Financial Fragility Indexes for Latin American Countries

Martinez Ventura, Constanza; Cizek, Pavel; Benink, Harald

Publication date:
2024

Document Version
Early version, also known as pre-print

No. 2024-004

FINANCIAL FRAGILITY INDEXES FOR LATIN AMERICAN COUNTRIES

By

Constanza Martínez, Pavel Čížek,
Harald Benink

26 February 2024

ISSN 0924-7815
ISSN 2213-9532

Financial Fragility Indexes for Latin American Countries

Constanza Martínez [a] Pavel Čížek[b] Harald Benink [c]

Abstract

This paper studies the financial fragility of seven Latin American countries, in a period in which two global episodes hit financial markets and economies worldwide: the great financial crisis (2007-2009) and the COVID-19 shock (2020-2021). General indexes of financial fragility are constructed using the Ensemble empirical mode decomposition (EEMD) method applied to financial indicators commonly related to the health of the financial system. A fixed weights scheme is used to aggregate these indicators at the country level and by type of indicator. Our results show that the financial fragility of these countries was increasing before and during the first episode, while for the other episode it started to increase during the lockdown period, but suddenly fell in response to the measures taken by the economic authorities. The policy implications derived from this study indicate that both the full implementation of macroprudential (countercyclical) policies for bank activities and the design of a specific regulatory framework for non-bank activities will be key to guarantee a rapid recovery of economies to future financial shocks.

JEL: C52, E5, G11, G21

Keywords: financial vulnerabilities, political budget cycles, business cycles, empirical mode decomposition

---

This document reflects the views of the authors and not necessarily those of Banco de la República or Tilburg University. The authors want to thank Julia Schaumburg, Arthur van Soest, Iman van Lelyveld, Fabio Castiglionesi, and Jakob de Haan for their valuable comments and suggestions.

[a] Financial Infrastructure Oversight Department, Banco de la República, Tilburg School of Economics and Management Econometrics and Operations Research, Tilburg University amartive@banrep.gov.co [Corresponding author]

[b] Department of Econometrics and Operations Research, Tilburg School of Economics and Management, Tilburg University, P.Cizek@tilburguniversity.edu

[c] Department of Public Governance, Tilburg School of Economics and Management, Tilburg University, H.A.Benink@tilburguniversity.edu & Financial Markets Group, London School of Economics.

1. Introduction

Financial instability or fragility is commonly related to the country's vulnerability to global financial shocks and crises. There are two strands of literature that provide elements to explain this concept: the neoclassical and the post-Keynesian views. The neoclassical framework is based on rational expectations and efficient markets, where risks are known ex ante and, therefore, fragility periods are a sort of calculated events (Miller, 1991). The post-Keynesian view considers uncertainty rather than risks and focuses on irrational bubbles and euphoria.

Financial fragility emerges in countries that accumulate leverage to the point of becoming very prone to suffer a financial crisis. These vulnerabilities can arise from domestic financial conditions (i.e., credit booms and busts, and overvaluations in asset prices) or from global financial conditions triggered by developments in advanced economies. Credit booms promote economic activity, but their excessive growth can give rise to financial imbalances that may eventually lead a credit expansion to an end. Financial crises are usually preceded by credit booms, overvaluations in the asset prices used as collateral, and/or strong changes in the global financial conditions. Thus, the financial indicators most used to measure financial fragility are credit ratios and the market valuations of the asset used as collateral.

This paper examines financial fragility in seven Latin American countries (Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, and Peru), which has not been previously done in related literature. Previous works on this topic are primarily based on indexes of financial vulnerabilities obtained from traditional filtering methods like the Hodrick-Prescott filter (Kaminsky and Reinhart, 1999; Borio and Lowe, 2002), the moving average filter, and the local-level filter (Giordani and Kwan, 2019). All these studies have made use of long time series, which allowed them to obtain reliable results from these filtering methods (see Borio and Lowe 2002; Borio 2014; Borio, Disyatat and Juselius, 2017, among others). We used these methods to examine our series, but the results unveiled several statistical issues that make the estimated long-term trend biased at the end of the sample period. These statistical issues arise when these filters are implemented on short length data as is our case: we use data from the first quarter of 2005 and the third quarter 2021, which is the period when all the countries examined have information available. As shown in this paper, these filters fail to produce well-adjusted representations of the long-term trend and the cyclical component of the variable under study.

To overcome these issues and develop a framework that allows to construct a general index of financial fragility, this paper implements the Ensemble empirical mode decomposition (EEMD) method which is more powerful than traditional smoothing techniques for decomposing financial indicators as it estimates higher-frequency components of the series contrary to eliminating them as traditional methods do. This algorithm disentangles the hidden quasi-periodicity of signals and identifies all cyclical fluctuations.

In addition to the above, the EEMD method properly addresses two shortcomings that arise when traditional smoothing techniques are applied to short-term series: the endpoint problem and unexpected spikes in smoothed series. The endpoint problem occurs when the long-term trend is biased at the end of the study period, which mostly relates to the fact that it is mainly driven by the contemporaneous value of the signal. In two-sided filters this problem produces filters that become asymmetric and one-sided at the end of the sample period (Output Gap WG, 2019). Another problem that may arise from using traditional techniques on short-term series are the unexpected spikes in the smoothed series that can arise even if the original data have been seasonally adjusted (Baxter and King, 1999). The EEMD method corrects these problems and, it is therefore, superior to the former techniques for studying shorter series, as it correctly identifies long-term trends observed in data with a short span. Thus, this method facilitates estimation of financial fragility even for countries and financial series observed for shorter time periods that do not cover many business cycles.

The gains from using EEMD on long-length data may not be substantial, as we verify for the U.S ratio of total credit to GDP, for which the long-term trend and cyclical components extracted are very similar to those obtained with traditional filtering methods. However, traditional methods do not allow to decompose the series into all its cyclical components as does the EEMD method.

The study of financial fragility is conducted in a period in which two global episodes hit these countries: the great financial crisis of 2007-2009 (GFC) and the COVID-19 shock. The drivers of these episodes as well as their consequences are clearly different. The former episode was fueled by the boom and burst of house prices in the U.S. in mid-2007, a period in which banks were taking on excessive risk due to the high deregulation of financial activity (Caballero and Krishnamurthy, 2009). However, it was not until the second half of 2008 with the Lehman Brothers collapse that the GFC intensified and spread worldwide. The Latin American region

was hard hit in the third quarter of 2008. The other episode was caused by the outbreak of the COVID-19 virus, which led most governments to implement temporary lock-down measures to limit the spread of the virus. In economic terms, these confinement measures gave rise to a shock driven by supply and demand factors.

The extent to which these episodes impacted the financial fragility at the country level depends on the policy measures implemented by economic authorities to contain their negative effects on productive activities, and to some external factors such as global uncertainty. This paper provides some insights in this regard, building financial fragility indexes at the country level, by type of indicator, and for the group of countries studied. To this end, we use the financial indicators typically used to study financial fragility, like credits to the private non-financial sector, property prices, and equity prices (see, for example, Drehman, Borio, and Tsatsaronis, 2012; Borio and Lowe, 2002; Claessens Kose, and Terrones, 2011; Giordani and Kwan, 2019). As in Giordani and Kwan (2019), we use ratios of credits to consumers, mortgages, and firms to GDP, as well as real estate prices (i.e. house to rent ratio). We could not use data on stock price to earnings as these authors given that it is not available for the sample of countries studied. Instead, we used a proxy measure given by the stock market capitalization to GDP. Our fragility indexes offer a comprehensive view of the financial conditions in these countries.

