weather-related natural disasters with associated damages of at least 1% of GDP (according to the EMDAT database), subject to IMF staff report availability. These criteria lead to a sample of 34 incidents that occurred in 16 countries. The time horizon considered in IMF staff's assessment of the monetary policy stance is within one year after the occurrence of each disaster. Constraints to changes in the monetary policy stance are typically hard pegs or dollarized economies. The aftermath of a disaster is defined as the period, generally shorter than one year, between the occurrence of the disaster and the IMF mission to the country. IMF Staff provide an appraisal of the MP stance adopted, and advice on the stance to adopt in the near future, with a time horizon usually not longer than one year after the completion of the IMF mission.

the fact that IMF staff also appraised positively cases of accommodative monetary policy stance shows that, in certain cases, expert judgment might have underscored the importance of stimulating the economy in the aftermath of disasters, in order to avoid recession traps.

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Figure 5: Narrative Analysis: IMF Staff Appraisal and Advice

Sources: IMF staff reports and authors' calculations.
Notes: Estimates are based on a narrative analysis of IMF staff reports on disaster-prone developing countries over the period 1999 to 2017. The analysis is restricted to weather-related natural disasters with associated damages of at least 1% of GDP (according to the EMDAT database), subject to IMF staff report availability. These criteria lead to a sample of 34 incidents that occurred in 16 countries. The time horizon considered in IMF staff's assessment of the monetary policy stance is within one year after the occurrence of each disaster. Constraints to changes in the monetary policy stance are typically hard pegs or dollarized economies. The aftermath of a disaster is defined as the period, generally shorter than one year, between the occurrence of the disaster and the IMF mission to the country. IMF Staff provide an appraisal of the MP stance adopted, and advice on the stance to adopt in the near future, with a time horizon usually not longer than one year after the completion of the IMF mission.

Even though IMF staff did not oppose to accommodative monetary responses in their appraisal of policies adopted in the aftermath of certain disasters, there are no cases where the advice was to switch from a tight to a loose monetary policy stance in the near future, while the reverse is true. This outcome is likely due to concerns about inflation derailment and anchoring of expectations, central bank's credibility, availability of reserves and exchange rate stabilization.

The heterogeneity in the monetary policy conduct and advice, besides the challenges triggered by natural disasters in terms of inflation, business cycle and exchange rate stabilization, raise questions on what policymakers' priorities should be. We investigate these issues using the model outlined in the following section.

3 The model

The framework is a SOE New-Keynesian model with stochastic trend growth and disaster shocks. Households supply labor and decide on the optimal level of consumption and invest-

ment. The economy's consumption and investment basket include domestic and imported goods, with a set up along the lines of Gali and Monacelli (2005). Firms combine capital and labor to produce a domestic good. Differently from a standard NK model, households feature Epstein-Zin preferences (Epstein and Zin, 1989), which help capture appropriately the effects of disaster risk, and disaster shocks hit the capital stock and total factor productivity as in Gourio (2012) and Fernández-Villaverde and Levintal (2018), besides impacting the demand for exports. Finally, an array of alternative Taylor-type interest rate rules captures a number of possible monetary policy regimes.

3.1 Disasters

The modeling of disasters closely follows Fernández-Villaverde and Levintal (2018). Investment, x_t, is subject to quadratic adjustment costs $S\left[\frac{x_t}{x_{t-1}}\right] = \frac{\kappa}{2}\left(\frac{x_t}{x_{t-1}}\hat{z}_t - \hat{z}\right)^2$ as in Christiano et al. (2005), where $\hat{z}_t = \left(\frac{A_t}{A_{t-1}}\right)^{\frac{1}{1-\alpha}}$ is the technological stochastic trend growth and A_t is the permanent component of productivity. It follows that the law of motion of capital is:

$$k_t^* = (1-\delta)\,k_t + \left(1 - S\left[\frac{x_t}{x_{t-1}}\right]\right)x_t, \tag{1}$$

with:

$$k_t = k_{t-1}^* e^{-d_t\theta_t}, \tag{2}$$

where k_t is the actual capital stock in period t, equal to the capital stock k_{t-1}^* chosen by households in period $t-1$ net of a possible disaster shock, as governed by the term k_{t-1}^* $e^{-d_t\theta_t}$. In particular, the dummy variable d_t takes value 1 with probability p_d, in case of a disaster realization, and 0 with probability $(1-p_d)$ otherwise. When a disaster occurs, the capital stock falls by a quantity θ_t, which follows an autoregressive process:

$$\log\theta_t = (1-\rho_\theta)\log\bar{\theta} + \rho_\theta\log\theta_{t-1} + \sigma_\theta\epsilon_{\theta,t}, \tag{3}$$

where the random variable θ_t takes a log-normal distribution with average disaster size $\bar{\theta}$, persistence parameter ρ_θ, and stochastic volatility $\sigma_\theta\epsilon_{\theta,t}$.[3]

It is important to note that a disaster realization is a one-off event, i.e. it occurs only in one quarter (when $d_t = 1$). Conversely, disaster risk shocks are persistent. Equation (3) implies that agents may temporarily expect the average disaster size $\bar{\theta}$ to be higher or lower,

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[3]Epidemics and pandemics are expected to work differently because they are not associated with a destruction of capital.

with ρ_θ governing the persistence of the risk shock.

In addition to destroying part of the capital stock, disaster shocks affect also total factor productivity (TFP), A_t^{agg}. Along similar lines as Gourio (2012) and Cantelmo (2022), TFP has both a permanent, A_t, and a temporary component, A_t^T, meaning that disasters might be followed by a partial recovery.[4] The permanent component is specified as a random walk with a drift while the temporary component follows a AR(1) process:

$$\log A_t^{\text{agg}} = \log A_t + \log A_t^T, \tag{4}$$

$$\log A_t = \log A_{t-1} + \Lambda_A + \sigma_A \epsilon_{A,t} - \omega (1 - \alpha) d_t \theta_t, \tag{5}$$

$$\log A_t^T = \rho_A \log A_{t-1}^T - (1 - \omega)(1 - \alpha) d_t \theta_t, \tag{6}$$

where Λ_A is the steady-state TFP growth, $\sigma_A \epsilon_{A,t}$ is the Gaussian component of permanent TFP and ρ_A is the persistence of temporary TFP. Parameter $\omega \in [0, 1]$ governs the relative impact of disasters on the two components of TFP. Moreover, disaster variables in the two processes of TFP are rescaled by the labor share of income, $(1 - \alpha)$, to ensure that capital and output fall by the same proportion.

3.2   Households

The representative household's utility reads as:

$$V_t^{1-\psi} = U_t^{1-\psi} + E\ _t\ V_{t+1}^{1-\gamma})^{\frac{1-\psi}{1-\gamma}}, \tag{7}$$

where the period-t utility U_t is defined over consumption c_t and labor l_t, $U_t = e^{\xi_t} c_t (1 - l_t)^\nu$, while V_{t+1} is its continuation value. Parameter γ governs risk aversion while $1/\hat{\psi}$ is the intertemporal elasticity of substitution, where $\hat{\psi} = 1 - (1 + \nu)(1 - \psi)$ is its inverse. As noted by Caldara et al. (2012), the importance of recursive preferences is twofold. First, they allow for a distinction between γ and $\hat{\psi}$.[5] Second, they imply a trade-off between current and a certainty equivalent of future utility. Households therefore have preference for early $(\gamma > \hat{\psi})$ or later $(\gamma < \hat{\psi})$ resolution of uncertainty. These features are particularly appealing in our context where agents face the risk of natural disasters, which induces precautionary savings captured by the recursive structure of preferences.

Households consume a constant-elasticity-of-substitution (CES) basket (c_t) of home $c_t^H)$

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[4]See discussion in Section 4. This specification nests that of Isoré and Szczerbowicz (2017) and Fernández-Villaverde and Levintal (2018). The latter assumes that only the permanent component of TFP is subject to disasters hence, by construction, disasters have permanent effects.

[5]The more standard case of expected utility can be achieved by setting $\gamma = \hat{\psi}$.

and foreign goods c_t^F). Thus,

$$c_t = \left[\varphi^{\frac{1}{\chi_c}} \left(c_t^H \right)^{\frac{\chi_c-1}{\chi_c}} + (1-\varphi)^{\frac{1}{\chi_c}} \left(c_t^F \right)^{\frac{\chi_c-1}{\chi_c}} \right]^{\frac{\chi_c}{\chi_c-1}}, \tag{8}$$

where φ indicates the home good bias and $\chi_c > 0$ is the intratemporal elasticity of substitution.

The consumption basket is the numeraire of the economy, with the unit price of this basket corresponding to:

$$1 = \left[\varphi \left(\frac{p_t^H}{p_t} \right)^{1-\chi_c} + (1-\varphi) \left(\frac{p_t^F}{p_t} \right)^{1-\chi_c} \right]^{\frac{1}{1-\chi_c}}, \tag{9}$$

where p_t^H represents the price of home goods, p_t^F represents the price of foreign goods, and p_t is the price of the composite consumption good. The relative price of home goods will then be $\tilde{p}_t^H \equiv \frac{p_t^H}{p_t}$. The relative price of foreign goods is $s_t \equiv \frac{p_t^F}{p_t} = \frac{e_t p_t^*}{p_t}$, where e_t is the nominal exchange rate and p_t^* is the price level of foreign goods expressed in foreign currency. Assuming that the law of one price holds, s_t corresponds also to the real exchange rate, defined as the price of one unit of foreign consumption basket in units of the domestic basket.

The definition of the real exchange rate pins down the following purchasing power parity relationship linking domestic to foreign inflation:

$$\frac{s_t}{s_{t-1}} = \frac{e_t}{e_{t-1}} \frac{\Pi_t^*}{\Pi_t}, \tag{10}$$

where $\Pi_t \equiv \frac{p_t}{p_{t-1}}$ is the gross domestic inflation rate and $\Pi_t^* \equiv \frac{p_t^*}{p_{t-1}^*}$ is the gross foreign inflation rate, which is exogenous and follows an autoregressive process,

$$\log \left(\frac{\Pi_t^*}{\Pi^*} \right) = \rho_{\Pi^*} \log \left(\frac{\Pi_{t-1}^*}{\Pi^*} \right) + \epsilon_t^{\Pi^*}, \tag{11}$$

where ρ_{Π^*} is the autoregressive parameters, and $\epsilon_t^{\Pi^*}$ is a mean zero, normally distributed random shock with standard deviation $\sigma_t^{y^*}$.

Minimizing total consumption expenditures subject to the consumption basket (8) yields the following demand functions for each good:

$$c_t^H = \varphi \left(\tilde{p}_t^H \right)^{-\chi_c} c_t \quad \text{and} \quad c_t^F = (1-\varphi) \left(s_t \right)^{-\chi_c} c_t. \tag{12}$$

Each period, the household's budget constraint (in real terms) reads as:

$$c_t + x_t + \frac{b_{t+1}}{p_t} + e_t\frac{b_{t+1}^*}{p_t} = w_t l_t + r_t k_t + R_{t-1}\frac{b_t}{p_t} + e_t R_{t-1}^* \Psi_{t-1}\frac{b_t^*}{p_t} + F_t + T_t, \qquad (13)$$

where x_t denotes investment in capital, w_t is the real wage, r_t is the rental rate on capital k_t, F_t are profits earned from firms, T_t is a lump-sum transfer from the government, b_t represents private domestic bonds which pay a gross return, R_t, and b_t^* are net foreign assets denominated in foreign currency paying a gross return R_t^*, which is exogenous and follows an autoregressive process:

$$\log\left(\frac{R_t^*}{R^*}\right) = \rho_{R^*}\log\left(\frac{R_{t-1}^*}{R^*}\right) + \epsilon_t^{R^*}, \qquad (14)$$

where ρ_{R^*} is the autoregressive parameters, and $\epsilon_t^{R^*}$ is a mean zero, normally distributed random shock with standard deviation $\sigma_t^{R^*}$. To prevent b_t^* from being a unit-root process, there exists a premium for holding net foreign assets (as in Schmitt-Grohe and Uribe, 2003), $\Psi_t \equiv \psi_0\exp\{-\psi_1(b_t^* - b^*)\}$, inversely related to the deviations of national foreign asset holdings to GDP, y_t, from their steady state. While ψ_0 captures the average wedge between R_t and R_t^*, $\psi_1 > 0$ makes the interest rate paid on foreign debt instruments elastic to net foreign asset holdings.

The household determines the optimal capital stock, k_t^*, which depreciates at a rate δ, and the investment x_t needed to achieve it.

Optimal choices of consumption, domestic and net foreign assets, labor supply, capital stock, and investment are taken to maximize utility (7), subject to (13), and (1), thus leading to the following first-order conditions:

$$1 = E_t\left[M_{t+1}\frac{R_t}{\Pi_{t+1}}\right], \qquad (15)$$

$$1 = E_t\left[M_{t+1}\frac{e_{t+1}}{e_t}\Psi_t\frac{R_t^*}{\Pi_{t+1}}\right], \qquad (16)$$

$$w_t = \nu\frac{c_t}{1 - l_t}, \qquad (17)$$

$$q_t = E_t\left[M_{t+1}e^{-d_{t+1}\theta_{t+1}}\left[r_{t+1} + q_{t+1}(1 - \delta)\right]\right], \qquad (18)$$

$$1 = q_t\left[1 - S\left[\frac{x_t}{x_{t-1}}\right] - S'\left[\frac{x_t}{x_{t-1}}\right]\frac{x_t}{x_{t-1}}\right] +$$

$$+ E_t M_{t+1}q_{t+1}S'\left[\frac{x_{t+1}}{x_t}\right]\left(\frac{x_{t+1}}{x_t}\right)^2. \qquad (19)$$

Equations (15) and (16) are the Euler equations, where $M_{t+1} \equiv \frac{\lambda_{t+1}}{\lambda_t}\frac{V_{t+1}^{\psi-\gamma}}{E_t\left(V_{t+1}^{1-\gamma}\right)^{\frac{\psi-\gamma}{1-\gamma}}}$ is the

stochastic discount factor with Epstein-Zin preferences and λ_t is the Lagrange multiplier on the budget constraint (13). Equation (17) represents the marginal rate of substitution between consumption and leisure, while equations (18) and (19) define the asset price and investment decisions, respectively.

Combining equations (15) and (16) yields the uncovered interest rate parity condition, whereby the domestic and foreign nominal interest rates are equal up to the nominal exchange rate depreciation and the risk premium:

$$\frac{R_t}{R_t^*} = \Psi_t E_t \left[\frac{e_{t+1}}{e_t} \right] = \Psi_t E_t \left[\frac{s_{t+1}}{s_t} \frac{\Pi_{t+1}}{\Pi_{t+1}^*} \right]. \tag{20}$$

Similarly to private consumption, investment x_t is also a CES basket of home, x_t^H, and foreign goods, x_t^F. For simplicity, the elasticity of substitution and the distributional parameter between the home and foreign components of investment are the same as in the consumption aggregator:

$$x_t = \left[\varphi^{\frac{1}{\chi_c}} \left(x_t^H \right)^{\frac{\chi_c-1}{\chi_c}} + (1-\varphi)^{\frac{1}{\chi_c}} \left(x_t^F \right)^{\frac{\chi_c-1}{\chi_c}} \right]^{\frac{\chi_c}{\chi_c-1}}. \tag{21}$$

Minimizing total investment expenditures subject to the consumption basket (21) yields the following demand functions for each type of investment goods:

$$x_t^H = \varphi \left(\tilde{p}_t^H \right)^{-\chi_c} x_t \quad \text{and} \quad x_t^F = (1-\varphi) \left(s_t \right)^{-\chi_c} x_t. \tag{22}$$

3.3 Firms

The firms' side of the model is completely standard and borrowed from Fernández-Villaverde and Levintal (2018), except for the fact that the small-open-economy aspect needs to be taken into consideration (along the lines of Gali and Monacelli, 2005). Perfectly competitive final good producers combine i domestic intermediate goods according to

$$y_t = \left(\int_0^1 y_{i,t}^{\frac{\epsilon-1}{\epsilon}} \right)^{\frac{\epsilon}{\epsilon-1}}, \tag{23}$$

where ϵ is the elasticity of substitution.[6] Intermediate goods producers combine labor and capital according to a Cobb-Douglas production function:

$$y_{i,t} = A_t^{\mathrm{agg}} k_{i,t}^{\alpha} l_{i,t}^{1-\alpha} \quad , \tag{24}$$

where $\alpha \in [0,1]$ is the capital share of income. Intermediate firms choose inputs and prices to maximize profits $F_{i,t} = \frac{p_{i,t}^H}{p_t} y_{i,t} - w_{i,t} l_{i,t} - r_{i,t} k_{i,t}$, subject to the production function (24) and a Dixit-Stiglitz demand function $y_{i,t} = \left(\frac{p_{i,t}^H}{p_t^H} \right)^{-\epsilon} y_t$, and are subject to Calvo price stickiness. At the symmetric equilibrium all i firms are equal, hence the first-order conditions of the profit-maximization problem imply the following relationships:

$$\frac{k_t}{l_t} = \frac{\alpha}{1-\alpha} \frac{w_t}{r_t}, \tag{25}$$

$$g_t^1 = mc_t y_t + \theta_p E_t M_{t+1} \left[\frac{(\Pi_t^H)^\chi}{\Pi_{t+1}^H} \right]^{-\epsilon} g_{t+1}^1, \tag{26}$$

$$g_t^2 = \left(\Pi_t^H \right)^O y_t + \theta_p E_t M_{t+1} \left[\frac{(\Pi_t^H)^\chi}{\Pi_{t+1}^H} \right]^{1-\epsilon} \left[\frac{(\Pi_t^H)^O}{(\Pi_{t+1}^H)^O} \right] g_{t+1}^2, \tag{27}$$

$$\epsilon g_t^1 = (\epsilon - 1) g_t^2, \tag{28}$$

$$1 = \theta_p \left[\frac{(\Pi_{t-1}^H)^\chi}{\Pi_t^H} \right]^{1-\epsilon} + (1 - \theta_p) \left[(\Pi_t^H)^O \right]^{1-\epsilon}, \tag{29}$$

$$v_t^p = \theta_p \left[\frac{(\Pi_{t-1}^H)^\chi}{\Pi_t^H} \right]^{1-\epsilon} v_{t-1}^p + (1 - \theta_p) \left[(\Pi_t^H)^O \right]^{1-\epsilon}, \tag{30}$$

$$\tilde{p}_t^H mc_t = \left(\frac{1}{1-\alpha} \right)^{1-\alpha} \left(\frac{1}{\alpha} \right)^{\alpha} \frac{w_t^{1-\alpha} r_t^{\alpha}}{A_t^{\mathrm{agg}}}, \tag{31}$$

where $\theta_p \in [0,1]$ denotes the per-period probability of not resetting the price; $\chi \in [0,1]$ governs the degree of indexation to past inflation of home good prices, $\Pi_t^H = \frac{p_t^H}{p_{t-1}^H}$; $\left(\Pi_t^H \right)^O = \frac{(p_t^H)^O}{p_t^H}$ is the ratio between the optimal reset price and the price of the final domestic good; mc_t is the marginal cost expressed in units of domestic goods; g^1 and g^2 are auxiliary variables; and finally v_t^p denotes price dispersion.

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[6]For simplicity the model abstracts from imported intermediate goods, although the capital stock, owned by households, is built with investment goods that are partly imported. For a setting featuring imported intermediate goods explicitly, see Justiniano and Preston (2010), among others. Moreover, the setting is standard in that monopolistic competition is at the level of intermediate firms, which are distinct from final goods producers to allow for Calvo price stickiness.

3.4 Monetary Policy

The central bank sets the interest rate according to a feedback rule, generalized as follows:

$$\frac{R_t}{R} = \left(\frac{\Pi_t}{\bar{\Pi}}\right)^{\gamma_\Pi} \left(\frac{\frac{y_t}{y_{t-1}}}{\exp\left(\Lambda_y\right)}\right)^{\gamma_y} \left(\frac{e_t}{e_{t-1}}\right)^{\gamma_e}. \tag{32}$$

We explore a number of alternative monetary policy regimes in line with the experience of disaster-prone countries, analyzed in Section 2, and the literature. Each case, obtained by means of appropriate parametrization, is labeled and discussed below.[7]

1. **Flexible Inflation targeting (FIT).** In this case the central bank is concerned exclusively with inflation stabilization, although temporary deviations from the inflation objective are allowed, hence inflation is stabilized at a longer horizon (see, e.g., Svensson, 2000). The larger the responsiveness (γ_Π) of the nominal interest rate to inflation deviations from target ($\bar{\Pi}$), the sooner inflation is brought back to target in the aftermath of shocks. Conversely, in the limiting case where γ_Π is very close but above 1, the Taylor principle is satisfied, hence inflation expectations are anchored, while keeping the monetary policy stance as mild as possible:

$$\frac{R_t}{R} = \left(\frac{\Pi_t}{\bar{\Pi}}\right)^{\gamma_\Pi}. \tag{33}$$

2. **Strict inflation targeting (SIT).** We label strict inflation targeting the limiting case in which the responsiveness of inflation is very large ($\gamma_\Pi = \infty$) and the central bank keeps the inflation rate constant, i.e. inflation is stabilized in the very short run (Svensson, 2000):

$$\frac{R_t}{R} = \left(\frac{\Pi_t}{\bar{\Pi}}\right)^{\gamma_\Pi}, \gamma_\Pi = \infty. \tag{34}$$

3. **Hard Peg (HP).** In this regime, the central bank's objective is to keep the nominal exchange rate constant (i.e. a fixed exchange rate regime as in Benigno, 2004). In practice, this outcome can be achieved by setting a very large responsiveness of the

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[7]These monetary policy rules imply that the central bank has acquired sufficient credibility and a functioning transmission mechanism between the monetary policy rate to interest rates that affect borrowing and lending, which may be weak, especially in low-income countries.

nominal interest rate to changes in the nominal exchange rate ($\gamma_e \to \infty$):

$$\frac{R_t}{R} = \left(\frac{e_t}{e_{t-1}} \right)^{\gamma_e}. \tag{35}$$

4. **Taylor rule (TR).** This rule follows the standard practice of many central banks that respond to both inflation developments and economic activity. The specific formulation is borrowed from Fernández-Villaverde and Levintal (2018) who, relative to equation (33), include also a responsiveness (γ_y) of the nominal interest rate to output growth:

$$\frac{R_t}{R} = \left(\frac{\Pi_t}{\bar{\Pi}} \right)^{\gamma_\Pi} \left(\frac{\frac{y_t}{y_{t-1}}}{\exp(\Lambda_y)} \right)^{\gamma_y}. \tag{36}$$

5. **Exchange-rate-augmented Taylor rule (ERTR).** Relative to the previous regime, this rule allows the central bank to respond also to changes in the nominal exchange rate ($\gamma_e > 0$), (see McCallum and Nelson, 1999, Batini et al., 2003 and Justiniano and Preston, 2010, among many others). This case captures concerns regarding the fact that depreciations may harm welfare via increases in the prices of imports:

$$\frac{R_t}{R} = \left(\frac{\Pi_t}{\bar{\Pi}} \right)^{\gamma_\Pi} \left(\frac{\frac{y_t}{y_{t-1}}}{\exp(\Lambda_y)} \right)^{\gamma_y} \left(\frac{e_t}{e_{t-1}} \right)^{\gamma_e}. \tag{37}$$

Section 6 provides robustness checks to alternative specifications of the rules listed above by allowing also for interest rate inertia, by replacing the interest rate responsiveness to CPI inflation (Π_t) with a responsiveness to inflation of domestic consumption goods prices (Π_t^H), and by targeting nominal GDP.

3.5   Equilibrium

Imports consist of the sum of purchases of foreign goods for consumption and investment,

$$imp_t = c_t^F + x_t^F = (1 - \varphi)(s_t)^{-\chi_c}(c_t + x_t). \tag{38}$$

Exports consist of the foreign demand for home goods, assumed to have an analogous algebraic expression as domestic demand, and to be subject to downward shifts when the economy is hit by natural disasters, $\psi^d d_t \theta_t$, where parameter ψ^d governs the impact of dis-

asters on external demand:[8]

$$exp_t = \varphi^* \left(\frac{p_t^H}{e_t p_t^*} \right)^{-\chi_c^*} y_t^* - \psi^d d_t \theta_t, \tag{39}$$

where φ^* and χ_c^* are the foreign distributional parameter and elasticity of substitution, respectively. Aggregate foreign demand, y_t^*, follows an autoregressive process:

$$\log \left(\frac{y_t^*}{y^*} \right) = \rho_{y^*} \log \left(\frac{y_{t-1}^*}{y^*} \right) + \epsilon_t^{y^*}, \tag{40}$$

where ρ_{y^*} is the autoregressive parameter, and $\epsilon_t^{y^*}$ is a mean zero, normally distributed random shock with standard deviation $\sigma_t^{y^*}$.

Therefore, the resource constraint reads as follows:

$$\tilde{p}^H y_t = c_t + x_t + \tilde{p}^H exp_t - s_t imp_t. \tag{41}$$

The balance of payments equilibrium requires the current account balance to be equal to the change in net foreign assets:

$$p_t^H exp_t - p_t^F imp_t + \left(R_{t-1}^* \Psi_{t-1} - 1 \right) e_t b_{t-1}^* = e_t \left(b_t^* - b_{t-1}^* \right). \tag{42}$$

By using the definitions of relative prices, $\tilde{p}_t^H \equiv \frac{p_t^H}{p_t}$ and $s_t \equiv \frac{p_t^F}{p_t} = \frac{e_t p_t^*}{p_t}$, foreign inflation, $\Pi_t^* \equiv \frac{p_t^*}{p_{t-1}^*}$, and the purchasing power parity condition (10), equation (42) can be rewritten in real terms as follows:

$$\tilde{p}_t^H exp_t - s_t imp_t + s_t \left(R_{t-1}^* \Psi_{t-1} - 1 \right) \frac{\tilde{b}_{t-1}^*}{\Pi_t^*} = s_t \left(\tilde{b}_t^* - \frac{\tilde{b}_{t-1}^*}{\Pi_t^*} \right), \tag{43}$$

where $\tilde{b}_t^* \equiv \frac{b_t^*}{p_t^*}$ denotes the real net foreign assets.

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[8] This channel captures, e.g., the fall in external demand for exports in the tourism sector when small island countries are impacted by hurricanes or similar natural disasters and the rise in trade barriers as crucial mobility infrastructure (such as harbors and airports) is disrupted. Empirical evidence (e.g., Rossello et al., 2020, among others) finds that events such as tsunamis, floods and volcanic eruptions generally reduce tourist arrivals and may divert tourist flows from one destination to another. This effect may be persistent, especially in low-income countries (Okafor et al., 2021).

Table 4: Baseline Calibration

Parameter		Value
Households		
Discount factor	β	0.9838
Inverse of IES of consumption	$\hat{\Psi}$	0.5000
Leisure preference parameter	ν	1.1000
Risk aversion	γ	3.8000
Intratemporal elasticity of substitution between home and foreign good	χ_c	0.6700
Domestic home good bias	φ	0.5502
Average wedge between R_t and R_t^*	ψ_o	1.0084
Interest rate elasticity to net foreign assets	ψ_1	0.0010
Foreign Demand		
Scaling parameter in foreign demand	φ^*	1.0000
Elasticity of foreign demand	χ_c^*	0.5800
Steady state of export-to-GDP ratio	exp_y	0.3231
Impact of disaster shocks on export demand	φ^d	0.2500
Firms		
Capital share of income	α	0.3200
Total factor productivity trend growth rate	Λ_A	0.0035
Weight of disasters on permanent TFP	ω	0.5000
Investment adjustment costs		12.0000
Private capital depreciation rate	δ	0.0250
Automatic price adjustment	χ	0.1100
Calvo price stickiness parameter	θ_p	0.6800
Elasticity of substitution in final good aggregator	ϵ	6.0000
Monetary Policy		
Inflation target	$\bar{\Pi}$	1.0122
Steady state of foreign inflation	$\bar{\Pi}^*$	1.0053
Inflation parameter in Taylor rule	γ_Π	1.5000
Output growth parameter in Taylor rule	γ_y	0.0000
Interest rate smoothing in Taylor rule	γ_R	0.0000
Exchange rate parameter in Taylor rule	γ_e	0.0000
Disaster Shocks		
Persistence of disaster risk shocks	ρ_θ	0.9000
Standard deviation of disaster risk shocks	σ_θ	0.1270
Annual disaster probability	p_d	0.1620
Mean disaster size	$\bar{\theta}$	0.0344
Other Shocks		
Persistence of temporary total factor productivity	ρ_A	0.7100
Persistence of foreign inflation rate	ρ_{Π^*}	0.2144
Persistence of foreign interest rate	ρ_{R^*}	0.8085
Persistence of foreign demand	ρ_{y^*}	0.8751
Standard deviation of total factor productivity shocks	σ_A	0.0280
Standard deviation of foreign inflation shocks	σ_{Π^*}	0.0052
Standard deviation of foreign interest rate shocks	σ_{R^*}	0.0095
Standard deviation of foreign demand shocks	σ_{y^*}	0.0023

4 Calibration and Solution Method

We calibrate the model to an average *disaster-prone* EMDEs at a quarterly frequency.

Table 4 reports the choice of all parameter values for the baseline calibration.

Households. The discount factor ( ) is set at 0.9838, such that it yields a steady-state annual interest rate of 8.52%, as reported by Garcia-Cicco et al. (2010) for a set of emerging market economies. Moreover, this value falls also in the range considered by Shen et al. (2018) for low-income countries. As conventional in the business cycle literature, the inverse of the intertemporal elasticity of substitution, $\hat{\Psi}$, is calibrated to the value of 0.5, and the leisure preference parameter, ν, is set at 1.1, such that agents work 1/3 of their time. Given the scant evidence on risk aversion within Epstein-Zin preferences for developing economies, we set $\gamma = 3.8$, as Gourio (2012) and Fernández-Villaverde and Levintal (2018) do for the U.S. economy.[9] Some experimental evidence in countries hit by natural disasters (Cassar et al., 2017 and Cameron and Shah, 2015) suggests that their economic agents tend to exhibit a more risk averse behavior, although these findings are difficult to translate into a value of γ.[10] We therefore see the calibration of risk aversion based on the U.S. economy as a lower bound for *disaster-prone* countries. Following Justiniano and Preston (2010), the intratemporal elasticity of substitution between the home and foreign good, χ_c, is set to 0.67, while the home good bias, φ, is set to 0.5502, in order to match the imports-to-GDP ratio of 55 percent in *disaster-prone* countries over the 1997-2017 sample. The average wedge between R_t and R_t^*, ψ_o, is calibrated at 1.0084 in line with a spread between the average deposit rate for *disaster-prone* countries and the average effective Federal Funds rate of 336 annual basis points over the same period. The interest rate elasticity to net foreign assets, ψ_1, is set to 0.001, given that its presence is only necessary to eliminate the unit root that there would otherwise be in net foreign assets (see, e.g., Schmitt-Grohe and Uribe, 2003).