This paper contributes to related literature in three ways. First, it offers a method that allows to measure financial fragility, considering the financial indicators most used to assess fragility. The EEMD method is a statistical technique that exploits all information in the series by identifying cyclical components at different frequencies and the long-term trend as residual. This method is more adequate to link and examine episodes of crises and shocks as the one we study here, especially if the observed time spans are limited to two or three decades. The EEMD method was not available a decade ago, when most studies on this issue were produced (e.g., Borio and Lowe 2002; Borio 2014; Borio, Disyatat and Juselius, 2017). Indeed, we are using it for the first time to measure financial fragility on emerging market economies with a relatively short history of data (i.e., we need still at least data covering the business cycle, which could be up to 16 years). In that sense, this paper contributes on the technical side to the empirical literature on financial fragility.

Second, this paper contributes to the literature on the causal decomposition of economic series, given that the EEMD method is not only used as a prediction tool, like previous papers did (e.g.,

Mao, Yang, Peng, and Shang, 2009; Stallone, Cicone and Materassi, 2020). We are giving further economic meaning to the signals obtained from the series decomposition, so as to identify political and business cycles from the signals extracted from the financial series. We provide an economic interpretation to the business and political cycles identified in the series, relating the occurrence of global episodes to the accumulation of financial vulnerabilities and stylized facts observed in each country.

Third, this paper contributes to the empirical literature on financial fragility by providing general indexes of fragility at the country level and by type of financial indicator that can be used as tools that could guide regulators and policymakers when they should step in to limit the contagion effects of an emerging crisis.

This paper relates to empirical studies on business and financial cycles (e.g., Borio and Lowe, 2002; Claessens, et al., 2011; Borio, 2014) and political budget cycles (e.g., Rogoff and Sibert, 1988; Rogoff, 1990; Shi and Svensson, 2006; Barberia and Avelino, 2011; Pepinsky (2007); Blaydes (2010); Brender and Drazen (2005); Shi and Svensson (2006), among others). The relationship between traditional financial indicators (e.g., credit ratios and stock markets and real estate prices), political budget cycles, and economic activity have been largely overlooked in the related literature. This paper fills that gap by extracting the common components of the financial indicators most used to identify financial cycles, which we use to study financial fragility and political budget and business cycles. To this aim we exploit the links between financial indicators, macroeconomic variables, and election periods.

This study leaves us two lessons. First, the drivers of the crisis and shock examined are key to understand their effects on financial fragility. Our results show that financial fragility was increasing before the GFC, which is consistent with a crisis generated by financial causes. The increased level of fragility only started to decline when the economic measures started to work in 2009, when the first signs of recovery appeared in these countries. However, the financial indicators worsened when the second-round effects impacted these economies. Unlike the GFC, the COVID-19 shock was not preceded by an increasing fragility, which coincides with the fact that this shock was not of an economic or financial nature. The second lesson that this study leaves us is that the timely reaction of economic authorities to crises and shocks is key to limit its negative effects on the financial system and economic activities.

The policy implications derived from the occurrence of these episodes point in two directions. One relates to the rapid reaction of most central banks of the region which rapidly introduced unconventional measures to face the GFC, mainly directed to expand the amount of liquidity in financial markets and the economy. Macroprudential policies can also help to shield financial markets from local and global episodes. Countercyclical measures are crucial in this regard, as these could help to lessen the effects of a crisis or to stabilize the economy. The Basel III accord introduced in most countries in sample was essential to mitigate the effects of the COVID-19 shock on these economies. The other direction points to the necessity to consider the design and implementation of a special macroprudential policy framework for non-bank financial intermediaries (e.g., credit unions and leasing companies), like the one the central bank of Ireland is currently designing (see Maklouf, 2023). Non-bank financial intermediation has the potential to increase financial fragility, which could become a major concern for economic authorities given that these activities are not prudentially regulated.

The remainder of this paper is organized as follows. Section 2 presents a literature review on three fronts: financial fragility, political cycles, and business cycles. Section 3 explains the traditional smoothing techniques and the EEMD method. Section 4 describes data and Section 5 presents the empirical results and some policy recommendations. Finally, some concluding comments are provided at the end of the paper.

2. Literature review

As mentioned above, this paper relates to three stands of literature: financial fragility and political and business cycles. This literature review provides a general overview of the most notable work in these areas and explains how they connect with each other.

2.1. On Financial Fragility

In October 2022, the International Monetary Fund published its periodic Global Financial Stability Report under the title *Navigating the High-Inflation Environment* (IMF, 2022). In this report the term "fragility" is prominent. The IMF notes that the global environment is fragile with storm clouds on the horizon associated with monetary tightening. Financial stability risks have increased as financial vulnerabilities are elevated in the sovereign and nonbank financial

institution sectors. According to the IMF, emerging markets are confronted with a multitude of risks from the strength of the US dollar, high external borrowing costs, stubbornly high inflation, volatile commodity markets, heightened uncertainty about the global economic outlook, and pressures from policy tightening in advanced economies.

The debate on fragility goes back a long time. Hyman Minsky was one of the first authors to introduce the term *financial fragility*. Minsky (1977) discusses financial fragility as the opposite of financial robustness. In a fragile financial system continued normal functioning can be disrupted by some not unusual event. In this sense, a fragile system is more susceptible to future outbreaks of financial disorder.

The concept of fragility is closely linked to the distinction between risk and uncertainty. Knight (1921) argues that one can distinguish three types of probability, namely a priori probability, statistical probability, and estimates or judgements. The first two cases of probability are called *risk* by Knight. The third case embodies non-measurable probability and is referred to as *(true) uncertainty*.

Financial fragility in a risk/uncertainty framework

As noted by Benink (1996), the distinction between risk and uncertainty is underlying the extreme poles between theories of financial fragility inspired by neo-classical theory (risk) and those theories based upon (post-)Keynesian thinking (uncertainty).

The neo-classical framework is focusing on rational expectations and efficient markets. In a rational expectations world, economic agents know the correct and objective probability distribution, which enables them to price correctly financial assets (efficient market hypothesis). In such a world, defaults represent bad outcomes ex post, rather than systematic misperception of the true ex ante odds. The famous Nobel Prize Laureate Merton Miller can be regarded as an advocate of this view (see, for instance, Miller, 1991).

Although the financial innovation and deregulation process of the 1980s went together with a rise in debt ratios, this does not necessarily imply overleveraging. The increase in the aggregate debt/equity ratio reflects, seen from a macroeconomic perspective, changing preferences of households for holding wealth (Miller, 1988). Higher debt ratios and increased financial fragility can be considered as a rational choice of risk aware agents on financial markets. The increased

financial fragility may increase the likelihood of periods of financial disorder, but it should not be considered automatically as an undesirable thing and as a rationale for increased regulation by international supervisory authorities. If risks are known and correctly priced by market participants, then these periods of financial disorder are *unlucky, but calculated* events (Miller, 1986, 1988 and 1991).

The (post-)Keynesian framework of financial fragility is completely the opposite of the neo-classical one and focuses on irrational bubbles and euphoria. The heart of the argument lies in a different perception of the world: uncertainty instead of risk, which precludes the framework of rational expectations and efficient markets.

Minsky's so-called *financial instability hypothesis* is grounded in an alternative interpretation of Keynes' *General Theory* (see Minsky, 1975). The essential element of this interpretation is intractable uncertainty: agents base their portfolio decisions on a very imprecise and shaky foresight of future developments, so that unexpected behavior of the economy can lead to a large change in the relative prices of assets, which is the root of a financial crisis (Gatti and Gallegati 1995).

The Great Financial Crisis of 2007-2009

At a conference on *Coping with Financial Fragility and Systemic Risk* in September 1994 one of the keynote speakers was Andrew Crockett, general manager of the Bank for International Settlements. In his speech, published in a conference book in 1995, Crockett argued:

The ability of some derivative products to significantly increase the leverage of market participants may increase aggregate uncertainty. I would also conjecture that because of the fundamental lack of transparency of some financial products and the difficulty of evaluating risk associated with them, the resulting concentration in some derivatives markets creates uncertainty externalities in other closely related markets. As a result of the close cross-market linkages, the uncertainty externalities cannot easily be segmented in periods of market volatility and stress. As participants seek to shield themselves against the impact of an event whose timing or probability of occurrence cannot be estimated, markets may at times experience an erosion of liquidity possibly leading to difficulties in other markets.