Foreign demand. The scaling parameter in foreign demand, φ^*, is normalized to one, the steady-state export-to-GDP ratio, exp_y, is set to 0.3231, in order to match the data for *disaster-prone* countries over the 1997-2017 sample. The elasticity of demand, χ_c^*, is set to 0.58, following Justiniano and Preston (2010), and the parameter governing the impact of disaster shocks on export demand, φ^d, is set equal to 0.25, to deliver an one-percent increase in the annualized CPI inflation rate in response to an average disaster shock, in line with the experience of disaster-prone countries reported in Section 2.

Firms. We follow Garcia-Cicco et al. (2010) also in setting the total capital share of income, α, to 0.32, while we set trend TFP growth, Λ_A, to 0.0035, as suggested by Araujo

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[9]Values of risk aversion between 3 and 4 are needed to replicate the average equity premium, see Barro (2009; 2015) and Gourio (2012).

[10]See also van den Berg et al. (2009), Dang (2012) and Brown et al. (2018). Fiala (2017) reviews this evidence in more detail and reports also some contrasting results. Cantelmo (2022) shows that sufficiently temporary higher risk aversion in the aftermath of disasters might generate large demand-side in addition to supply-side effects.

et al. (2016). For the baseline calibration, we assume that the shock is distributed equally between the permanent and stationary components of TFP ($\omega = 0.5$), given the uncertainty surrounding this parameter. However, we check the extent to which the results are robust to alternative choices.[11] The parameter governing investment adjustment costs, κ, is set to 12, in line with the calibration of Schubert and Turnovsky (2011) for a set of developing economies. The private capital depreciation rate, δ, is borrowed from Shen et al. (2018) who set it equal to a value of 0.025. Following the calibration of Justiniano and Preston (2010) for small-open economies, the automatic price adjustment, χ, is set to 0.11, and the Calvo price stickiness parameter is set to 0.68. Lastly, the elasticity of substitution of demand faced by final good producers, ϵ, is set to the conventional value of 6, adopted also by Isoré and Szczerbowicz (2017) in the context of a DSGE model with natural disasters.

Monetary Policy. The inflation target parameter, $\bar{\Pi}$, is calibrated to 1.0122 to match the average annual inflation rate for *disaster-prone* countries of 4.87 percent, while the steady state of foreign inflation, $\bar{\Pi}^*$, is set at 1.0053 to match the average annual U.S. inflation rate of 2.12 percent. For baseline illustrative results, the parameter governing the responsiveness of the interest rate to inflation in the Taylor rule, γ_Π, is set to 1.5, a conventional value that satisfies the Taylor principal (Taylor, 1993), whereas the remaining parameters in the Taylor Rule (γ_y, γ_R, γ_e) are set equal zero, essentially shutting down any additional monetary policy objective besides inflation targeting. However, we activate these objectives in various policy experiments and discuss the calibration of the relevant parameters in the appropriate sections.

Disaster Shocks. Absent evidence specific for EMDEs, we calibrate the persistence of the disaster risk shock, ρ_θ, to 0.90, following Gourio (2012), Isoré and Szczerbowicz (2017) and Fernández-Villaverde and Levintal (2018). The standard deviation, $\sigma_\theta = 0.1270$, matches the quarterly dispersion of damages to GDP in *disaster-prone* countries of 28 percent. In accordance with the evidence found for *disaster-prone* countries (Cantelmo et al., 2019), we set the annual disaster probability, p_d, to 16.2 percent and the average loss, $\bar{\theta} = 0.0344$, so that the average disaster destroys about 7 percent of GDP, when the the

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[11]The extreme cases of $\omega = 0$ and $\omega = 1$ imply that disasters only have a temporary or a permanent effect, respectively. Hsiang and Jina (2014) estimate that tropical cyclones have a highly persistent effect on the growth rate and reject hypothesis of "creative destruction" or "build-back better." Moreover, a peculiarity of disaster-prone countries is that they are subject to recurrent natural disasters, hence even if a single disaster alone would not be very persistent, when more events compound the effects might become virtually permanent. With a focus on other types of disasters, Nakamura et al. (2013) show that disasters are followed by partial recoveries, hence with a temporary higher growth rate of output after the disaster relative to the pre-disaster growth rate. By appealing to their evidence, our baseline calibration assumes that natural disasters have both a short-run and a long-run impact on productivity, hence the aftermath of disasters is characterized by faster growth and a partial recovery.

disaster affects also export demand.[12]

Other Shocks. We set the persistence of the temporary component of TFP affected by disaster shocks, ρ_A, equal to 0.71 as in Gourio (2012), while the standard deviation of the shock hitting the permanent component of TFP, σ_A, equal to 0.0280 to match the average for *disaster-prone* countries of the standard deviation of the cyclical component of the logarithm of real GDP, which amounts to 2.87 percent at an annual frequency. In order to calibrate the persistence and standard deviations of shocks to the foreign interest rate, inflation and demand, we estimate AR(1) processes for the U.S. quarterly CPI inflation rate, Federal Funds rate and cyclical components of GDP (computed with a standard HP filter). This leads to the following persistence parameters for the foreign inflation rate, ρ_{Π^*}, the foreign interest rate, ρ_{R^*}, and foreign demand, ρ_{y^*}, of 0.2144, 0.8085 and 0.8751, respectively; and the following standard deviations of shocks to the the same variables, σ_{Π^*}, σ_{R^*} and σ_{y^*} of 0.0052, 0.0095 and 0.0023, respectively.

Solution Method. To simulate our model, we resort to Taylor projection, a solution method proposed by Levintal (2018) and Fernández-Villaverde and Levintal (2018) to solve DSGE models with rare disasters. Fernández-Villaverde and Levintal (2018) demonstrate that a Taylor projection up to third order is more accurate and generally faster to compute than perturbation methods up to a fifth order of approximation and projection methods (Smolyak collocation) up to a third order to solve a wide range of DSGE models with rare disasters. Taylor projection essentially combines the setup of standard projection methods (e.g. Judd, 1992) with approximation methods via Taylor expansions. The method yields a solution that, although not global, is possible to approximate at many points of the state-space, and this makes it accurate in dealing with large nonlinearities. These features of Taylor projection are particularly appealing for studying natural disasters within a DSGE model and motivate our choice of using a third-order Taylor projection over alternative methods.

5 Results

5.1 Effects of a Natural Disaster Shock in a Small Open Economy

We start from analyzing the effects that the realization of an average natural disaster shock has on disaster-prone small-open economies. In this subsection we present results assuming a flexible CPI inflation targeting, that is, the central bank targets CPI inflation allowing for temporary deviations from the target (alternative monetary policy regimes are presented in Subsection 5.2). As explained in Section 3, the disaster affects the stock of capital and

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[12]Note that $\bar{\theta} = -\log(1 - \Delta)$, where Δ is the loss in terms of GDP.

Figure 6: Impulse Responses of Selected Macroeconomic Variables to an Average Natural Disaster Shock in a *Disaster-Prone* Country
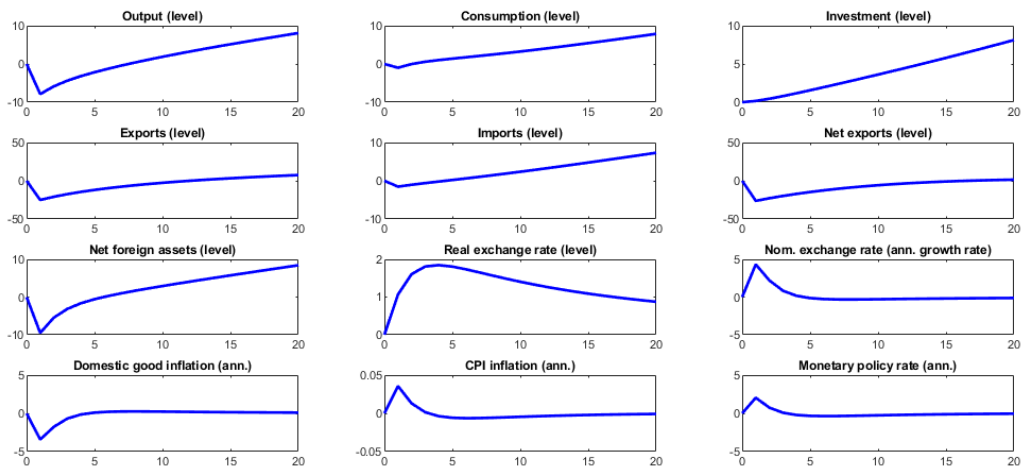
Notes: X-axes are in quarters. Y-axes are in percent deviations from the stochastic steady state. The stochastic steady state is obtained by simulating the model in the absence of shocks for 100 quarters.

productivity as in other contributions with closed-economy models (Gourio, 2012; Fernández-Villaverde and Levintal, 2018; Cantelmo et al., 2019), with the addition of the export demand channel (illustrated in Subsection 3.5 and analyzed in Subsection 6.1).

As common in the related literature, we obtain the stochastic steady state by simulating the model in the absence of shocks for 100 quarters. Soon afterwards, the model is perturbed by a one-off disaster shock of average size and impulse response functions (IRFs) are traced for 20 quarters.

Output, consumption, investment, exports, imports, net exports and net foreign assets are non-stationary and are plotted in percent deviations from the stochastic steady state. These variables grow each period at the same growth rate as TFP. Given that disasters hit both components of TFP, the growth rate of TFP initially falls and then experiences an overshooting before gradually reverting to its pre-disaster level (Subsection 3.1). Therefore, real output and consumption fall in the aftermath of the shock and then grow, initially at a higher rate, before converging to their balanced growth path. Investment increases to rebuild the destroyed stock of capital, exports and imports fall, but the fall in exports is more pronounced than that of imports, leading to a contraction in net exports.

Given that the disaster shock affects domestic output and export demand, it acts both as a demand and as a supply shock. The disaster impacts domestic production and incomes while the export channel reduces import capacity via the balance of payment condition (equation 43). Given that the elasticity of substitution between domestic and imported

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goods (χ^c) is less than unity, the contraction in import demand is less than proportional than the fall in exports, which requires the real exchange rate to depreciate (shown as an increase in the figure) in order to further curb import demand, stimulate exports and induce a net inflow of capital (i.e. a fall in net foreign assets).

This real exchange rate depreciation is facilitated by an initial sharp depreciation (increase) in the nominal exchange rate, which makes CPI inflation increase. The fall in the demand for home goods causes a contraction in (sticky) home good prices. Since domestic goods inflation remains below its steady state level for a prolonged period, CPI inflation experiences an undershooting following the initial increase. Given that the central bank targets CPI inflation, the response of the monetary policy rate tracks its dynamics. However, the strength of this response clearly depends on the calibration of parameter γ_Π. For example, setting $\gamma_\Pi = 1.1$, which is the welfare-maximizing response, subject to satisfying the Taylor principle (see Figure 8 in Section 5.3), implies that the central bank accommodates the disaster shock to a large extent. In that case, the responses of CPI inflation and the monetary policy rate are close to those implied by a Taylor rule that responds also to output, while the fall of GDP is mitigated.[13]

5.2 Differences Associated with Alternative Monetary Policy Regimes

In this subsection we analyze the impact of alternative monetary policy regimes, mimicked by the alternative interest rate rules outlined in Subsection 3.4, in the context of a natural disaster realization. Figure 7 depicts the impulse responses of key macroeconomic variables to the same average natural disaster shock analyzed in the previous subsection, under alternative assumptions on the monetary policy regime.

In Subfigure 7-(a) we compare the baseline flexible inflation targeting regime ($\gamma_\Pi = 1.5$, $\gamma_y = 0$, $\gamma_e = 0$), in which the central bank targets only CPI inflation, but allows for temporary departures of inflation from target, with strict inflation targeting, and a hard peg. Strict inflation targeting is achieved by setting a very large interest rate responsiveness to inflation to keep it virtually constant ($\gamma_\Pi \to \infty$, $\gamma_y = 0$, $\gamma_e = 0$). A hard peg is a fixed exchange regime achieved by setting a very large interest rate responsiveness to the exchange rate ($\gamma_\Pi = 0$, $\gamma_y = 0$, $\gamma_e \to \infty$). The differential impact of these three regimes on output is limited because the natural disaster shock dominates its dynamics, but both a hard peg and strict inflation targeting magnify the GDP loss to an extent. Expectedly, the specific monetary policy regime has significant implications for nominal variables. The peg, by definition, eliminates the shock-absorbing effect of the exchange rate, thus exacerbating the recession and causing

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[13]Impulse responses are available upon request.

Figure 7: Impulse Responses of Selected Macroeconomic Variables to an Average Natural Disaster Shock in a *Disaster-Prone* Country, under Alternative Specification of the Monetary Policy Regime
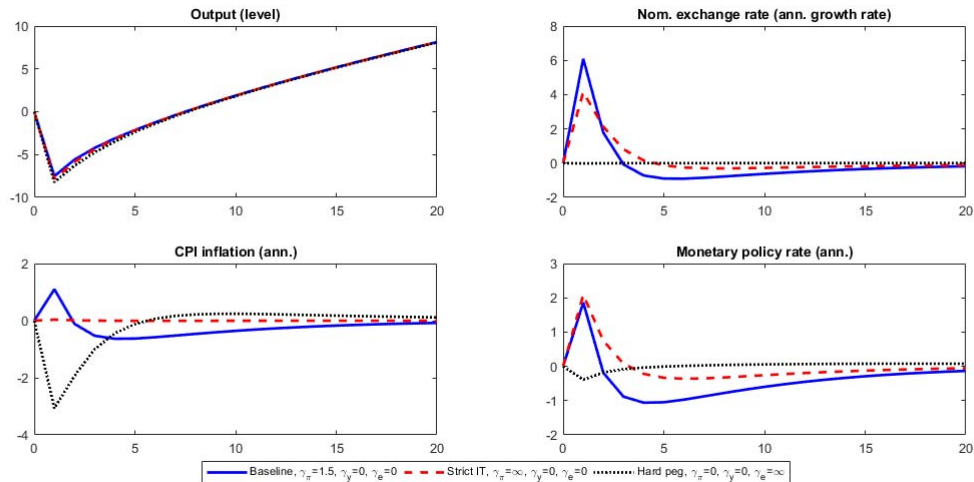
(a) Baseline (Flexible Inflation Targeting), Strict Inflation Targeting and Hard Peg
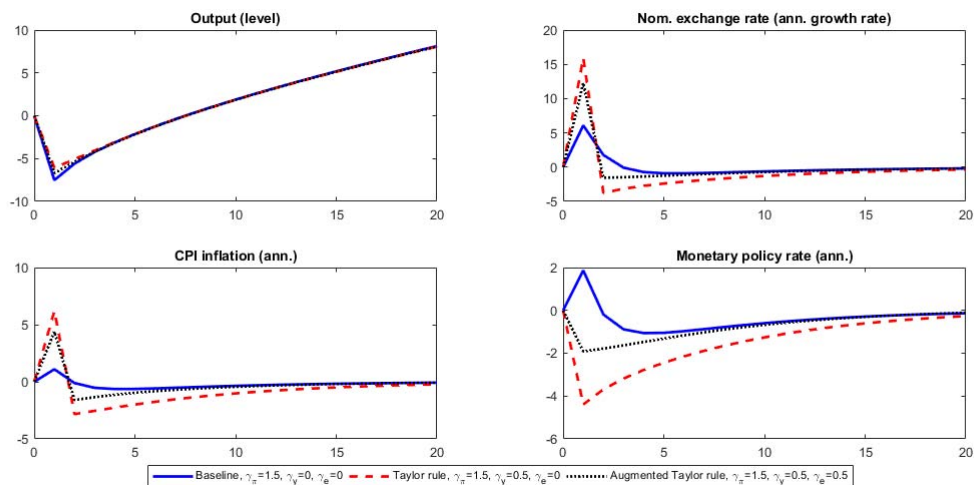
(b) Baseline (Flexible Inflation Targeting), Conventional Taylor Rule and Exchange-Rate-Augmented Taylor Rule

Notes: X-axes are in quarters. Y-axes are in percent deviations from the stochastic steady state. The stochastic steady state is obtained by simulating the model in the absence of shocks for 100 quarters. Bold blue lines represents the effect of an average natural disaster shock in a disaster-prone country, under the baseline assumption of flexible inflation targeting. Dashed red lines and dotted black lines represent alternative monetary policy regimes.

a fall in aggregate demand and inflation. The central bank accommodates the shock by lowering the policy rate but still the initial output loss is larger than under flexible inflation targeting. Strict inflation targeting requires a more prolonged increase in the interest rate

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to keep inflation constant. The exchange rate still depreciates, but to a smaller extent than in the flexible inflation targeting.

In Subfigure 7-(b) we compare the baseline flexible inflation targeting regime ($\gamma_\Pi = 1.5$, $\gamma_y = 0$, $\gamma_e = 0$) with a conventional Taylor rule, whereby the central bank reacts to inflation and output ($\gamma_\Pi = 1.5$, $\gamma_y = 0.5$, $\gamma_e = 0$), and an exchange-rate-augmented Taylor rule whereby the central bank also reacts to the exchange rate ($\gamma_\Pi = 1.5$, $\gamma_y = 0.5$, $\gamma_e = 0.5$). Again, the differential impact of these three regimes on output is limited but the effects on nominal variables are very different. While with flexible inflation targeting monetary policy is tightened following the disaster shock, the responsiveness to output in the conventional Taylor rule leads to a monetary policy accommodation, which mildly mitigates the output contraction and leads to a stronger exchange rate depreciation and higher inflation. If the central bank is also concerned with the stability of the exchange rate, this leads to intermediate responses, between those delivered by flexible inflation targeting and a conventional Taylor rule.

5.3   Welfare Outcomes

In the previous subsections, results are based on the analysis of impulse responses to a disaster shock, conditional on monetary policy regimes. This is especially useful to highlight tradeoffs among alternative monetary policy reactions to disasters. The model, and the economies under investigation, however, are subjected by several other shocks, in addition to natural disasters. Therefore, it is informative to simulate the model with all shocks activated and to evaluate welfare outcomes.[14]

Table 5 reports output and inflation volatilities, welfare levels and welfare gain/losses associated with the various monetary policy regimes vis-à-vis the flexible inflation targeting regime. Output and inflation volatilities are captured by the standard deviations of the percent fluctuations of output around its trend and the CPI inflation rate, simulated for 900 quarters, after running the model in the absence of shocks for 100 quarters. The welfare level is the average of the simulated recursive definition of households' utility (equation 7). Finally, the consumption equivalent (C.E.) welfare gain represents the permanent increase in consumption (in percent) necessary to make agents as well off as in the flexible inflation targeting regime (with a minus sign representing a welfare loss). It is however important to note that due to computational constraints we do not optimize the parameters of the various monetary policy rules but we calibrate them according to the literature, see discussion below.

Under the baseline calibration, flexible inflation targeting dominates all other regimes.

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[14]In Section 6.2 we show that the results are not driven by a specific shock.

Table 5: Output and Inflation Volatilities, and Welfare Levels Associated with Alternative Monetary Policy Regimes

Monetary policy regime	γ_Π	γ_y	γ_e	Output volatility (%)	Inflation volatility (%)	Welfare level	C.E. gain w.r.t. FIT (%)
Flexible inflation targeting	1.5	0	0	2.8500	1.1403	0.4611	-
Strict inflation targeting	∞	0	0	2.8900	0.6173	0.4596	-0.3253
Hard peg	0	0	∞	3.0500	1.2862	0.4580	-0.6723
Taylor rule	1.5	0.5	0	2.9800	1.3083	0.4575	-0.7807
Exchange-rate aug. TR	1.5	0.5	0.5	2.9900	1.3097	0.4573	-0.8241

Notes: Parameters γ_Π, γ_y and γ_e represent the responsiveness to inflation, output and the exchange rate, respectively, in the interest-rate rule. Output and inflation volatilities are the standard deviations of the percent fluctuations around their respective trends, simulated for 900 quarters, after running the model in the absence of shocks for 100 quarters. The welfare level is the average of the simulated recursive definition of households' welfare. The consumption-equivalent (C.E.) welfare gain represent the permanent increase in consumption (in percent) necessary to make agents as well off as in the flexible inflation targeting regime (with a minus sign representing a welfare loss).

Relative to this regime, strict inflation targeting leads to a lower inflation volatility, a slightly higher output volatility and a welfare loss equivalent to a permanent loss in consumption of about 0.3 percent. A hard peg, by removing the shock-absorbing properties of a flexible exchange rate, is associated with higher output and inflation volatilities, and to a C.E. welfare loss of about 0.7 percent. In this sense, we extend the results of the small-open economy of Kollmann (2002) to one subject to natural disasters and our findings agree with those of Elekdag and Tuuli (2022) who find that exchange-rate flexibility mitigates the negative impact of weather shocks relative to a fixed-exchange rate regime. Both the conventional and the exchange-rate-augmented Taylor rule deliver an increase in the output and inflation volatilities and a C.E. welfare loss of about one percent relative to flexible inflation targeting.

Given that the various monetary policy regimes are based on illustrative, and possibly suboptimal, parameterizations, in Figure 8, we report the welfare level as a function of the responsiveness parameters to inflation, output and the exchange rate in the interest-rate rule. In the simulations, these parameters are changed one at a time, leaving the other two set at their baseline values (i.e. $\gamma_\pi = 1.5$, $\gamma_y = \gamma_e = 0$). The same exercise is replicated also under alternative assumptions on the frequency and severity of natural disasters shocks: (i) no disaster shocks; (ii) larger damages (1.5 larger than baseline); and (iii) higher disaster frequency (1.5 higher than baseline). As expected, the no-disaster scenario delivers a higher welfare level, while higher disaster frequency or severity lead to lower welfare levels than the baseline scenario. However, regardless of the assumptions on the disaster-shock calibra-

Figure 8: Welfare Level as a Function of Responsiveness Parameters to Inflation, Output and the Exchange Rate in the Interest-Rate Rule, under Alternative Assumptions on the Frequency and Severity of Natural Disasters Shocks
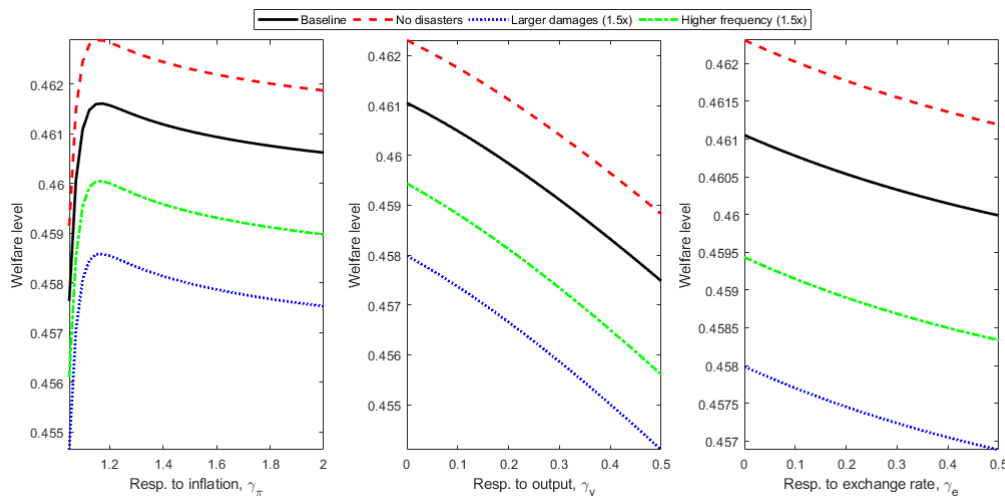
Notes: Bold black lines represent the baseline calibration. Dashed red lines represent the case of no natural disasters, while dotted blue and green lines represent the case of more severe and more frequent natural disasters, respectively.

tion, a flexible inflation targeting regime remains the welfare-optimal regime, with a small interest-rate responsiveness to inflation ($\gamma_\Pi \approx 1.1$) being the welfare-maximizing value. This means that the central bank can set the monetary stance at the minimum to keep inflation expectations anchored, ultimately accommodating a disaster shock to a large extent (see also discussion in Section 5.1). Positive values for the monetary policy responsiveness parameters to output or the exchange rate deliver a decrease in the level of welfare. In other words, it is optimal for the central bank to focus only on inflation stabilization, although departures of the inflation rate from target are allowed for in the aftermath of shocks. This way the central bank is able to effectively absorb both demand and supply shocks by stimulating aggregate demand and firms production, respectively, while keeping inflation under control. These results are consistent with the empirical findings of Fratzscher et al. (2020) who show that countries adopting an inflation targeting regime suffer lower output losses and milder surges in inflation than in countries adopting alternative regimes in response to large natural disasters. Moreover, the superiority of inflation targeting in the presence of supply shocks is a well established result in the literature of optimal monetary policy. Indeed, the inflation-output tradeoff resulting from supply-side disturbances is generally solved in favor of inflation stabilization, see e.g. Kollmann (2002) and Giannoni (2014) in case of standard New-Keynesian models, and Keen and Pakko (2011) and Kim and Ruge-Murcia (2019) when the NK model includes extreme events.

Figure 9: Impulse Responses of Selected Macroeconomic Variables to an Average Natural Disaster Shock in a *Disaster-Prone* Country, under Alternative Assumptions on the Effect of a Natural Disaster on Export Demand
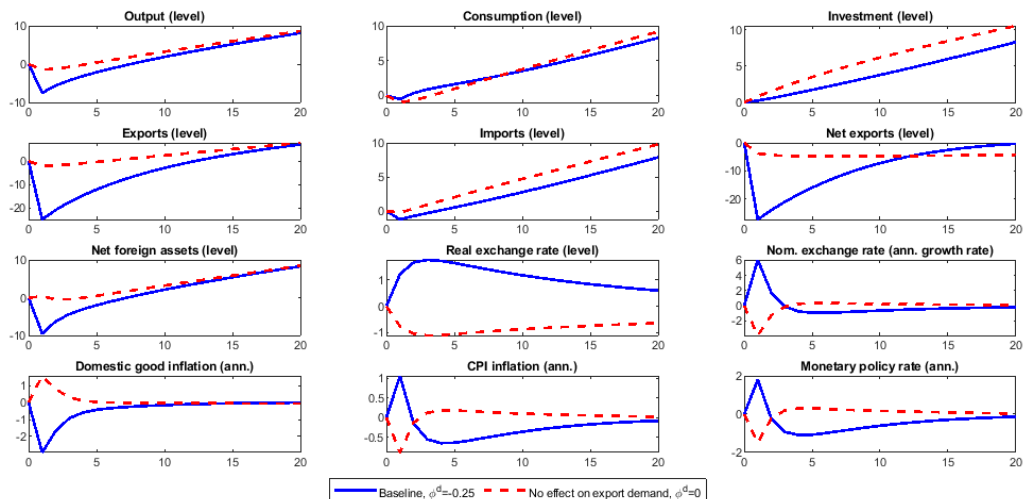
Notes: X-axes are in quarters. Y-axes are in percent deviations from the stochastic steady state. The stochastic steady state is obtained by simulating the model in the absence of shocks for 100 quarters. Bold blue lines represents an average natural disaster shock in a *disaster-prone* country, assuming that natural disasters affect the demand for exports ($\varphi^d = 0.25$). Dashed red lines represents a natural disaster shock of the same intensity, assuming that the disaster has no effect on export demand ($\varphi^d = 0$).

6 Sensitivity Analysis

6.1 Excluding the Export Demand Channel

The baseline results include the effects of the export demand channel illustrated in Sub-section 3.5, capturing the typical case of tourism-dependent small islands hit by cyclones, which experience an avalanche of cancellations when these episodes ensue. Given that this model feature departs from the closest contributions to this paper in the literature, it seems appropriate to disentangle its role and assess the sensitivity of the results to its removal.

Besides the baseline case with the export channel activated ($\varphi^d = 0.25$), in Figure 9 we also present a counterfactual with no direct impact of the disaster shock on export demand ($\varphi^d = 0$). As far as real variables are concerned, the export channel of natural disasters has an amplification role but does not affect the sign of the responses. However, this feature is especially important for the effects that natural disasters have on nominal variables, particularly CPI inflation.

When the export demand channel is deactivated, the disaster shock behaves as a pure supply-side shock with the decline in home good production leading to an increase in do-

Table 6: Output and Inflation Volatilities, and Welfare Levels Associated with Alternative Monetary Policy Regimes–No Export Demand Channel ($\varphi^d = 0$)

Monetary policy regime	γ_Π	γ_y	γ_e	Output volatility (%)	Inflation volatility (%)	Welfare level	C.E. gain w.r.t. FIT (%)
Flexible inflation targeting	1.5	0	0	2.5100	1.1595	0.4566	-
Strict inflation targeting	∞	0	0	2.5100	0.6264	0.4548	-0.3942
Hard peg	0	0	∞	2.6600	1.3057	0.4529	-0.8103
Taylor rule	1.5	0.5	0	2.7400	1.3426	0.4527	-0.8541
Exchange-rate aug. TR	1.5	0.5	0.5	2.7100	1.3452	0.4523	-0.9417

Notes: Parameters γ_Π, γ_y and γ_e represent the responsiveness to inflation, output and the exchange rate, respectively, in the interest-rate rule. Output and inflation volatilities are the standard deviations of the percent fluctuations around their respective trends, simulated for 900 quarters, after running the model in the absence of shocks for 100 quarters. The welfare level is the average of the simulated recursive definition of households' welfare. The consumption-equivalent (C.E.) welfare gain represent the permanent increase in consumption (in percent) necessary to make agents as well off as in the flexible inflation targeting regime (with a minus sign representing a welfare loss).

mestic inflation. With export demand effectively insulated from the disaster shock, domestic import capacity is also partially insulated. The supply side shock has an income effect and, given the relatively low elasticity of substitution between the home and imported goods, the adjustment requires an appreciation (decrease) of the real exchange rate to shift the fall in aggregate demand on the domestic good. The real appreciation is achieved by an impact appreciation (decrease) in the nominal exchange rate, which leads to a decline in CPI inflation. Since, in this case, domestic goods inflation remains above its steady state level for a prolonged period, CPI inflation experiences an overshooting following the initial decrease. The response of the monetary policy rate closely tracks that of CPI inflation.

Since, following disasters, we observe an increase in CPI inflation on average (Figure 2), it seems appropriate to leave this channel activated for the baseline calibration. However, given the empirical heterogeneity in the responses of CPI inflation, monetary policy and the real exchange rate in the aftermath of disasters (documented in Section 2), the intensity of the export demand channel of disaster shocks (captured by parameter φ^d) represents an effective lever to align responses of these key variables to the experience of specific countries and/or disasters.