Crockett spoke his words exactly 14 years before the fall of Lehman Brothers in September 2008. And, already in August 2007, the first phase of the great financial crisis emerged when banks stopped lending to each other due to concerns about potential losses, and implications

for banks' capital buffers, on portfolios of US subprime mortgage loans which had been securitized and sold on financial markets to international investors, notably in Europe.

As noted by Benink (2020), securitization, special purpose vehicles (SPVs) and investment banks within the shadow banking system contributed substantially to the crisis that came to its peak after the fall of Lehman Brothers. Policymakers in the US thought that Lehman Brothers, being an investment bank, could be allowed to fail without serious repercussions. This proved to be a mistake since Lehman was strongly interconnected with the conventional banking system as an important counterparty for hedging and trading activities, notably in the credit default swap market. Lehman's failure had important indirect effects on the banking system as well since the liquidity in money market instruments declined and even dried up in some markets. These direct and indirect connections between the shadow banking system and the conventional banking system contributed to the severity of the banking crisis, both in the US and elsewhere (Adrian, Ashcraft and Cetorelli, 2015 and European Shadow Financial Regulatory Committee, 2016).

The Great Financial Crisis of 2007-2009 clearly contains elements of overleveraging and overindebtedness, excessive risk taking, underpricing of risk, and of euphoria. It also led to a reappraisal of the work of Hyman Minsky, as noted by Martin Wolf, chief economics commentator of the Financial Times, in a column in September 2014:

The financial crises and the years of economic malaise that followed represent profound failures of the economy and of policy. Above all, they were failures of understanding. We have learnt much since. But we have not learnt enough to avoid a repeat of this painful experience. We retain unbalanced and financially fragile economies.

That was the pre-crisis "old orthodoxy". Those in charge saw little danger in the rapid growth of credit; they were largely unconcerned by rising leverage; they thought financial innovation added to rather than reduced stability; and they believed it was easier to clean up after asset-price bubbles than to prevent them from growing in the first place.

On all this they were proved wrong, as the late and disregarded Hyman Minsky had sought to warn them. Among his many insights into how financial systems actually work, as opposed to how too many economists believed they did, was his realization that stability ultimately destabilizes.

Policy failures, as noted by Wolf, are failures of understanding. But, also, politicians can make mistakes since they are prone to political cycles, as we analyze in section 2.2.

2.2. On Political cycles

Theoretical and empirical studies on political cycles examine the relationship between the political system and macroeconomic policy. Although this literature is quite extensive, it can be classified into three broad strands: the political business cycle, the partisan cycles, and the political budget cycles. We briefly review the first two and focus on the political budget cycles since these can lead to credit booms and changes in stock market returns and house prices, both in the run-up and around elections. Strategic manipulation of fiscal policy by the incumbent politician can also lead to credit cycles and asset price bubbles and busts, which jointly can increase financial fragility.

The literature on political business cycles states that if all political parties have the same information about voters' preferences, they will implement the same policies if elected (Alesina, 1987). The Nordhaus and MacRae models (Nordhaus, 1975; MacRae, 1977) are the most outstanding works in this area. In these models the key assumption is that voters assess the economy and do so in a backward looking way and predict that voters' electoral decisions are based solely on pre-election economic performance. The incumbent politician uses this information to design policies that allow him to be reelected, which give rise to the formation of political business cycles.

Partisan cycles models assume that political parties differ in the economic policies they plan to implement (due to the party's objectives and incentives) in their preferences regarding these policies. The key assumption of these models is that political parties (right- and left-wing politicians) follow policies that are in line with the interests of their constituencies and differ in their preferences regarding these policies. Governments of leftist regimes tend to prefer policies that guarantee low levels of unemployment and high levels of inflation, while parties of the center and right tend to choose the opposite configuration (Hibbs, 1977). Alesina's (1987) model additionally assumes that voters' decisions are exogenous and find two possible outcomes: the elected politician may follow his party's goals giving rise to partisan cycles, or he may cooperate by implementing policies agreed with the other party. This latter strategy is intended to improve the situation of both parties in the long run, and it does not give rise to cycles since both parties choose the same unemployment-inflation combination. However, since this is a repeated game, if one party deviates from cooperation, the other will play non-cooperatively from there on.

Models of political budget cycles rely on the key assumption that voters have rational expectations and, therefore, the manipulation that the incumbent candidate made of fiscal policies leads to the formation of cycles. In this strand of literature, Rogoff and Sibert (1988) study political budget cycles, incorporating forward-looking rational expectations to model voters' decisions as a problem of information asymmetry about the ability of the incumbent politician. They assume that the politician in power is the only one who can observe his true ability and that only the most competent will try to signal (reveal) his ability to voters by expanding fiscal policy before the electoral period. As a result, the public deficit will increase in the period prior to the elections. Rogoff (1990) extended that model assuming rational but imperfectly informed voters and an incumbent politician that will channel government spending into consumption spending because the effects of that policy are more easily observed by voters than that of public spending in infrastructure.

In this same line, Drazen (2000) combined the pre-electoral manipulation of fiscal policy with the pressures that the politician in power can exert on the central bank to accommodate the fiscal shocks (i.e., monetary policy instruments like reserves and policy rates). In Drazen's model, the economic tool used by the politician to influence voters' decisions is broad money aggregates. This assumption impedes that the model being disqualified for assuming that the incumbent controls monetary policy. Shi and Svensson (2006) address information asymmetries about the politician's skills by means of a moral hazard model that assumes that his competence level cannot be observed contemporaneously and that voters want to elect the best candidate. They find that budget deficit increases before elections, irrespective of the level of effort exerted by the politician.

Political budget cycles differ across countries (i.e., they are heterogeneous), are not of a fixed magnitude, and can vary according to contextual features like the age and level of democracy and economic development (de Haan and Klomp, 2013). These cycles are more likely to occur in countries with weaker levels of democracy and transparency (Shi and Svensson, 2000; Gonzalez, 2002; Brender and Drazen, 2005), and tend to be larger and stronger in developing economies than in developed ones.[1]

[1] de Haan and Klomp (2013) provide a comprehensive review of the literature on contextual factors.

Several studies have focused on political budget cycles in developing countries that experienced a not too far transition to democracy. Barberia and Avelino (2011) found evidence that opportunistic fiscal behavior has given rise to political budget cycles in Latin America and have been especially strong in countries considered as recent democracies (e.g., Argentina, Chile, Ecuador, Mexico, and Peru). These cycles are strongly related to high fiscal deficits and reductions in tax collection in election years. González (2002) found similar results for Mexico, where outgoing governments have made use of such strategies to win presidential elections.[2] Drazen and Eslava (2010) assume that both voters and politicians have heterogeneous preferences toward different types of public expenses, which result in incumbents trying to win support by showing closeness to voters in terms of fiscal preferences.

Political budget cycles may also arise in non-democratic regimes (e.g., dictatorships), which usually have constitutions that stipulate regular elections but lack real competition (Egorov and Sonin, 2020). In these regimes, elections are nor free, neither fair. However, dictatorships may use policy manipulations (e.g. food assistance, unemployment benefits, and social insurance benefits) during election periods to achieve political dominance, even when election results are predetermined (Han, 2022). Persson and Tabellini (2009) study these cases by developing a theoretical model of dictatorships. Higashijima (2022) examine political budget cycles in authoritarian regimes, using an empirical approach that extends traditional election variables (i.e., government spending, subsidies, increments in pensions and salaries for public servants) to include government revenues (i.e., tax reductions and exemptions). Other empirical that provide evidence of political budget cycles in non-democratic regimes include Soh (1988), Block, Ferree and Singh (2003), Pepinsky (2007), and Blaydes (2010).[3]

Another strand of literature that has considered democratic and non-democratic regimes, has also found evidence of political budget cycles (Brender and Drazen 2005; Shi and Svensson 2006; and Shmuel, 2020). In this last work, Shmuel found empirical evidence of PBCs in weak autocracies and weak democracies. That is, countries with dictatorships that have strong incentives to manipulate the economy, or with incumbent presidents that have sufficient incentives and ability to manipulate the economy.

[2] Mexico became a democracy with the presidential elections of 2000 (Barberia and Avelino, 2011).
[3] These non-democratic regimes are found in the Republic of Korea, Africa, Malaysia, and Egypt, among others.

While the formation of political budget cycles depends on voters' expectations about the economic performance, information asymmetries about the politician's skills, and contextual characteristics, the strategic management of fiscal policy for electoral purposes can end up influencing private credit as well as housing and stock prices. Indeed, countries with a limited level of development of their political institutions (i.e., legislature, judiciary, central bank independence, and the media) tend to confer more power on political connections, which can turn into special favors to their supporters. That is, preferential access to bank loans, government concessions and contracts (see Claessens, Feijen, and Laeven, 2008; Barberia and Avelino, 2011).

The empirical literature on political budget cycles has found evidence of subsidized credit expansions in election years. Incumbent politicians tend to use government-owned banks to channel more credits to households and firms (Dinç, 2005), offer low-cost credits to specific firms (Sapienza, 2004), and extend credits to specific productive sectors (Cole, 2009).[4] As these strategies are used for electoral purposes, they are designed to be rapidly visible to influence voters' decisions. Incumbent politicians can also offer subsidies on mortgages loans; and while these loans may not guarantee more votes, there is strong evidence for the United States that voters punish candidates that do not offer such subsidies (see Antoniades and Calomiris, 2020).

Politically connected firms can also obtain preferential lending (i.e., larger and low-cost credits, and enjoy a higher default rate) if the incumbent politician or his political party wins the election (Khwaja and Mian, 2005). Indeed, private firms receive subsidized credits with the commitment to expand employment before the election year in politically attractive regions (Carvalho, 2014).[5]

Political budget cycles can also arise from campaign contributions offered by private companies to candidates. In these cases, the firms that supported the winning candidate can have preferential access to bank loans during his government, as well as increases in the price of equities when the electoral result is announced. The rise in equity prices is mainly generated by the market's expectations that contributions to the electoral campaign will generate future political favors that will increase the market value of the firm (Claessens et al., 2008).

[4] In India, subsidized loans are short-term and are targeted at the agricultural sector, which is the one that concentrates most jobs (Cole, 2009).

[5] These agreements do not increase the firm's total employment, since they offer more jobs in politically attractive regions and, at the same time, reduce them in unattractive regions (Carvalho, 2014).

2.3. On Business and financial cycles

In addition to political budget cycles discussed in the previous section, this paper examines the business cycle that can be identified from the decomposition of financial indicators (see Section 5.2.4). Financial cycles are not discussed in this paper given that the short span of the data does not allow us to identify a complete cycle in the sample of countries. Nevertheless, we recognize its relevance to identify an increase in financial fragility and, therefore, its potential to anticipate financial crises.

The classical definition of business cycles, attributed to Burnes and Mitchel (1946), is based on the occurrence of expansions and contractions of economic activity. Stock and Watson (1999) extended this view by describing business cycles in terms of output deviations from an estimated long-term trend. This last approach has provided the basis for the development of most studies on business and financial cycles.

Empirical studies on business cycle fluctuations can benefit from the study of the financial cycle given that researchers and policymakers can anticipate financial distress and the emergence of financial crises by exploiting the predictive power of these cycles (see Borio 2014 and Borio et al., 2017, among many others). The business cycle is usually studied using data on the gross domestic product (GDP), while the financial cycle has been examined using credit ratios and asset prices which function as proxies of financial intermediation (see Borio and Lowe, 2002; Claessens et al., 2011). Economic activity is strongly linked to financial activities since the latter constitute a subset of the GDP.

The first studies on financial cycles considered financial indicators individually (see Dell'Ariccia, Igan, and Laeven, 2012), but after noticing that more information content could be obtained by studying the interaction between these indicators, most studies switched to methods that combined them to properly understand the build-up of financial imbalances that precede a financial crisis. Indeed, the joint effect of these indicators on the financial system is what increases the odds of facing financial vulnerabilities that can suddenly turn into crises (e.g., Borio and Drehmann, 2009; Claessens et al., 2011; Borio, 2014).

The smoothing technique most used to evaluate the output and financial indicators is the HP filter (Hodrick-Prescott, 1997), which minimizes the variable's deviations with respect to a long-term trend estimated using a preestablished smoothing parameter (see, for example, Borio et al.,

2017). The HP filter and other traditional smoothing techniques are fully explained in Section 3.1. The average length of a business cycle ranges from one to eight years, while for the financial cycle fluctuates between eight and thirty years (Drehmann, et al., 2012; Borio, 2014).

The synchronization or co-movement of business cycles across countries can be explained by several factors, such as trade relationships, economic and financial integration, and capital flows. Business cycle co-movements have been measured using correlation coefficients of business cycle indicators between countries (Massmann and Mitchell, 2004), the cohesion of the series (see Croux, Forni, and Reichlin, 2001) and the concordance index of Harding and Pagan (see de Haan, Inklaar, and Jong-A-Pin, 2008).

3. Methods used to obtain indicators of financial fragility

Many approaches characterizing financial fragility often center around the concept of the long-run equilibria of selected financial indicators (see Section 4 for their selection and discussion). Their long-run trends are often extracted from financial data using various filtering methods: for example, using the Hodrick-Prescott filter (Kaminsky and Reinhart, 1999; Borio and Lowe, 2002), using dynamic models and dynamic conditional correlations (Sensoy et al., 2014), or the local-level filter (Giordani and Kwan, 2019). These methods, discussed in detail in Section 3.1, often require long samples covering at least several political, business, or even financial cycles (e.g., see discussion in Section 3.1 and in Giordani and Kwan, 2019). If long series spanning many decades are not available, as is typically the case for many developing economies, the ability of the filtering techniques to identify the long-run trends deteriorates. This motivates the introduction of an alternative procedure based on the ensemble empirical mode decomposition in Section 3.2, which provides us a tool to detect and estimate various cycles (e.g., political or business cycles discussed in Section 2) rather than to eliminate them as the filtering techniques do. Hence, it can identify the cyclical components as well as the remaining long-term trends even in relatively short data series.

Each of the mentioned techniques facilitates estimation of the long-term trends and (cyclical) deviations from them. The trends will be detected for J financial indicators described by time series y_{jt} for $j = 1, \dots, J$. The deviations from the trends characterizing the long-run

equilibrium for J financial indicators then form the basis for measuring fragility, and after aggregation described in Section 3.3, result in the financial fragility index.

3.1. Filtering methods

Filtering techniques are used to extract unobserved components from univariate time series, such as trends and cyclical effects, which are crucial for modeling and forecasting. Most time-series filters describe a variable of interest y_{jt} in terms of a smooth trend μ_{jt} and cyclical component c_{jt} for series $j = 1, \dots, J$ and time periods $t = 1, \dots, T$. The trend component can additionally be a deterministic function of time or a stochastic one. The trend of time series can be extracted and thus separated from the cyclical component using smoothing techniques: for example, the moving-average filter, the Hodrick-Prescott filter, the Hamilton filter, and the local-level filter, described below.