Table 6 reports output and inflation volatilities, welfare levels and welfare gain/losses associated with the various monetary policy regimes vis-à-vis the flexible inflation targeting regime, when the export demand channel is deactivated ($\varphi^d = 0$). Relative to the baseline case, reported in Table 5, the welfare-based ranking of the various regimes remains unaltered,

Figure 10: Impulse Responses of Selected Macroeconomic Variables to an Average Natural Disaster Shock in a *Disaster-Prone* Country, under Alternative Measures of Inflation in the Monetary Policy Rule
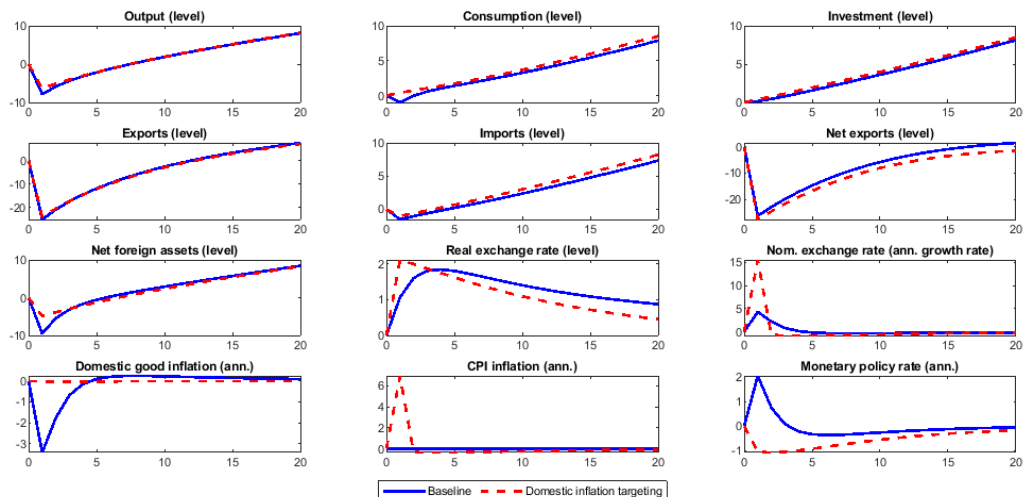
Notes: X-axes are in quarters. Y-axes are in percent deviations from the stochastic steady state. The stochastic steady state is obtained by simulating the model in the absence of shocks for 100 quarters. Bold blue lines represents an average natural disaster shock in a *disaster-prone* country, assuming that the central bank targets CPI inflation. Dashed red lines represents a natural disaster shock of the same intensity, assuming that the central bank targets domestic inflation.

with flexible inflation targeting dominating all other cases.

6.2 Excluding one Shock at a Time

Another sensitivity experiment worth conducting is switching off one shock at a time, while keeping all other shocks activated (including natural disaster shocks) and computing welfare outcomes across alternative monetary policy regimes. This exercise is meant to rule out that the results presented earlier in the paper, hinge on the presence of one specific shock. As shown in Table 7, irrespective of the shock being deactivated, the flexible inflation targeting regime continues to dominate all other regimes. The welfare ranking among the other regimes changes to an extent when the foreign interest rate shock or the TFP shock are excluded, leaving the bottom line of the analysis unaltered, i.e. that flexible inflation targeting is the welfare maximizing regime.

6.3 CPI Inflation Targeting versus Domestic Inflation Targeting

We now analyze how sensitive our results are to the measure of inflation targeted by the central bank. Specifically, we replace CPI inflation (Π_t) with domestic inflation (Π_t^H) in each

Table 7: Output and Inflation Volatilities, and Welfare Levels Associated with Alternative Monetary Policy Regimes–Excluding One Shock at a Time

Excluding the foreign inflation shock							
Monetary policy regime	γ_Π	γ_y	γ_e	Output volatility (%)	Inflation volatility (%)	Welfare level	C.E. gain w.r.t. FIT (%)
Flexible inflation targeting	1.5	0	0	2.8500	1.1384	0.4614	-
Strict inflation targeting	∞	0	0	2.8800	0.6167	0.4599	-0.3251
Hard peg	0	0	∞	3.0300	1.2721	0.4584	-0.6502
Taylor rule	1.5	0.5	0	2.9800	1.3072	0.4579	-0.7586
Exchange-rate aug. TR	1.5	0.5	0.5	2.9800	1.3122	0.4577	-0.8019
Excluding the foreign interest rate shock							
Monetary policy regime	γ_Π	γ_y	γ_e	Output volatility (%)	Inflation volatility (%)	Welfare level	C.E. gain w.r.t. FIT (%)
Flexible inflation targeting	1.5	0	0	2.6500	0.3873	0.4747	-
Strict inflation targeting	∞	0	0	2.7200	0.4519	0.4737	-0.2107
Hard peg	0	0	∞	2.9000	0.8683	0.4723	-0.5056
Taylor rule	1.5	0.5	0	2.8300	0.736	0.4714	-0.6952
Exchange-rate aug. TR	1.5	0.5	0.5	2.8400	0.7699	0.4715	-0.6741
Excluding the foreign demand shock							
Monetary policy regime	γ_Π	γ_y	γ_e	Output volatility (%)	Inflation volatility (%)	Welfare level	C.E. gain w.r.t. FIT (%)
Flexible inflation targeting	1.5	0	0	2.8500	1.1407	0.4611	-
Strict inflation targeting	∞	0	0	2.8800	0.6177	0.4597	-0.3036
Hard peg	0	0	∞	3.0500	1.2874	0.4581	-0.6506
Taylor rule	1.5	0.5	0	2.9800	1.3091	0.4576	-0.7591
Exchange-rate aug. TR	1.5	0.5	0.5	2.9800	1.3103	0.4573	-0.8241
Excluding the TFP shock							
Monetary policy regime	γ_Π	γ_y	γ_e	Output volatility (%)	Inflation volatility (%)	Welfare level	C.E. gain w.r.t. FIT (%)
Flexible inflation targeting	1.5	0	0	1.9500	1.0903	0.4918	-
Strict inflation targeting	∞	0	0	1.9900	0.4647	0.4909	-0.1830
Hard peg	0	0	∞	2.0800	1.0165	0.4911	-0.1423
Taylor rule	1.5	0.5	0	1.8500	1.0847	0.4914	-0.0813
Exchange-rate aug. TR	1.5	0.5	0.5	1.8900	1.0548	0.4912	-0.1220

Notes: Parameters γ_Π, γ_y and γ_e represent the responsiveness to inflation, output and the exchange rate, respectively, in the interest-rate rule. Output and inflation volatilities are the standard deviations of the percent fluctuations around their respective trends, simulated for 900 quarters, after running the model in the absence of shocks for 100 quarters. The welfare level is the average of the simulated recursive definition of households' welfare. The consumption-equivalent (C.E.) welfare gain represent the permanent increase in consumption (in percent) necessary to make agents as well off as in the flexible inflation targeting regime (with a minus sign representing a welfare loss).

monetary policy rule. We start by assessing the impulse responses to an average natural disaster shock in Figure 10. Relative to the baseline, where CPI inflation is targeted (blue-

Table 8: Output and Inflation Volatilities, and Welfare Levels Associated with Alternative Monetary Policy Regimes–Domestic Inflation Targeting

Monetary policy regime	γ_Π	γ_y	γ_e	Output volatility (%)	Inflation volatility (%)	Welfare level	C.E. gain w.r.t. FIT (%)
Flexible inflation targeting	1.5	0	0	2.6400	0.3592	0.4623	-
Strict inflation targeting	∞	0	0	2.5800	0.0040	0.4619	-0.0865
Hard peg	0	0	∞	3.0500	1.2862	0.4580	-0.9301
Taylor rule	1.5	0.5	0	2.7700	0.4876	0.4595	-0.6057
Exchange-rate aug. TR	1.5	0.5	0.5	2.8400	0.6675	0.4587	-0.7787

Notes: Parameters γ_Π, γ_y and γ_e represent the responsiveness to inflation, output and the exchange rate, respectively, in the interest-rate rule. Output and inflation volatilities are the standard deviations of the percent fluctuations around their respective trends, simulated for 900 quarters, after running the model in the absence of shocks for 100 quarters. The welfare level is the average of the simulated recursive definition of households' welfare. The consumption-equivalent (C.E.) welfare gain represent the permanent increase in consumption (in percent) necessary to make agents as well off as in the flexible inflation targeting regime (with a minus sign representing a welfare loss).

solid lines), targeting domestic inflation (red-dashed lines) has the obvious effect that the latter is stabilized while the former is allowed to increase. This is reflected in the opposite response of the central bank rate, which is lowered to avoid the fall in domestic inflation. The nominal exchange rate increases more than under CPI inflation targeting. However, in real terms the exchange rate appreciates only slightly more than in the baseline. As a result, net exports only marginally deteriorate but, given the monetary policy accommodation, the initial fall in output is reduced.

Next, we analyze the welfare properties of the monetary policy regimes when the central bank targets domestic inflation. Results are reported in Table 8. In general, both output and inflation volatilities are reduced while welfare level is higher, relative to targeting CPI inflation.[15] Welfare losses relative to FIT are likewise smaller, except for the case of a hard peg. Therefore, targeting domestic inflation improves welfare relative to targeting CPI inflation, which is a result consistent with Gali and Monacelli (2005). Crucially, the welfare ranking is preserved under the different measures of inflation to target, implying that FIT is still superior to the alternative monetary policy regimes.

Figure 11: Impulse Responses of Selected Macroeconomic Variables to an Average Natural Disaster Shock in a *Disaster-Prone* Country, under Inflation vs Nominal GDP Targeting
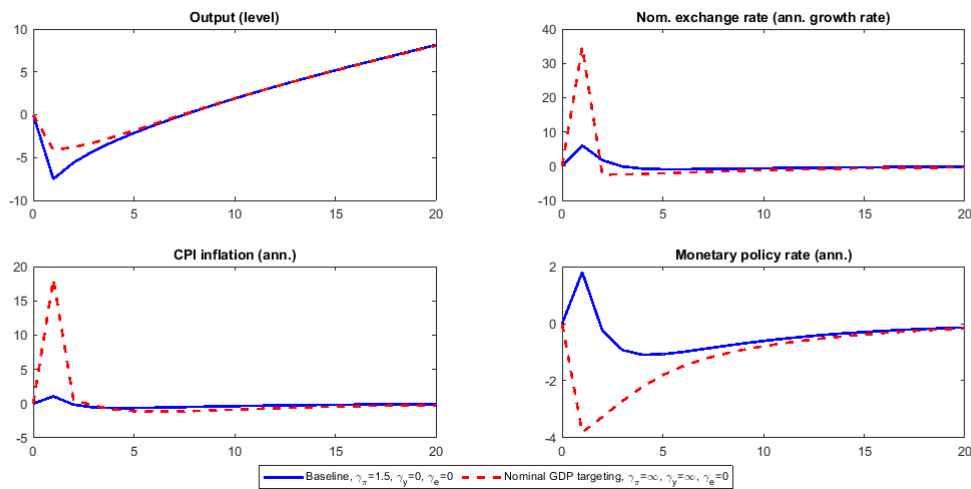
Notes: X-axes are in quarters. Y-axes are in percent deviations from the stochastic steady state. The stochastic steady state is obtained by simulating the model in the absence of shocks for 100 quarters. Bold blue lines represents the effect of an average natural disaster shock in a disaster-prone country under the baseline assumption of flexible inflation targeting. Dashed red lines the effect of an average natural disaster shock in a disaster-prone country under nominal GDP targeting.

6.4 Nominal GDP Targeting

In this subsection, we assess the properties of nominal GDP targeting (NGT). This regime has received attention in the literature on optimal monetary policy, although no central banks has yet attempted to follow such a strategy. Some studies (McCallum and Nelson, 1999, Garin et al., 2016, Bullard and Singh, 2020 and McKibbin et al., 2021, among others) argue that NGT offers several advantages relative to inflation targeting. First, by targeting the growth rate of nominal GDP, it requires knowledge of easily observable variables, instead of, e.g. the output gap. Second, it does not suffer from indeterminacy issues because, in the long run, NGT is equivalent to price level targeting, which supports a determinate equilibrium for any level of trend inflation. Third, McKibbin et al. (2021) argue that, since climate change will increase the variability of inflation and output because more supply shocks will occur due to disaster strikes, NGT can be more effective than other alternatives at stabilizing the economy. However, these contributions generally neglect the effects of NGT on exchange rate dynamics hence their results do not necessarily extend to a small-open-economy setting. Moreover, Jensen (2002) and Billi (2017) show that the desirability of NGT arises only in the

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[15]Obviously, volatilities and welfare level are unaffected in case of hard peg. However, the consumption equivalent gain changes because welfare changes in the FIT case.

Table 9: Output and Inflation Volatilities, and Welfare Levels Associated with Alternative Monetary Policy Regimes–Nomical GDP Targeting

Monetary policy regime	γ_Π	γ_y	γ_e	Output volatility (%)	Inflation volatility (%)	Welfare level	C.E. gain w.r.t. FIT (%)
Flexible inflation targeting	1.5	0	0	2.8500	1.1403	0.4611	-
Nominal GDP targeting	∞	∞	0	3.1000	1.9232	0.4486	-2.7109

Notes: Parameters γ_Π, γ_y and γ_e represent the responsiveness to inflation, output and the exchange rate, respectively, in the interest-rate rule. Output and inflation volatilities are the standard deviations of the percent fluctuations around their respective trends, simulated for 900 quarters, after running the model in the absence of shocks for 100 quarters. The welfare level is the average of the simulated recursive definition of households' welfare. The consumption-equivalent (C.E.) welfare gain represent the permanent increase in consumption (in percent) necessary to make agents as well off as in the flexible inflation targeting regime (with a minus sign representing a welfare loss).

presence of supply shocks, i.e. when the central bank faces a trade-off between stabilizing inflation and output. Since in our setting, there are both demand and supply shocks, it is worth exploring whether NGT is welfare improving relative to other regimes or not.

We follow Garin et al. (2016) in choosing an appropriate parametrization of the Taylor rule to obtain NGT:

$$\frac{R_t}{R} = \left(\frac{\Pi_t}{\bar{\bar{\Pi}}}\right)^{\gamma_\Pi} \left(\frac{\frac{y_t}{y_{t-1}}}{\exp\left(\Lambda_y\right)}\right)^{\gamma_y}, \qquad \gamma_\Pi = \infty, \ , \gamma_y = \infty. \tag{44}$$

In Figure 11, we compare the baseline flexible inflation targeting regime ($\gamma_\Pi = 1.5$, $\gamma_y = 0$, $\gamma_e = 0$) with nominal GDP targeting ($\gamma_\Pi \to \infty$, $\gamma_y \to \infty$, $\gamma_e = 0$). By targeting the growth of nominal GDP, this regime is very effective at mitigating the output collapse in the aftermath of the disaster realization. This outcome is achieved through an accommodating monetary policy, a large exchange rate depreciation and a spike in inflation, which then returns to its steady state, essentially implying a shift in the price level.

Table 9 compares welfare under the two regimes. We find that, by substantially increasing both output and inflation volatilities, NGT is suboptimal relative to FIT. One reason behind this results is that, as shown by Figure 11, NGTentails too large shifts in the exchange rate and hence of inflation.

6.5   Alternative Modeling Assumptions

Our final sensitivity checks concern specific modeling assumptions. In particular, we assess welfare under the alternative monetary policy regimes and: (i) CRRA utility function,

whereby risk aversion (γ) equals the inverse of the elasticity of intertemporal substituion ($\hat{\Psi}$) and the role of risk is dampened; (ii) more permanent or transitory effects of disasters on TFP by setting ω to 0.75 and 0.25, respectively (relative to the baseline calibration, $\omega = 0.50$); (iii) inertial interest rate rule, with a smoothing parameter $\gamma_R = 0.80$.

Table 10 reports the results under each alternative modeling assumption. The welfare ranking of monetary policy strategies carries through the various modifications hence FIT remains superior to the alternatives. However, a few remarks are in order. First, employing a CRRA utility function does not dramatically alter volatilities but increases welfare under all rules and reduces the welfare losses relative to FIT. Underestimating welfare costs of natural disasters with CRRA utility is also highlighted by Douenne (2020).[16] Consistently, since our baseline calibration of risk aversion (i.e. $\gamma = 3.8$) already likely entails underestimating the welfare effects of natural disasters on disaster-prone countries, further reducing it would probably miss much of these effects. Second, even when assuming more permanent or transitory effects of disaster shocks on TFP, the flexible inflation targeting regime is the welfare maximizing policy. Finally, adding the interest rate inertia in the monetary policy rule mostly reduces the volatility of inflation and slightly increases welfare relative to the baseline case of no-interest rate smoothing, a result in line with the literature (see, e.g., Schmitt-Grohé and Uribe, 2007). However, the welfare ranking of the various regimes remains unaltered.

7   Conclusions

In this paper we assessed the role of monetary policy in emerging and developing economies where climate-related natural disasters are a major source of macroeconomic fluctuations.

First, we conducted a narrative analysis documenting the macroeconomic effects of natural disasters, the monetary policy regimes in place, central banks' responses and IMF policy advices. This analysis shows that natural disasters are typically followed by a decline in output and often by an increase in inflation. If there is at least some degree of monetary policy independence, central banks generally change their monetary policy stance in the aftermath of disasters. While monetary policy is commonly tightened, there is a sizable number of cases in which it is accommodated. Policy appraisals and advice by IMF staff have also been mixed, possibly underscoring that while tightening is a direct consequence of

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[16]In particular, Douenne (2020) shows that lowering risk aversion to equal the inverse of the elasticity of intertemporal substituion leads to underestimate the welfare costs of natural disasters. Conversely, increasing the inverse of the elasticity of intertemporal substituion to equal risk aversion leads to conclude that natural disasters foster growth. All in all, these two parameters have empirically very different values hence Epstein-Zin preferences are more appropriate for the quantitative assessment of disasters.

Table 10: Output and Inflation Volatilities, and Welfare Levels Associated with Alternative Monetary Policy Regimes–Alternative Modeling Assumptions

CRRA utility function ($\gamma = \hat{\Psi} = 0.5$)							
Monetary policy regime	γ_Π	γ_y	γ_e	Output volatility (%)	Inflation volatility (%)	Welfare level	C.E. gain w.r.t. FIT (%)
Flexible inflation targeting	1.5	0	0	2.8300	1.1331	0.4831	-
Strict inflation targeting	∞	0	0	2.8600	0.6066	0.4823	-0.1656
Hard peg	0	0	∞	3.0300	1.2614	0.4814	-0.3519
Taylor rule	1.5	0.5	0	2.9700	1.3019	0.4807	-0.4968
Exchange-rate aug. TR	1.5	0.5	0.5	2.9600	1.2993	0.4806	-0.5175
More permanent effects of disasters on TFP ($\omega = 0.75$)							
Monetary policy regime	γ_Π	γ_y	γ_e	Output volatility (%)	Inflation volatility (%)	Welfare level	C.E. gain w.r.t. FIT (%)
Flexible inflation targeting	1.5	0	0	2.8000	1.1394	0.4622	-
Strict inflation targeting	∞	0	0	2.8300	0.6161	0.4607	-0.3245
Hard peg	0	0	∞	2.9900	1.2844	0.4591	-0.6707
Taylor rule	1.5	0.5	0	2.9300	1.3072	0.4584	-0.8222
Exchange-rate aug. TR	1.5	0.5	0.5	2.9300	1.3092	0.4583	-0.8438
More transitory effects of disasters on TFP ($\omega = 0.25$)							
Monetary policy regime	γ_Π	γ_y	γ_e	Output volatility (%)	Inflation volatility (%)	Welfare level	C.E. gain w.r.t. FIT (%)
Flexible inflation targeting	1.5	0	0	2.9100	1.1414	0.4598	-
Strict inflation targeting	∞	0	0	2.9500	0.6188	0.4584	-0.3045
Hard peg	0	0	∞	3.1100	1.2887	0.4568	-0.6525
Taylor rule	1.5	0.5	0	3.0400	1.3097	0.4564	-0.7395
Exchange-rate aug. TR	1.5	0.5	0.5	3.0500	1.3106	0.4562	-0.7829
Interest rate inertia in Taylor rule ($\gamma_R = 0.80$)							
Monetary policy regime	γ_Π	γ_y	γ_e	Output volatility (%)	Inflation volatility (%)	Welfare level	C.E. gain w.r.t. FIT (%)
Flexible inflation targeting	1.5	0	0	2.8100	0.8339	0.4622	-
Strict inflation targeting	∞	0	0	2.8900	0.6173	0.4596	-0.5625
Hard peg	0	0	∞	3.0500	1.2862	0.4580	-0.9087
Taylor rule	1.5	0.5	0	2.9700	1.0559	0.4595	-0.5842
Exchange-rate aug. TR	1.5	0.5	0.5	2.9800	1.1811	0.4592	-0.6491

Notes: Parameters γ_Π, γ_y and γ_e represent the responsiveness to inflation, output and the exchange rate, respectively, in the interest-rate rule. Output and inflation volatilities are the standard deviations of the percent fluctuations around their respective trends, simulated for 900 quarters, after running the model in the absence of shocks for 100 quarters. The welfare level is the average of the simulated recursive definition of households' welfare. The consumption-equivalent (C.E.) welfare gain represent the permanent increase in consumption (in percent) necessary to make agents as well off as in the flexible inflation targeting regime (with a minus sign representing a welfare loss).

concerns toward inflation and sharp currency movements, stimulating economic activity has

been prioritized in certain cases.

We then compared these empirical facts with simulations obtained with a small-open-economy New Keynesian model augmented with disaster shocks, in which we laid out alternative monetary policy regimes and evaluated their welfare outcomes. The model analysis demonstrates that, from a welfare standpoint, a flexible inflation targeting regime—whereby inflation can depart temporarily from target—is superior both to extreme regimes, such as strict inflation targeting or hard pegs, and to hybrid regimes in which monetary policy reacts also to output and the exchange rate, besides inflation. In other words, even in the presence of natural disaster shocks, it remains suboptimal for central banks to directly target the exchange rate or economic activity. Under flexible inflation targeting, welfare is maximized by keeping the interest rate response at the lowest level needed to keep inflation expectations anchored while minimizing the impact on real activity. These findings are consistent with existing theoretical prescriptions according to both standard New-Keynesian models (see e.g. Kollmann, 2002 and Giannoni, 2014) and models with extreme events (Keen and Pakko, 2011 and Kim and Ruge-Murcia, 2019). Moreover, they underscore the importance of reforms geared at strengthening the monetary policy transmission mechanism and the credibility of central banks.

While monetary policy is not a substitute for structural and financial climate adaptation policies, welfare losses from ill-devised monetary policy rules may be sizable and may compound with those deriving from the devastating impacts of disasters. While focusing on monetary policy, this paper abstracts from fiscal responses or donor support, which we investigated in previous research (Cantelmo et al., 2019), and does not consider monetary-fiscal policy interactions that may affect welfare, which we leave for future research.

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Appendix

A   List of Disaster-Prone Countries

Table A.1: *Disaster-Prone Countries*: Fourth Quartile (75%-100%) of the Annual Probability Distribution of Natural Disasters.

Country	Annual Probability per 1000 sq. km (%)	Damages (% of GDP) Average	Max	Small economy
Marshall Islands	100.00	2.72	2.72	Yes*
St. Vincent and the Grenadines	100.00	4.57	15.0	Yes*
Tuvalu	100.00	N.A.	N.A.	Yes*
Micronesia, Fed. Sts.	50.00	1.85	3.49	Yes*
St. Lucia	48.39	1.07	3.13	Yes*
Tonga	46.67	12.2	29.0	Yes*
Grenada	44.12	74.8	148	Yes*
Dominica	33.33	118	260	Yes*
Kiribati	24.69	N.A.	N.A.	Yes*
Maldives	16.67	N.A.	N.A.	Yes*
Comoros	10.75	0.84	0.84	Yes*
Mauritius	9.80	1.69	4.03	Yes*
Samoa	8.80	8.58	16.6	Yes*
Jamaica	5.91	1.41	8.82	No
Gambia	5.31	N.A.	N.A.	Yes**
Cabo Verde	4.96	0.07	0.07	Yes*
Fiji	4.11	1.70	12.9	Yes*
Vanuatu	4.10	30.2	60.1	Yes*
Haiti	3.60	3.69	25.1	Yes**
El Salvador	3.33	1.87	5.33	No
Macedonia, FYR	2.72	0.44	0.86	No
Burundi	2.69	0.24	0.42	Yes**
Rwanda	2.47	0.00	0.00	Yes**
Eswatini	2.30	0.00	0.00	Yes*
Belize	1.96	12.8	33.4	Yes*
Lebanon	1.91	N.A.	N.A.	No
Montenegro	1.81	N.A.	N.A.	Yes*
Dominican Republic	1.75	1.03	9.14	No
Albania	1.74	0.16	0.39	No
Solomon Islands	1.73	0.80	2.04	Yes*
Timor-Leste	1.68	N.A.	N.A.	Yes*
Costa Rica	1.57	0.21	0.67	No
Sri Lanka	1.52	0.24	1.47	No
Moldova	1.33	2.47	9.22	No

Source: Cantelmo et al. (2019).

Notes: Countries are ordered by the annual probability of a natural disaster per 1000 squared kilometers over the sample 1998-2017. EM-DAT provides damages in US dollars. Damages in percent of GDP are obtained dividing damages by GDP of the year of the event. Damages (% of GDP) are computed for each country by using data for each single event over the sample 1998-2017. Small economies comprise small states and low-income countries.*Denotes Small states which are countries with a population below 1.5 million that are not advanced economies or high-income oil exporting countries (IMF). ** Denotes Low-income-countries which are countries with a GNI per capita below $995 in 2017 (World Bank).

B Narrative Analysis Documentation

Table B.1: Narrative Analysis Documentation

Belize, 2000

#	Question	Answer	Quotes from the 2001 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Belize dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...Belize dollar, pegged to the U.S. dollar since 1976...
3	Can we characterize monetary policy as independent?	Mixed	[Belize has a soft peg with some room for independent monetary policy]
4	Did GDP contract or slowdown in the aftermath of the disaster?	N	...Real GDP growth is estimated to have increased sharply to 10.4 percent in 2000...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...Consumer prices increased by 1 percent during the year after three years of moderate deflation.
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...The Belize dollar appreciated in real effective terms by about 4 percent from end-1998 to end-2000...
7	Were there any challenges for maintaining the peg? (peg countries)	Y	...the liquidity injection through the DFC operations, increased the liquidity overhang in the economy, and created pressures in foreign exchange markets...
8	Were reserves impacted negatively?	Y	...and a similar loss of net international reserves as the central bank absorbs liquidity...
9	Was monetary policy tightened, accommodated or unchanged?	Tightened	...reduce excess liquidity to help secure the sustainability of the exchange rate peg...
10	What was the monetary policy tool authorities used?	Reduce excess liquidity	...reduce excess liquidity to help secure the sustainability of the exchange rate peg...
11	Did IMF agree with the authorities' policy action?	Y	...The staff welcomes the authorities' decision...and believes that a continuation of such a policy...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	....The staff supported the central bank's intention to reduce bank liquidity...

Belize, 2001

#	Question	Answer	Quotes from the 2002 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Belize dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...Belize dollar, pegged to the U.S. dollar since 1976...
3	Can we characterize monetary policy as independent?	Mixed	[Belize has a soft peg with some room for independent monetary policy]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...Real GDP growth declined from 11 percent in 2000 to 5 percent in 2001, as a result of several hurricanes...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...However, on the positive side, inflation remained very low at an annual rate of $1\frac{1}{4}$ percent...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...The real effective exchange rate, calculated using the official exchange rate, appreciated by about 5 percent...
7	Were there any challenges for maintaining the peg? (peg countries)	Y	...The authorities agreed that current policies were unsustainable and that policy corrections were necessary to prevent severe balance of payments difficulties and maintain the exchange rate peg...
8	Were reserves impacted negatively?	Y	...Overall, net international reserves of the CBB declined...
9	Was monetary policy tightened, accommodated or unchanged?	Accommodated	...Monetary policy has accommodated the expansionary thrust of fiscal policy with the result that a sizeable liquidity overhang accumulated...
10	What was the monetary policy tool authorities used?	Liquidity injection	...The fiscal deficit was financed from deposits at the Central Bank of Belize (CBB)...
11	Did IMF agree with the authorities' policy action?	N	...the fiscal and monetary policies were unsustainable...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...The staff also recommended a tightening of monetary policy...

Belize, 2007

#	Question	Answer	Quotes from the 2008 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Belize dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...Belize dollar, pegged to the U.S. dollar since 1976...
3	Can we characterize monetary policy as independent?	Mixed	[Belize has a soft peg with some room for independent monetary policy]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...Following an upturn in 2006, economic growth weakened in 2007, reflecting the impact of Hurricane Dean on agricultural output and tourism, closures in garment and aquaculture industries, and a leveling off in oil production...

#	Question	Answer	Quotes from the 2016 Article IV Staff Report
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...However, inflation remained low at 3 percent...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...the Belize's real exchange rate appreciated...
7	Were there any challenges for maintaining the peg? (peg countries)	N	[No reference to any challenges]
8	Were reserves impacted negatively?	N	...international reserves increased further, to US$108 million by end-2007...
9	Was monetary policy tightened, accommodated or unchanged?	Unchanged	[Monetary policy was unchanged]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy was unchanged]
11	Did IMF agree with the authorities' policy action?	Y	[Staff did not challenge the authorities' choices]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Neutral	[No mention on future monetary policy changes]

Dominica, 2015

#	Question	Answer	Quotes from the 2016 Article IV Staff Report
1	Does the country have its own legal tender?	N	[Eastern Caribbean dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...given the peg of the EC dollar...
3	Can we characterize monetary policy as independent?	N	...the monetary policy stance is decided by the Monetary Council of the ECCU...
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...Economic growth contracted by nearly 4 percent last year...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...Inflation is expected to remain low...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...real effective exchange rate (REER) appreciated by 4.8 percent...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	...unchanged peg to the U.S. dollar since 1976...
8	Were reserves impacted negatively?	N	...The ratio of international reserves to money base was 96 percent at end-2015, compared with the statutory mandate of 60 percent...
9	Was monetary policy tightened, accommodated or unchanged?	NA	[Monetary policy is not independent]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy is not independent]
11	Did IMF agree with the authorities' policy action?	NA	[Monetary policy is not independent]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	NA	[Monetary policy is not independent]

Dominica, 2017

#	Question	Answer	Quotes from the 2018 Article IV Staff Report
1	Does the country have its own legal tender?	N	[Eastern Caribbean dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...given the peg of the EC dollar...
3	Can we characterize monetary policy as independent?	N	...this issue goes beyond our authorities' direct purview given that the monetary policy stance is decided by the Monetary Council of the ECCU...
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...While Erika had caused severe damage, estimated at 96 percent of GDP...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...Sharp increases in the prices of food and medication were experienced by hurricane-struck countries...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...the real effective exchange rate (REER) depreciated in 2017...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	...unchanged peg to the U.S. dollar since 1976...
8	Were reserves impacted negatively?	Y	...reserves decreased modestly in 2017...
9	Was monetary policy tightened, accommodated or unchanged?	NA	[Monetary policy is not independent]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy is not independent]
11	Did IMF agree with the authorities' policy action?	NA	[Monetary policy is not independent]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	NA	[Monetary policy is not independent]

Dominican Republic, 1998

#	Question	Answer	Quotes from the 1999 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Dominican Peso]

#	Question	Answer	Quotes from the 1999 Article IV Staff Report
2	Is its currency pegged to some other currency or basket of currencies?	N	...flexible exchange rate policy...
3	Can we characterize monetary policy as independent?	Y	...Monetary policy is conducted through a mix of direct and indirect instruments...
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...As expected, real GDP growth slowed modestly...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...inflation rose...
6	Was there an appreciation/depreciation of the real exchange rate?	Depreciation	...5% percent depreciation of the real effective exchange rate during 1998...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[No peg]
8	Were reserves impacted negatively?	N	...International reserves rose by about US 100 million...
9	Was monetary policy tightened, accommodated or unchanged?	Accommodated	...Base money growth (12-month basis) accelerated to nearly 20 percent, mainly reflecting an accommodation...
10	What was the monetary policy tool authorities used?	Increased broad money growth rate	...Base money growth (12-month basis) accelerate by nearly 20 percent...
11	Did IMF agree with the authorities' policy action?	Neutral	...The mission suggested that the central bank rely more on indirect monetary instruments...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...Policy discussions focused on the need to ... through a tighter stance and a prudent monetary policy...