3.1.1. The moving-average filter

The trend component μ_{jt} of a time series y_{jt} can be extracted by the prior moving average filter:

$$\mu_{jt} = \frac{1}{K} \sum_{k=0}^{K} a_k y_{jt-k}, \quad (1)$$

which provides a smoothed value for each $t \in \{1 + K, \dots, T\}$, where T denotes the number of observations of the original data and $K+1$ is the number of points included in the average, also known as the order of the filter. Typically, the moving-average filter assumes uniform weighting coefficients a_k at all lags, and to eliminate the cyclical component, K needs to be at least as long as the length of the longest cycle. This limits the length of the estimable trend, which lags the actual trend, and introduces various biases into estimation due to approximating the trend by a constant for K periods. This then affects the cyclical component as, in low frequency time series, the difference of the original series and the trend identifies the cyclical component.

3.1.2. The Hodrick-Prescott filter

The trend and cyclical components of a time series can also be separated using the Hodrick-Prescott (HP) filter. This filter minimizes the distance between the long-term trend μ_{jt} and the

time series y_{jt} while penalizing the variation of the trend changes by the smoothing parameter λ:

$$\min_{\mu_{jt}} \left\{ \sum_{t=1}^{T} \left(y_{jt} - \mu_{jt} \right)^2 + \lambda \sum_{t=1}^{T} \left((\mu_{jt} - \mu_{jt-1}) - (\mu_{jt-1} - \mu_{jt-2}) \right)^2 \right\}, \quad (2)$$

where λ is a positive scalar. A small value of lambda ($\lambda \to 0$) will produce a series that mimics y_{jt}, while a large value ($\lambda \to \infty$) will produce a trend linear in time *t*. The estimates of the long-term trend μ_{jt} are subject to the parameter λ predetermined by the researcher (Hodrick and Prescott, 1997), and just like in the case of the moving averages, the difference between the observed variable and the estimated trend defines the cyclical component: $y_{jt} - \mu_{jt}$. The trend smoothing parameter is usually related to the frequency of the data and the cycle length. In most studies on the business cycle with quarterly data, λ = 1,600 is usually assumed. However, as Drehmann et al. (2010) have shown, this may not work for the financial cycle that generally lasts four times the business cycle and that thus requires λ = 400,000 which corresponds to a cycle of approximately 30 years.[6] Hence its application to shorter series available for developing economies will result in almost exactly linear trends in most circumstances.

The HP filter has received various criticism, one of which relates to the fact that the mean reversion of y_{jt} requires a long sample of observations in order to properly capture the trend and long cycles. Thus for λ =400,000, any trend fitted on a sample period shorter than 30 years will be estimated with a bias, making the filtered series unstable. Another criticism has to do with the lack of penalization on the steepness of the trend: in particular, using the smoothing parameter equal to 400,000 produces a practically straight line, which indicates the trend is increasing indefinitely. Lastly, this filter may not be suitable for studying macroeconomic variables given that the smoothing parameter penalizes changes in the growth rate of the trend but not in the trend itself (see Giordani et al., 2017).[7]

[6] This adjustment in the smoothing parameter was inspired by the work of Ravn and Uhlig (2002), whose rule to define a lambda for yearly data is given by $\lambda = (1/4)^4 \times 1{,}600$. Since the data frequency used for the financial cycle is quarterly, the term in brackets corresponds to the unity, but considering a financial cycle that lasts four times the business cycle, this term goes up to 4. Thus, an average business cycle that lasts 7.5 years and corresponds to a λ = 1,600 can be used to compute an average financial cycle of 30 years that corresponds to a λ = 400,000.

[7] Some criticisms to the HP filter from the statistical point of view include: *i)* the end-points problems (unusual behavior of the cyclical components near the beginning and the end of the sample caused by the different weights applied to the growth components); *ii)* spurious dynamics in filtered values that can

3.1.3. The Hamilton filter

To eliminate some of the concerns regarding the HP filter, Hamilton (2018) proposed a model-based filter that decomposes univariate time series into a stochastic trend that is a random walk and a stationary cyclical component. As can be seen in equation (3) below, this filter relies on an OLS regression of y_{jt} on its four lags of y_{jt} that start typically with the eighth lag:

$$y_{jt} = \beta_{j0} + \beta_{j1} y_{jt-8} + \beta_{j2} y_{jt-9} + \beta_{j3} y_{jt-10} + \beta_{j4} y_{jt-11} + \nu_{jt}. \quad (3)$$

The trend component is given by the fitted values from this regression and the cyclical component by the residual term ($c_{jt} = \hat{\nu}_{jt}$). Although motivated by shortcomings of the HP filter, it shares the key disadvantages as it depends on a somewhat arbitrary choice of its parameters (e.g., the lag orders) and it induces dynamics in the estimated cycles (see Moura, 2022).

3.1.4. The local level filter

The local level filter proposed by Giordani and Kwan (2019) is conceptually similar to the HP filter (3) in that it seeks the trend μ_{jt} approximating well the time series y_{jt} in the mean-square sense, but it instead penalizes the trend variability rather the variation in the trend slope:

$$\min_{\mu_{jt}} \left\{ \sum_{t=1}^{T} \left(y_{jt} - \mu_{jt} \right)^2 + \lambda \sum_{t=1}^{T} \left(\mu_{jt} - \mu_{jt-1} \right)^2 \right\}. \quad (4)$$

The one-sided version of the local level filter can be expressed as the exponentially weighted moving average – EWMA, where the weighting coefficients decline exponentially with the lag number. Similarly to the HP filter, the smoothing constant λ depends on the cycle lengths and series frequency and the filter will reproduce y_{jt} for $\lambda \to 0$ and a constant for very large values $\lambda \to \infty$. To be able to extract the long-term trend free of shorter and longer business and financial cycles, the smoothing constant λ has to be very large – Giordani and Kwan (2019) suggest even for quarterly values λ's in the range of 2,000–8,000, effectively averaging data over more than

have no basis in the true data-generating process; identifying, as a result, non-existent cycles); *iii)* and the conflicts that implementing this filter may present with statistical foundations (see Hamilton, 2018).

one decade. Hence its application to shorter series available for developing economies will result in practically constant trends in most circumstances.

3.2. Ensemble empirical mode decomposition

An alternative approach to estimating the trend and cyclical components is based on the ensemble empirical mode decomposition (EEMD) proposed by Wu and Huang (2009), which improves upon the standard empirical mode decomposition (EMD) and remedies instability and mode-mixing of EMD (see Stallone et al., 2020). To circumvent the difficulties of the filtering techniques described in Section 3.1, the EEMD method extracts the cyclical components rather than the trend of a time series y_{jt}; see for example Mao et al. (2020) and Oladosu (2009) for applications of EEMD to macroeconomic and financial data.[8] More specifically, the data are represented as

$$y_{jt} = \sum_{k=1}^{K} c_{jt}^{k} + \mu_{jt}, \tag{5}$$

where c_{jt}^{k} represents the *k*th cyclical component and μ_{jt} is the remainder of the series after extracting all cyclical components, that is, the trend.

The reason for the decomposition of time series into multiple cyclical components c_{jt}^{k} is that EEMD proceed sequentially. It extracts first the component with the highest frequency (e.g., the seasonal variation) and removes it from the original time series. Next taking the remainder after removing the higher-frequency component, the component with a lower frequency (e.g., 4-year political cycles) is extracted and removed, and so on until the component with the lowest frequency is extracted (e.g., corresponding to business or financial cycles). The cyclical component c_{jt}^{k} is referred to as the *k*th intrinsic mode function (IMF_k). The remainder after the decomposition is the trend μ_{jt} and the cyclical component c_{jt} identified by the filtering methods described in Section 3.1 thus correspond to the sum of IMFs, $c_{jt} = c_{jt}^{1} + \ldots + c_{jt}^{K}$.