El Salvador, 1998

#	Question	Answer	Quotes from the 1999 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[El Salvador Colón]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...the present peg to the U.S. dollar will be maintained...
3	Can we characterize monetary policy as independent?	Mixed	[El Salvador has a soft peg with some room for independent monetary policy]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...Developments in 1999 point to a slowdown in real GDP growth to 2.2% percent...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...consumer prices rose by 4.2 percent (3% percent in the program) due to the impact of Hurricane Mitch...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...The colon appreciated by 2.7 percent in real effective terms...
7	Were there any challenges for maintaining the peg? (peg countries)	Y	...the sustainability of the peg over the medium term will require efforts...
8	Were reserves impacted negatively?	Y	...To reverse the reserve loss, in early November...
9	Was monetary policy tightened, accommodated or unchanged?	Tightened	...The rate of growth of broad money declined to 9% percent in 1998...
10	What was the monetary policy tool authorities used?	Decreased broad money	...The rate of growth of broad money declined...
11	Did IMF agree with the authorities' policy action?	Y	...The staff generally agreed with the authorities' strategy...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Neutral	[No mention on future monetary policy changes]

El Salvador, 2005

#	Question	Answer	Quotes from the 2006 Article IV Staff Report
1	Does the country have its own legal tender?	N	[U.S. Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	NA	...As a result, El Salvador has an exchange rate arrangement with no separate legal tender category...
3	Can we characterize monetary policy as independent?	N	...Under dollarization... lack of independent monetary policy...
4	Did GDP contract or slowdown in the aftermath of the disaster?	N	...GDP growth has started to accelerate...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...year-on-year inflation fell to $3\frac{1}{2}$ percent...
6	Was there an appreciation/depreciation of the real exchange rate?	No change	...El Salvador's real exchange rate has remained broadly stable in recent years...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[The country does not have its own legal tender]
8	Were reserves impacted negatively?	N	...The authorities agreed to keep the central bank's disposable foreign reserves at current levels...
9	Was monetary policy tightened, accommodated or unchanged?	NA	[Monetary policy is not independent]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy is not independent]
11	Did IMF agree with the authorities' policy action?	NA	[Monetary policy is not independent]

| 12 | What was the IMF advice on the monetary policy stance to adopt after IMF mission? | NA | [Monetary policy is not independent] |

El Salvador, 2009

#	Question	Answer	Quotes from the 2010 Article IV Staff Report
1	Does the country have its own legal tender?	N	[U.S. Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	NA	...As a result, El Salvador has an exchange rate arrangement with no separate legal tender category...
3	Can we characterize monetary policy as independent?	N	...As a result, El Salvador has an exchange rate arrangement with no separate legal tender category...
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...In the first quarter of 2010 GDP fell only 0.5 percent (y/y) after declining 4.9 percent in the last quarter of 2009...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...Prices have remained stable...
6	Was there an appreciation/depreciation of the real exchange rate?	No change	...El Salvador's real effective exchange rate (REER) has remained relatively stable...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[The country does not have its own legal tender]
8	Were reserves impacted negatively?	Y	...decrease in net international reserves ...
9	Was monetary policy tightened, accommodated or unchanged?	NA	[Monetary policy is not independent]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy is not independent]
11	Did IMF agree with the authorities' policy action?	NA	[Monetary policy is not independent]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	NA	[Monetary policy is not independent]

El Salvador, 2011

#	Question	Answer	Quotes from the 2012 Article IV Staff Report
1	Does the country have its own legal tender?	N	[U.S. Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	NA	...As a result, El Salvador has an exchange rate arrangement with no separate legal tender category...
3	Can we characterize monetary policy as independent?	N	...As a result, El Salvador has an exchange rate arrangement with no separate legal tender category...
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...El Salvador has been trapped into a risky combination of low growth...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...Inflation remained low...
6	Was there an appreciation/depreciation of the real exchange rate?	No change	...El Salvador's real effective exchange rate (REER) has remained relatively stable...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[The country does not have its own legal tender]
8	Were reserves impacted negatively?	N	...adequate level of gross international reserves...
9	Was monetary policy tightened, accommodated or unchanged?	NA	[Monetary policy is not independent]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy is not independent]
11	Did IMF agree with the authorities' policy action?	NA	[Monetary policy is not independent]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	NA	[Monetary policy is not independent]

Fiji, 2003

#	Question	Answer	Quotes from the 2004 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Fijian Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...Since April 1975, the exchange rate of the Fiji dollar has been linked to a basket of currencies of Fiji's five major trading partners...
3	Can we characterize monetary policy as independent?	Mixed	...The mission emphasized that fiscal and monetary policy must be consistent with the peg...
4	Did GDP contract or slowdown in the aftermath of the disaster?	N	...Fiji's economic growth in recent years has been high by historical standards...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...inflation remained modest...
6	Was there an appreciation/depreciation of the real exchange rate?	No change	[Negligible increase]

7	Were there any challenges for maintaining the peg? (peg countries)	Y	...an adjustment in the peg may need to be considered at some stage, in response to the large external shocks Fiji faces...
8	Were reserves impacted negatively?	Y	...International reserves have declined relative to imports...
9	Was monetary policy tightened, accommodated or unchanged?	Tightened	...The tightening of monetary policy in May 2004 was appropriate...
10	What was the monetary policy tool authorities used?	Increased interest rates	...The RBF raised interest rates by 50 basis points...
11	Did IMF agree with the authorities' policy action?	Y	...and the mission endorsed this first tightening of the monetary stance...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...A tightening of monetary policy should play a complementary role...

Fiji, 2009

#	Question	Answer	Quotes from the 2010 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Fijian Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...Since April 1975, the exchange rate of the Fiji dollar has been linked to a basket of currencies of Fiji's five major trading partners...
3	Can we characterize monetary policy as independent?	Mixed	...The mission emphasized that fiscal and monetary policy must be consistent with the peg...
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...The economy is expected to contract by $2\frac{1}{2}$ percent in 2009...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...inflation did not rise substantially as a result of the devaluation...
6	Was there an appreciation/depreciation of the real exchange rate?	No change	...The real effective exchange rate has remained stable...
7	Were there any challenges for maintaining the peg? (peg countries)	Y	[No reference to any challenges]
8	Were reserves impacted negatively?	Y	...As a result, foreign reserves fell to low levels...
9	Was monetary policy tightened, accommodated or unchanged?	Unchanged	[No reference to any monetary policy instruments mobilized]
10	What was the monetary policy tool authorities used?	NA	[No reference to any monetary policy instruments mobilized]
11	Did IMF agree with the authorities' policy action?	Y	[Staff did not challenge the authorities' choices]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...Staff and the authorities agreed that monetary policy should be tightened...

Fiji, 2010

#	Question	Answer	Quotes from the 2011 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Fijian Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...Since April 1975, the exchange rate of the Fiji dollar has been linked to a basket of currencies of Fiji's five major trading partners...
3	Can we characterize monetary policy as independent?	Mixed	...The mission emphasized that fiscal and monetary policy must be consistent with the peg...
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...Fiji's economy contracted by 3 percent...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...contributed to low inflation...
6	Was there an appreciation/depreciation of the real exchange rate?	No change	...The real effective exchange rate has remained stable...
7	Were there any challenges for maintaining the peg? (peg countries)	N	[No reference to any challenges]
8	Were reserves impacted negatively?	N	...Foreign exchange reserves have improved steadily...
9	Was monetary policy tightened, accommodated or unchanged?	Accommodated	...Staff did not object to the RBF's accommodative monetary policy...
10	What was the monetary policy tool authorities used?	Decreased policy rates	...accommodative monetary stance as broadly appropriate. Given the structural lack of credit demand and the weak transmission mechanism, the effectiveness of low policy rates may nevertheless...
11	Did IMF agree with the authorities' policy action?	Y	...Staff did not object to the RBF's accommodative monetary policy...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...Monetary policy should be gradually tightened...

Fiji, 2012

#	Question	Answer	Quotes from the 2013 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Fijian Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...Since April 1975, the exchange rate of the Fiji dollar has been linked to a basket of currencies of Fiji's five major trading partners...

#	Question	Answer	Quotes from the 2017 Article IV Staff Report
3	Can we characterize monetary policy as independent?	Mixed	...The mission emphasized that fiscal and monetary policy must be consistent with the peg...
4	Did GDP contract or slowdown in the aftermath of the disaster?	N	...helping the economy expand by 2.2 percent, despite the negative impact from Cyclone Evan and the massive floods...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...inflation was on a declining trend in 2012 reaching 2.5 percent (new 2008 base) by year end. In September 2013, inflation was 3.1 percent...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...The slow appreciation of the real exchange rate has continued...
7	Were there any challenges for maintaining the peg? (peg countries)	N	[No reference to any challenges]
8	Were reserves impacted negatively?	N	...and international reserves have stabilized to a comfortable level...
9	Was monetary policy tightened, accommodated or unchanged?	Accommodated	...The authorities have maintained an accommodative monetary policy...
10	What was the monetary policy tool authorities used?	Decreased interest rates	...Low interest rates and the one-time payouts under The FNPF reform were the main drivers for growth...
11	Did IMF agree with the authorities' policy action?	Y	...Directors saw the accommodative monetary policy as appropriate...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...the RBF should use open market operations more aggressively to reduce excess liquidity and, if necessary, tighten policy rates...

Fiji, 2016

#	Question	Answer	Quotes from the 2017 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Fijian Dollar]
2	IIs its currency pegged to some other currency or basket of currencies?	Y	...Since April 1975, the exchange rate of the Fiji dollar has been linked to a basket of currencies of Fiji's five major trading partners...
3	Can we characterize monetary policy as independent?	Mixed	...The mission emphasized that fiscal and monetary policy must be consistent with the peg...
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...GDP growth is estimated to have rebounded to 3.8 percent in 2017 from 0.4 percent in 2016...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...Directors noted that the pickup in headline inflation...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...In 2016, NEER and REER appreciated...
7	Were there any challenges for maintaining the peg? (peg countries)	N	[No reference to any challenges]
8	Were reserves impacted negatively?	Y	...but foreign reserves remained adequate...
9	Was monetary policy tightened, accommodated or unchanged?	Accommodated	...Monetary policy remains accommodative...
10	What was the monetary policy tool authorities used?	Decreased interest rates	...The combination of lower lending interest rates and...
11	Did IMF agree with the authorities' policy action?	Y	...Maintaining an accommodative monetary policy stance was appropriate in the aftermath of Cyclone Winston...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...Monetary policy should be tightened as the recovery becomes firmer...

Grenada, 1999

#	Question	Answer	Quotes from the 2000 Article IV Staff Report
1	Does the country have its own legal tender?	N	[Eastern Caribbean dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...the Eastern Caribbean dollar, that has been pegged to the U.S. dollar...
3	Can we characterize monetary policy as independent?	N	...The ECCU has a common central bank, the Eastern Caribbean Central Bank (ECCB)...
4	Did GDP contract or slowdown in the aftermath of the disaster?	N	...reflecting the rapid growth in activity, the average per capita income rose...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...by a reduction in unemployment and low inflation...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...The real effective value of the Eastern Caribbean dollar calculated for Grenada has appreciated...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	...unchanged peg to the U.S. dollar since 1976...
8	Were reserves impacted negatively?	N	...international reserves of Grenada in the ECCB would be maintained...
9	Was monetary policy tightened, accommodated or unchanged?	NA	[Monetary policy is not independent]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy is not independent]
11	Did IMF agree with the authorities' policy action?	NA	[Monetary policy is not independent]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	NA	[Monetary policy is not independent]

Grenada, 2004

#	Question	Answer	Quotes from the 2005 Article IV Staff Report
1	Does the country have its own legal tender?	N	[Eastern Caribbean dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...the Eastern Caribbean dollar, that has been pegged to the U.S. dollar...
3	Can we characterize monetary policy as independent?	N	...The ECCU has a common central bank, the Eastern Caribbean Central Bank (ECCB)...
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...The economy contracted by 3 percent in 2004...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...Inflation has remained low...
6	Was there an appreciation/depreciation of the real exchange rate?	Depreciation	...real effective exchange rate (REER) has depreciated ...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	...unchanged peg to the U.S. dollar since 1976...
8	Were reserves impacted negatively?	N	...Gross international reserves of the Eastern Caribbean Central Bank (ECCB) have continued to rise...
9	Was monetary policy tightened, accommodated or unchanged?	NA	[Monetary policy is not independent]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy is not independent]
11	Did IMF agree with the authorities' policy action?	NA	[Monetary policy is not independent]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	NA	[Monetary policy is not independent]

Haiti, 1998

#	Question	Answer	Quotes from the 1999 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Haitian Gourde]
2	Is its currency pegged to some other currency or basket of currencies?	N	...It is generally agreed that a flexible exchange rate is appropriate...
3	Can we characterize monetary policy as independent?	Y	[The country has its own legal tender that features no peg]
4	Did GDP contract or slowdown in the aftermath of the disaster?	N	...Haitian authorities have managed to maintain macroeconomic stability...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...Inflation declined...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...the gourde appreciated by about $3\frac{1}{2}$ percent with respect to the U.S. dollar and by about $9\frac{1}{2}$ percent in real effective terms...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[No peg]
8	Were reserves impacted negatively?	N	...official reserves have risen...
9	Was monetary policy tightened, accommodated or unchanged?	Tightened	...The authorities have persevered with prudent monetary and fiscal policy...
10	What was the monetary policy tool authorities used?	Decreased broad money growth rate	...use open market operations to control the money supply...
11	Did IMF agree with the authorities' policy action?	Y	...On monetary policy, Directors welcomed the authorities' intention...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...Monetary policy will continue to focus on controlling inflation...

Haiti, 2004

#	Question	Answer	Quotes from the 2005 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Haitian Gourde]
2	Is its currency pegged to some other currency or basket of currencies?	N	...It is generally agreed that a flexible exchange rate is appropriate...
3	Can we characterize monetary policy as independent?	Y	[The country has its own legal tender that features no peg]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...The property damage and the interruption to economic activity are estimated to have totaled $5\frac{1}{2}$ percent of GDP...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...prices have been highly volatile on a month-to-month basis, as a result of supply disruptions caused by the September 2004 floods...
6	Was there an appreciation/depreciation of the real exchange rate?	Depreciation	...Also, since mid-2004 both nominal and real exchange rates have depreciated...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[No peg]
8	Were reserves impacted negatively?	N	...and net international reserves have increased...
9	Was monetary policy tightened, accommodated or unchanged?	Accommodated	...During August–October 2004, interest rates were reduced to 7.6 percent from 13.6 percent...

#	Question	Answer	Quotes from the 2012 Article IV Staff Report
10	What was the monetary policy tool authorities used?	Decreased interest rates	...During August–October 2004, interest rates were reduced to 7.6 percent from 13.6 percent...
11	Did IMF agree with the authorities' policy action?	N	...Directors expressed concern...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...Monetary policy needs to be tightened...