[8] As explained in Wu and Huang (2009), the steps of the EEMD decomposition can be described as follows. Firstly, create artificial observations by adding random white noise to each ith observation ($y_{it} = y_t + w_{it}$). Secondly, decompose the artificial observations (y_{it}) into IMFs. Thirdly, repeat steps 1 and 2 with different white noise series. Lastly, obtain the means of the corresponding IMFs as the final result.

The process of extraction of the cyclical components involves identifying local extrema, creating upper and lower envelopes via cubic spline interpolation, and calculating the mean of these envelopes. This process might be adversely affected by intermittent oscillations, unusual observations, or incomplete oscillation patterns at the beginning and end of the sample, all of which are leading to the mode-mixing (i.e., mixing of components with a lower and higher frequency). EEMD addresses this by adding white noise from $N(0, \sigma^2)$ distribution to the (standardized) time series. Doing this *M* times results in an ensemble of *M* time series by using M white noise realizations. Computing the decompositions of these *M* series and averaging them results in the final decomposition.

The implementation of the described EEMD algorithm thus relies on the following parameters: *i)* the ensemble size *M* that establishes the number of copies to use; *ii)* the noise strength that is the standard deviation σ of the added Gaussian noise; *iii)* the stopping criterion for the procedure that defines the maximum number of siftings (Helske and Luukko, 2021), that is, of the maximum number of possibly extracted IMF components. We perform estimation for a range of parameter values, but given the result insensitivity to their choice (see Section 5), the final results are reported for values typically used in the literature: ensemble size *M = 1000*, the noise strength $\sigma = 0.3$, and the maximum number of siftings equal to 50.

The benefit of the described EEMD decomposition for series of financial and macroeconomic data is that it estimates higher-frequency components rather than eliminating them, which is feasible even for shorter data samples. EEMD thus work more reliably for shorter time series, and additionally, provides researchers with the cyclical components at all identified frequencies, allowing them to identify the cycles that were detected (cf. Mao et al., 2020) and see which were not found due to being longer than the data as we discuss in Section 5.

The EEMD method has not been used in previous empirical studies on financial fragility, here traditional filtering methods and long time series are the norm (see Borio and Lowe 2002; Borio et al., 2017, among others). However, when the data span is short, these filters fail to produce well-adjusted representations of the long-term trend of the variable and of its cyclical component. Hence, we use this method to study financial fragility in Latin American countries, where currently the availability of financial data in quarterly frequency is below 20 years.

3.3. The aggregation method

Both traditional smoothing techniques and the proposed EEMD method described in Sections 3.1 and 3.2 estimate the trend, and more importantly, the cyclical component characterizing the difference between the actual series and the long-run trend. More specifically, for data y_{jt} on each financial indicator $j = 1, \dots, J$ (i.e., credit to consumers, mortgages, and firms to GDP, real estate prices, and the ratio of stock market capitalization to GDP), we obtain the cyclical component c_{jt} that forms the basis for constructing the financial fragility index. To define such an index, the cyclical components $c_t = (c_{1t}, \dots, c_{Jt})'$ of the abovementioned indicators have to be aggregated into a scalar index. Although this is typically achieved by taking the simple average of the standardized c_t elements (e.g., see Giordani and Kwan, 2019), this strategy is applicable only for a very small number of indicators. For a larger number of indicators, the set of their cyclical components should not be only standardized, but orthonormalized instead to account for the fact that the indicators can be correlated or measure the same underlying factors.

The aggregation method used to obtain the financial fragility indicator depends on the number of series used in the construction of the index. We assume here that the number of indicators is smaller than the number of time periods as is the case in most studies on financial fragility, and therefore, we can use the covariance standardization (in the opposite case, a dimension-reduction technique would need to be used such as the principal component analysis). The covariance standardization consists in estimating the covariance structure $S = cov(c_t)$ of the cyclical-component vector c_t, multiplying c_t (standardizing them) by the square root $\hat{S}^{-1/2}$ of the inverse of estimated $\hat{S}$, and then taking the average of the resulting uncorrelated components. This procedure produces a weighting scheme that remains fixed for the sample period. The standardization of the vector-valued independent component analysis can be applied only if the covariance matrix *S* is positive semidefinite and invertible. If *S* were singular, it would indicate that some employed indicators are linearly dependent and some of them thus do not contribute any new information and can be excluded from the analysis.

We use this transformation to add sets of multiple series (i.e. cycles or IMFs) into single indexes of financial fragility, some of which represent country-level results, other correspond to results at the level of financial indicators, and others at the region's level. This aggregation method could also be used to combine subgroups of countries.

4. Data

According to Borio (2014), the most parsimonious way to study self-reinforcing interactions between perceptions of value and risk, attitudes towards risk, and financing constraints that can translate into financial fragility (i.e., booms followed by busts) is based on credit to the private non-financial sector and property prices (e.g., Drehman et al., 2012). Other studies have additionally included equity market values in the set of asset prices (see Borio and Lowe, 2002; Giordani and Kwan, 2009; Claessens et al., 2011). The credit to the non-financial private sector is the most frequently used indicator, as it reveals how indebted firms and consumers are in a country. This level of indebtedness is measured through the ratio of the total private credit to GDP, broken down in loans for consumption, mortgages, and private corporations (Giordani and Kwan, 2019). Lending activity related to consumer loans are short term and mostly represents the acquisition of vehicles and nondurable goods and services. Loans to acquire real estate are generally long-term and usually measured with the ratio of mortgage credit to GDP. Loans to private entities and firms largely depend on the conditions under which they are granted. These credits are also measured as a percentage of GDP.

Other sources of financial vulnerability are the valuations of the assets used as collateral in private loans. One of these assets are privately owned houses and apartments, whose market valuation is measured through the ratio between the real estate price index and the rental price of residential housing obtained from the consumer price index. As regards equities, market valuations are measured with the ratio between the market capitalization and GDP.

We study these sources of fragility for Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, and Peru for the period between the first quarter of 2005 and the third quarter of 2021. To this end, we use data from the central banks, ministries of finance, supervisory agencies, national bureaus of statistics, the BIS, and the Ibero-American federation of stock exchange (see Table A.1 in the Appendix). Two important notes about these financial indicators: *i)* since all credits are stock variables, these ratios are constructed using quarterly data of loans and the annual GDP and, *ii)* due to the lack corporate credit data, these loans are calculated by subtracting the mortgage and consumer loans from the total value of credits to the non-financial private sector. As can be seen in the descriptive statistics (see Table A.2 in the Appendix), on average, consumer, mortgage, and corporate credits respectively represent 7.5%, 6.6%, and 38.0% of GDP. As for the other

indicators, it is found that the real estate markets of the countries in sample are over-valued (1.08), and that there are strong differences in the ratio of stock market capitalization to GDP across countries. In this regard, the stock markets of Ecuador (7.4%) and Argentina (12.2%) may well be considered underdeveloped which strongly contrasts with Chile (97.8%) and to a lesser extent with Brazil (52.1%), Peru (42.8%), and Colombia (42.5%). Put another way, the financial structure of Chile is more market-based, while in Ecuador and Argentina is more bank-based.

Before implementing traditional smoothing techniques and the EEMD method, all series were seasonally adjusted using the ARIMA X-11 method and standardized by subtracting the mean and dividing them by their standard deviation. This standardization ensures that the estimated trends are comparable across time and countries and that the cyclical components can be properly aggregated.

5. Empirical results

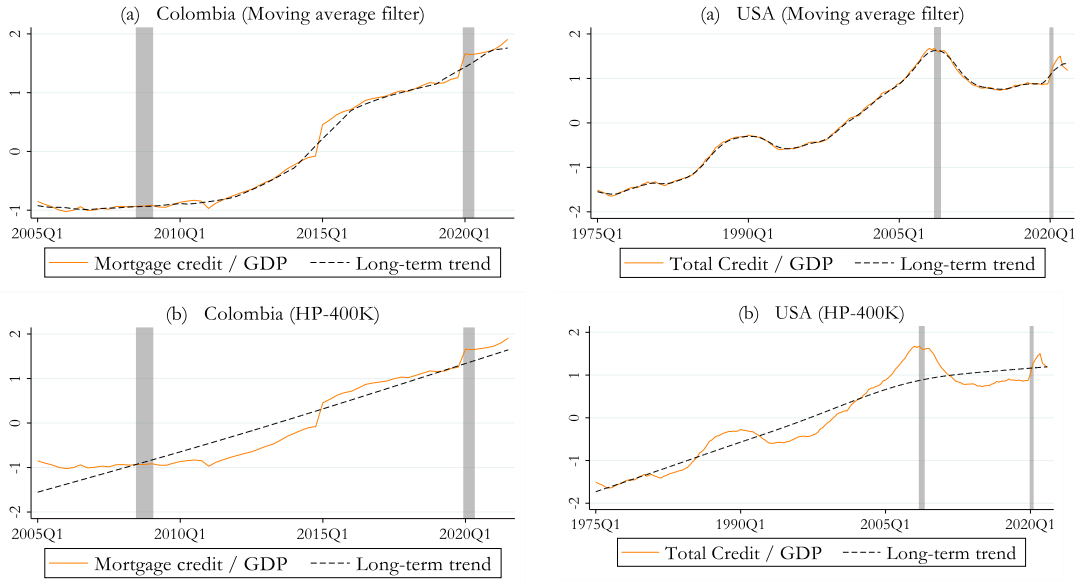
Financial fragility indicators are examined in a period with two special episodes: the GFC and the COVID-19 shock, both of which are global in nature but with drivers and consequences that differ across countries. In the remainder of the paper, these episodes are identified by gray shaded areas to facilitate the visual inspection of the financial indicators, before, during, and after each one of them. We marked the GFC between the third quarter of 2008 (when the U.S. economy entered a recessive period and Lehman Brothers filed for bankruptcy) and the first quarter of 2009 (as in March 2009 financial markets of the region showed noticeable signs of recovery (CGFS, 2010)). The COVID-19 shock was dated in the first and second quarters of 2020, when most countries implemented confinements measures.

To compare different techniques, they are used to decompose two indicators: we present the estimated long-term trends (dotted lines) for a shorter time series – the ratio of mortgage credit to GDP of Colombia observed quarterly from 2006 till 2021 – and for a long time series – the US ratio of the total credit to the non-financial private sector to GDP observed quarterly from 1975 till 2021.

For this data, the results in Figure 1 compare the following techniques. Panel (a) presents a moving-average filter that includes four lagged values, the current observation, and three forward

terms of y_t. Panel (b) shows the HP filter with a trend smoothing parameter (λ) equal to 400,000, and panel (c) the Hamilton filter.[9] Panel (d) presents the local level filter with a trend smoothing parameter δ set, as in Giordani and Kwan (2019), via the equation $0.5 = \delta^H$ that defines it as a function of the desired half-life of the process H; in this case, it equals 60 quarters. Finally, panel (e) displays the results of the proposed EEMD method using the noise strength equal to 0.3, the stopping criterion equal to 50, and the number of copies of the input signal used as an ensemble equal to 1,000; see Section 5.1 for more details.

As can be seen in Figure 1, none of the traditional smoothing methods work well with short-term series like ours.[10] On the left side of Figure 1, most traditional filters identify a long-term upward trend in the ratio of mortgage credit to GDP in Colombia. However, none of them capture well the upward convex trend exhibited by this ratio. (The same occurs with the financial indicators of the other countries of the sample, presented in Appendix B.). Specifically, the moving average and Hamilton filters mimic the short-term behavior of this credit ratio, the HP filter results in a linear trend as predicted in Section 3.1, and the local level filter delivers practically flat trend. This contrasts with the EEMD method that captures the trend by a smooth convex function approximating well the long-term credit development.



[9] Lambda's default value (1,600) was also used but the results mostly mimic the original indicators.
[10] One-sided versions of these smoothing techniques can be obtained using only the data observed in real time, while two-sided versions make use of the entire sample of observations (Giordani and Kwan, 2019).

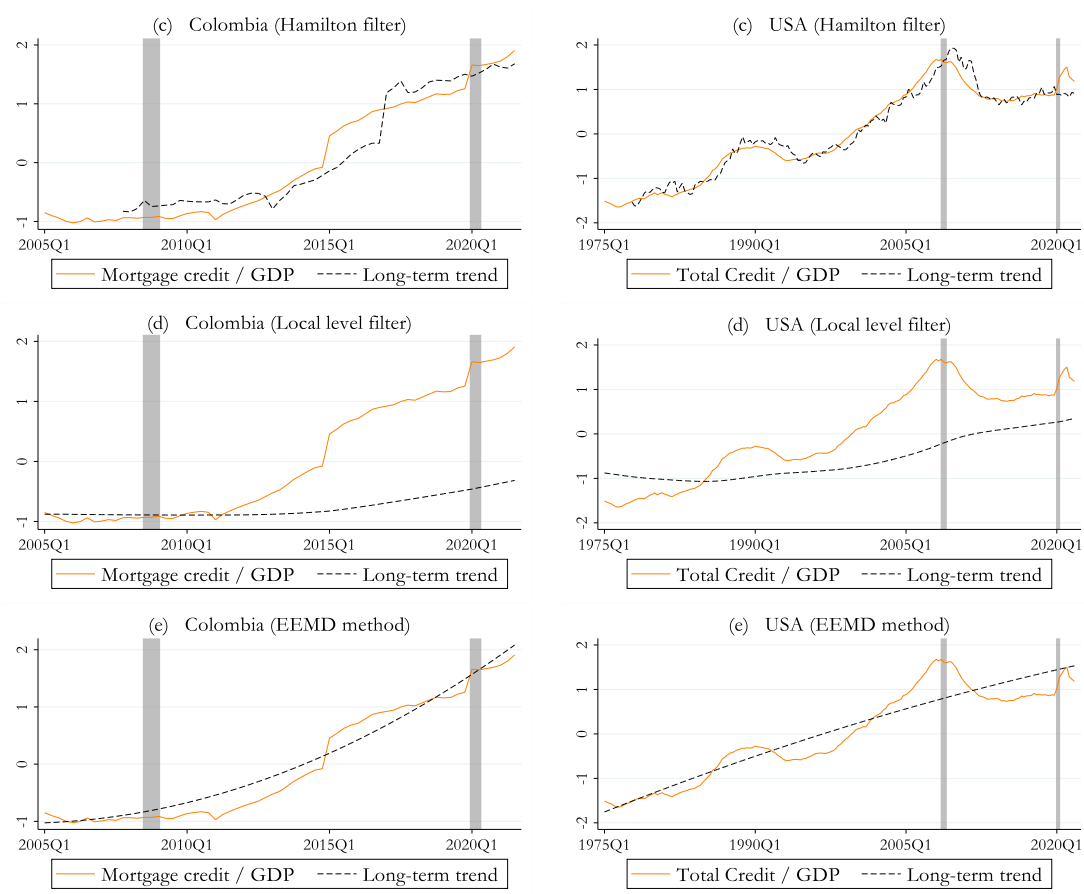


Figure 1. Traditional filters vs the EEMD method

Notes: Solid lines represent the ratios of Mortgage credit to GDP for Colombia and the Total credit to GDP for the United States. Dashed black lines are long-term trends. Results for the (a) eighth order moving average filter, (b) HP filter for $\lambda = 400{,}000$, (c) Hamilton filter, (d) Local-level filter for a $1\text{-}\delta^{H} = 0.011486$, and (e) the EEMD method. Gray shaded areas represent the GFC and the COVID-19 shock.