Haiti, 2012

#	Question	Answer	Quotes from the 2012 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Haitian Gourde]
2	Is its currency pegged to some other currency or basket of currencies?	N	...It is generally agreed that a flexible exchange rate is appropriate...
3	Can we characterize monetary policy as independent?	Y	[The country has its own legal tender that features no peg]
4	Did GDP contract or slowdown in the aftermath of the disaster?	N	...GDP continued to grow, albeit modestly, in per capita terms...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...Inflation spiked but remained at single digits...
6	Was there an appreciation/depreciation of the real exchange rate?	No change	...Haiti's real effective exchange rate (REER) has remained broadly stable...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[No peg]
8	Were reserves impacted negatively?	N	...Gross liquid international reserves were considerably strengthened...
9	Was monetary policy tightened, accommodated or unchanged?	Unchanged	..Directors endorsed the current neutral stance of monetary policy...
10	What was the monetary policy tool authorities used?	NA	..Directors endorsed the current neutral stance of monetary policy...
11	Did IMF agree with the authorities' policy action?	Y	...Directors endorsed the current neutral stance of monetary policy...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...endorsed the current neutral stance of monetary policy but encouraged the authorities to keep price inflation in check...

Jamaica, 2004

#	Question	Answer	Quotes from the 2005 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Jamaican Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	N	[No peg]
3	Can we characterize monetary policy as independent?	Y	[The country has its own legal tender that features no peg]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...Real GDP contracted sharply in late 2004 following the devastating effects of Hurricane Ivan....
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...Consumer prices registered a marked increase in the aftermath of Hurricane Ivan...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...In real effective terms, however, given the high inflation, the Jamaican dollar appreciated by 9 percent...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[No peg]
8	Were reserves impacted negatively?	N	...net international reserves (NIR) increased rapidly...
9	Was monetary policy tightened, accommodated or unchanged?	Tightened	...Monetary policy has been geared at containing inflation...
10	What was the monetary policy tool authorities used?	Increased interest rates	...moderate increases in domestic interest rates...
11	Did IMF agree with the authorities' policy action?	Y	[No reference to disagreement]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...Directors emphasized the need for careful conduct of monetary and exchange rate policies in the period ahead...

Jamaica, 2007

#	Question	Answer	Quotes from the 2008 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Jamaican Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	N	[No peg]
3	Can we characterize monetary policy as independent?	Y	[The country has its own legal tender that features no peg]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...Economic growth weakened...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...inflation accelerated...
6	Was there an appreciation/depreciation of the real exchange rate?	No change	...The current level of the real effective exchange rate (REER) in Jamaica is broadly in line with fundamentals...

7	Were there any challenges for maintaining the peg? (peg countries)	NA	[No peg]
8	Were reserves impacted negatively?	Y	...to stem reserve losses...
9	Was monetary policy tightened, accommodated or unchanged?	Tightened	....Tighten monetary policy moderately...
10	What was the monetary policy tool authorities used?	Increased interest rates	...increases in interest rates...
11	Did IMF agree with the authorities' policy action?	Y	...Directors commended the authorities' commitment...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...Directors were of the view that a further moderate rise in interest rates might be needed to alleviate inflationary . pressures and stem capital outflows...

Jamaica, 2010

#	Question	Answer	Quotes from the 2011 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Jamaican Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	N	[No peg]
3	Can we characterize monetary policy as independent?	Y	[The country has its own legal tender that features no peg]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...rebounded from the destruction of tropical storm Nicole in 2010...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...contributed to a fall in 12- month inflation...
6	Was there an appreciation/depreciation of the real exchange rate?	Depreciation	...to a depreciation of the currency in real effective terms...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[No peg]
8	Were reserves impacted negatively?	Y	...Net international reserves fell...
9	Was monetary policy tightened, accommodated or unchanged?	Accommodated	...the central bank lowered the policy rate to 6.25 percent...
10	What was the monetary policy tool authorities used?	Decreased interest rates	...the central bank lowered the policy rate to 6.25 percent...
11	Did IMF agree with the authorities' policy action?	Neutral	[Staff did not challenge the authorities' choices]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Neutral	[No mention on future monetary policy changes]

Marshall Islands, 2015

#	Question	Answer	Quotes from the 2016 Article IV Staff Report
1	Does the country have its own legal tender?	N	[U.S. Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...The U.S. dollar is used as the legal tender...
3	Can we characterize monetary policy as independent?	N	[Does not have its own legal tender]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...overcoming the contraction of the previous year...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...a moderate inflation of 1.1 percent...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...The real exchange rate so far in FY2016 is 7 percent above the historical average...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[Does not have its own legal tender]
8	Were reserves impacted negatively?	N	[No reference to negative impact]
9	Was monetary policy tightened, accommodated or unchanged?	NA	[Monetary policy is not independent]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy is not independent]
11	Did IMF agree with the authorities' policy action?	NA	[Monetary policy is not independent]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	NA	[Monetary policy is not independent]

Mauritius, 2002

#	Question	Answer	Quotes from the 2003 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Mauritian Rupee]
2	Is its currency pegged to some other currency or basket of currencies?	N	[No peg]
3	Can we characterize monetary policy as independent?	Y	[The country has its own legal tender that features no peg]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...real GDP growth is expected to slow in 2002/03...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...Consumer price inflation has recently shown a declining trend...

#	Question	Answer	Quotes from the 2017 Article IV Staff Report
6	Was there an appreciation/depreciation of the real exchange rate?	No change	...the real effective exchange rate has remained relatively stable...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[No peg]
8	Were reserves impacted negatively?	N	...the net international reserves of the central bank increased...
9	Was monetary policy tightened, accommodated or unchanged?	Tightened	...Monetary policy was tightened in 2002/03...
10	What was the monetary policy tool authorities used?	Increased interest rates	...monitor liquidity conditions carefully before reducing interest rates...
11	Did IMF agree with the authorities' policy action?	Y	...Directors agreed that monetary policy in Mauritius is appropriately tight..
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...the staff discussed the importance of maintaining prudent monetary and exchange rate policies...

Micronesia, Fed. States of, 2015

#	Question	Answer	Quotes from the 2017 Article IV Staff Report
1	Does the country have its own legal tender?	N	[U.S. Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	NA	...U.S. dollars, the legal tender and official currency in the FSM...
3	Can we characterize monetary policy as independent?	N	[Does not have its own legal tender]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...Real GDP is estimated to have grown by 3.0 percent in 2016 (after 3.7 percent in 2015)....
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...Inflation is expected to remain low...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...The real effective rate appreciated by 5 percent...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	...U.S. dollars, the legal tender and official currency in the FSM...
8	Were reserves impacted negatively?	N	...The ratio of international reserves to money base was 96 percent at end-2015, compared with the statutory mandate of 60 percent...
9	Was monetary policy tightened, accommodated or unchanged?	NA	[Monetary policy is not independent]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy is not independent]
11	Did IMF agree with the authorities' policy action?	NA	[Monetary policy is not independent]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	NA	[Monetary policy is not independent]

Moldova, 2000

#	Question	Answer	Quotes from the 2001 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Moldovan Leu]
2	Is its currency pegged to some other currency or basket of currencies?	N	...fully floating exchange rate...
3	Can we characterize monetary policy as independent?	Y	[The country has its own legal tender that features no peg]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...real GDP is expected to remain flat in 2000...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...In 2000 inflation was much lower...
6	Was there an appreciation/depreciation of the real exchange rate?	Appreciation	...caused the leu exchange rate to appreciate...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[No peg]
8	Were reserves impacted negatively?	N	...Reserves increased to US$181 million...
9	Was monetary policy tightened, accommodated or unchanged?	Tightened	...Monetary policy was successfully tightened in the first half of 2000...
10	What was the monetary policy tool authorities used?	Increased interest rates	...reverse the downward trend in interest rates...
11	Did IMF agree with the authorities' policy action?	Y	...Monetary policy was successfully tightened in the first half of 2000...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	....disciplined monetary policy...

Moldova, 2007

#	Question	Answer	Quotes from the 2007 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Moldovan Leu]
2	Is its currency pegged to some other currency or basket of currencies?	N	...fully floating exchange rate...
3	Can we characterize monetary policy as independent?	Y	[The country has its own legal tender that features no peg]

4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...The economy grew strongly in the first half of 2007, but slowed somewhat in the second half due to...the summer drought....
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...inflation continues to be stubbornly in double digits...
6	Was there an appreciation/depreciation of the real exchange rate?	No Change	...but the exchange rate remains broadly in line with fundamentals....
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[No peg]
8	Were reserves impacted negatively?	N	...The build-up of reserves at the end of the year exceeded US$ 1.3 billion which was well above what was projected under the program...
9	Was monetary policy tightened, accommodated or unchanged?	Tightened	....Despite the tightening up early in the year, reserve money continued o grow which prompted the central bank to raise reserve requirements...
10	What was the monetary policy tool authorities used?	Increased interest rates	...and raised policy interest rates by 2.5 percentage points...
11	Did IMF agree with the authorities' policy action?	Y	...The authorities and staff agreed that monetary policy should remain tight until disinflation is firmly reestablished....
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...The authorities and staff agreed that monetary policy should remain tight until disinflation is firmly reestablished....

Samoa, 2012

#	Question	Answer	Quotes from the 2015 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Samoan Tala]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...The exchange rate of the tala is pegged to a basket of currencies...
3	Can we characterize monetary policy as independent?	Mixed	[Samoa has a soft peg with some room for independent monetary policy]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...Growth is recovering gradually from natural disasters...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...and inflation remains subdued...
6	Was there an appreciation/depreciation of the real exchange rate?	No change	...The exchange rate has remained stable...
7	Were there any challenges for maintaining the peg? (peg countries)	N	...pegged against a basket of major trading partner currencies, has remained broadly stable...
8	Were reserves impacted negatively?	N	...reserves are adequate...
9	Was monetary policy tightened, accommodated or unchanged?	Accommodated	... A loose monetary policy has supported the recovery...
10	What was the monetary policy tool authorities used?	Decrease interest rates	...lower interest rates...
11	Did IMF agree with the authorities' policy action?	Y	...monetary policy is appropriate...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...stressed that the central bank should stand ready to adopt a tightening stance...

Solomon Islands, 2014

#	Question	Answer	Quotes from the 2016 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Solomon Island Dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...The basket exchange rate regime is operating well...
3	Can we characterize monetary policy as independent?	Mixed	[Solomon Islands have a soft peg with some room for independent monetary policy]
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	.... The impact of Cyclone Raquel and El Niño has caused a reduction in agricultural production...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...There was a return to low inflation...
6	Was there an appreciation/depreciation of the real exchange rate?	No change	.... In real effective terms, the exchange rate has been stable...
7	Were there any challenges for maintaining the peg? (peg countries)	N	[No reference to any challenges]
8	Were reserves impacted negatively?	Y	...FX reserves could diminish in the future and should not divert attention...
9	Was monetary policy tightened, accommodated or unchanged?	Accommodated	...Monetary policy remains accommodative...
10	What was the monetary policy tool authorities used?	NA	[no reference to a specific instrument, just the reference above]
11	Did IMF agree with the authorities' policy action?	Y	...Directors considered the current monetary policy stance to be appropriate...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Accommodate	...Directors considered the current monetary policy stance to be appropriate...

Sri Lanka, 2016

#	Question	Answer	Quotes from the 2017 Article IV Staff Report
1	Does the country have its own legal tender?	Y	[Sri Lankan Rupee]
2	Is its currency pegged to some other currency or basket of currencies?	N	[No peg]
3	Can we characterize monetary policy as independent?	Y	[The country has its own legal tender that features no peg]
4	Did GDP contract or slowdown in the aftermath of the disaster?	N	...Growth has held up despite severe weather...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...inflation has picked up...
6	Was there an appreciation/depreciation of the real exchange rate?	Depreciation	...The rupee depreciated...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	[No peg]
8	Were reserves impacted negatively?	Y	...international reserves hit their bottom...
9	Was monetary policy tightened, accommodated or unchanged?	Tightened	...the Central Bank of Sri Lanka (CBSL) raised the policy rate by 25 basis points...
10	What was the monetary policy tool authorities used?	Increased interest rates	...the Central Bank of Sri Lanka (CBSL) raised the policy rate by 25 basis points...
11	Did IMF agree with the authorities' policy action?	Y	...Monetary policy should be tightened further...
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	Tighten	...Monetary policy should be tightened further...

St. Vincent and the Grenadines, 2002

#	Question	Answer	Quotes from the 2002 Article IV Staff Report
1	Does the country have its own legal tender?	N	[Eastern Caribbean dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...EC dollar pegged to the U.S. dollar...
3	Can we characterize monetary policy as independent?	N	...St. Vincent and the Grenadines (VCT) is a member of the Eastern Caribbean Currency Union (ECCU) with a common currency, the EC dollar...
4	Did GDP contract or slowdown in the aftermath of the disaster?	N	...slight pick up in real GDP growth to about 1 percent...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...low inflation and exchange rate stability...
6	Was there an appreciation/depreciation of the real exchange rate?	No change	...low inflation and exchange rate stability...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	...unchanged peg to the U.S. dollar since 1976...
8	Were reserves impacted negatively?	N	...in the increase in excess reserves...
9	Was monetary policy tightened, accommodated or unchanged?	NA	[Monetary policy is not independent]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy is not independent]
11	Did IMF agree with the authorities' policy action?	NA	[Monetary policy is not independent]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	NA	[Monetary policy is not independent]

St. Vincent and the Grenadines, 2010

#	Question	Answer	Quotes from the 2011 Article IV Staff Report
1	Does the country have its own legal tender?	N	[Eastern Caribbean dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...Caribbean Currency Union (ECCU) with a common currency, the EC dollar...EC dollar (pegged to the U.S. dollar...
3	Can we characterize monetary policy as independent?	N	...St. Vincent and the Grenadines (VCT) is a member of the Eastern Caribbean Currency Union (ECCU) with a common currency, the EC dollar...
4	Did GDP contract or slowdown in the aftermath of the disaster?	Y	...As a result, real GDP contracted by a cumulative 4.7 percent since 2007 and is expected to remain slightly negative this year...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	Y	...Inflation has picked up ...
6	Was there an appreciation/depreciation of the real exchange rate?	Depreciation	...Real effective exchange rate depreciation...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	...unchanged peg to the U.S. dollar since 1976...
8	Were reserves impacted negatively?	N	...in the increase in excess reserves...
9	Was monetary policy tightened, accommodated or unchanged?	NA	[Monetary policy is not independent]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy is not independent]

| 11 | Did IMF agree with the authorities' policy action? | NA | [Monetary policy is not independent] |
| 12 | What was the IMF advice on the monetary policy stance to adopt after IMF mission? | NA | [Monetary policy is not independent] |

St. Vincent and the Grenadines, 2013

#	Question	Answer	Quotes from the 2014 Article IV Staff Report
1	Does the country have its own legal tender?	N	[Eastern Caribbean dollar]
2	Is its currency pegged to some other currency or basket of currencies?	Y	...Caribbean Currency Union (ECCU) with a common currency, the EC dollar...EC dollar (pegged to the U.S. dollar...
3	Can we characterize monetary policy as independent?	N	...St. Vincent and the Grenadines (VCT) is a member of the Eastern Caribbean Currency Union (ECCU) with a common currency, the EC dollar...
4	Did GDP contract or slowdown in the aftermath of the disaster?	N	...modest recovery that had brought growth to 2.4 percent in 2013...
5	Did inflation increase (or was it expected to increase) in the aftermath of the disaster?	N	...Average inflation is estimated to have fallen...
6	Was there an appreciation/depreciation of the real exchange rate?	Depreciation	...Real effective exchange rate depreciation...
7	Were there any challenges for maintaining the peg? (peg countries)	NA	...unchanged peg to the U.S. dollar since 1976...
8	Were reserves impacted negatively?	N	...This indicates that the level of reserves is in general adequate...
9	Was monetary policy tightened, accommodated or unchanged?	NA	[Monetary policy is not independent]
10	What was the monetary policy tool authorities used?	NA	[Monetary policy is not independent]
11	Did IMF agree with the authorities' policy action?	NA	[Monetary policy is not independent]
12	What was the IMF advice on the monetary policy stance to adopt after IMF mission?	NA	[Monetary policy is not independent]

Note: Authors' comments are provided in square brackets.

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