The right side of Figure 1 presents the results for the ratio of total credit to GDP of US. All traditional filters also identify an upward long-term trend, but similarly to the Colombian data, the moving average and Hamilton filter with the standard settings just follow the short-term development of the series, while the local level filter results in a rather flat line. However due to the length of the series, the HP filter captures the long-term trend well and its result is very similar to the long-term trend obtained by the EEMD method.

Finally, let us note that besides the caveats of the traditional filters applied to short-term series as discussed in Section 3.1 and demonstrated in Figure 1. There might be two additional shortcomings that are not visible in Figure 1 but can arise when the series are decomposed with traditional filters. One concerns the endpoint problem, whereby the estimate of the long-term trend is biased at the end of the study period as it is mainly driven by the contemporaneous value

of the signal. In two-sided filters this problem is caused by the fact that they become asymmetric and one-sided at the end of the sample (Output Gap WG, 2019). The other shortcoming can be unexpected spikes arising in the smoothed series if they have been seasonally adjusted before applying the smoothing techniques (see Baxter and King, 1999). The EEMD method corrects also these problems, and it is therefore more suitable than traditional techniques for studying these shorter series: it identifies well long-term trends observed in data with a short or long span.

5.1. Long-term effects

As mentioned in Section 3.2, the implementation of the EEMD algorithm relies in a set of auxiliary parameters. The presented results were obtained by applying the following values: the noise strength that defines the additional Gaussian noise was set equal to 0.3, the ensemble size is set to 1000, and the maximum number of siftings equals 50. Alternative parameters were used, but the results remain almost unchanged. The input indicators were decomposed into intrinsic mode functions (IMFs), which are signals with different scales. More specifically, for different configurations of the abovementioned parameters, the method found five IMFs and the long-term trend in all cases. The length and frequency of the cycles were used to classify the components of a particular indicator. Those with an undefined behavior, high frequency fluctuations, and sparse cycles of around two years and below (IMF1 (in orange) and IMF2 (in brown) in the following figures) are seasonal components that remained in the series, presumably because they appear at other frequencies different than those captured by the technique used to seasonally adjust them.

We relate the political cycles to IMFs that last between four and six years (IMF3 (in purple)), below 15 years to business cycles (IMF4 (in blue)), and above 15 years to financial cycles (IMF5 (in green)). EEMD decomposes financial indicators into IMFs representing the long-term trend (y_t^*) and the four components previously explained: $y_t = y_t^* + political\ cycles + business\ cycles + financial\ cycles + remaining\ seasonal\ components$. The estimated long-term trends (dashed black lines) correctly identify the direction of the financial indicators, as can been seen in Figures 3 to 9.

The ratio of corporate credit to GDP shows upward trend in all countries, which is linear for Brazil, Chile, Colombia, Mexico, and Peru, and convex for Argentina and Ecuador. The steeper slope in the last two countries reveal that at the beginning and after the COVID-19 shock, private non-financial firms not only continued using bank loans but increased them considerably.

These results coincide with their limited fiscal spaces to respond to that shock, as Argentina and Ecuador had fiscal deficits that have been increasing since the GFC and lack possibilities to access financing in the international market (CLAF, 2020). Besides, these countries have almost non-existent monetary spaces due to the weak currency of Argentina (i.e., its local currency is pegged to the US dollar) and the dollarized economy of Ecuador (CGD-IDB WG, 2020).

The mortgage-to-GDP ratios show a sustained growth in Brazil, Chile, Mexico, and Peru (their long-term trend increase linearly), and an acceleration in Colombia and Ecuador since 2019 (upward and convex trends). Conversely, the convex decreasing trend of Argentina coincides with a housing market that has been restricted since 2002 due to the existence of inflation-indexed mortgage loans that are adjusted every month. The lack of similar salary adjustments may have discouraged people from acquiring mortgages (see Socoloff, 2020).

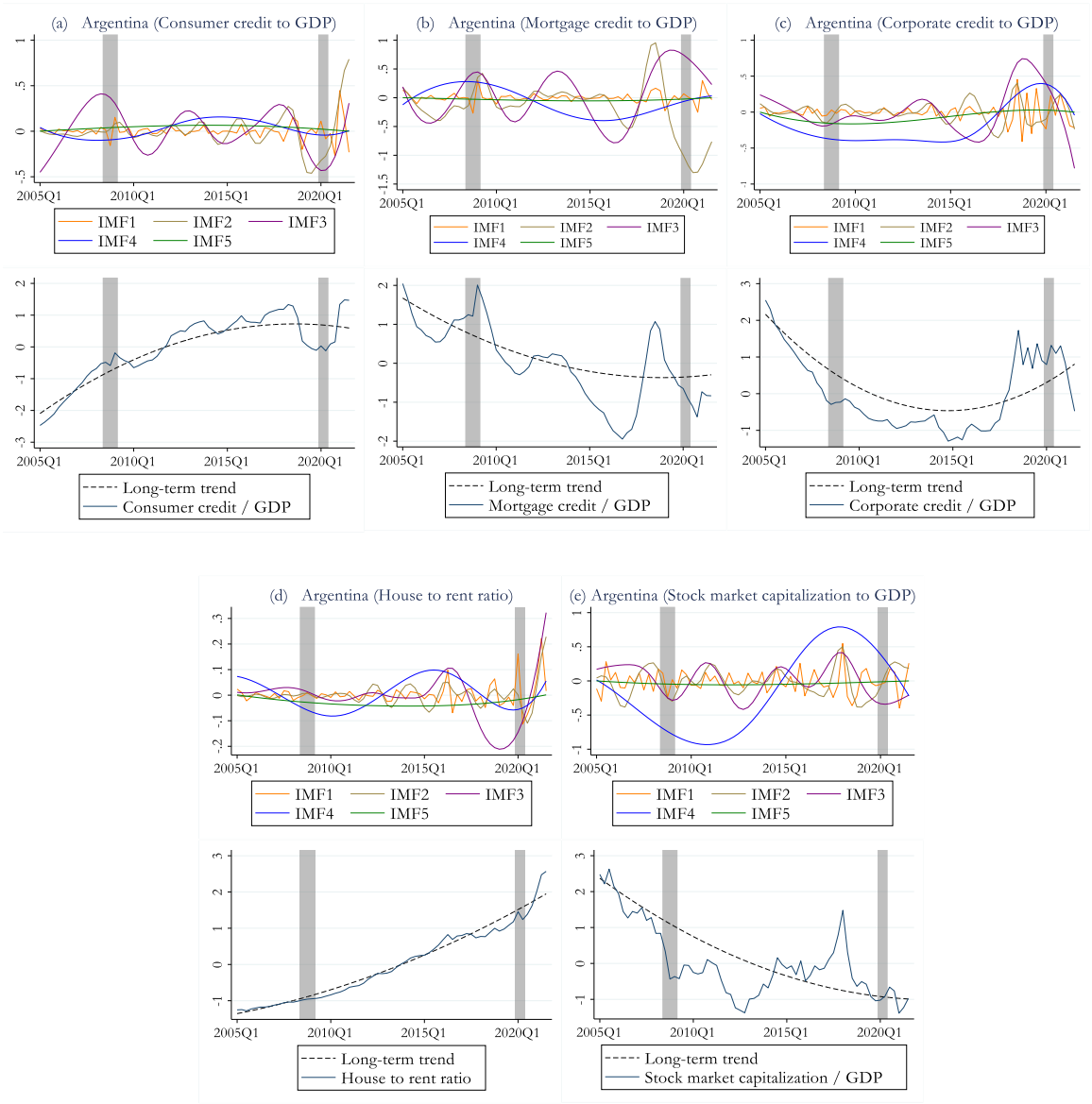


Figure 2. Results obtained with the EEMD method -Argentina-
Notes: IMF1 (orange) and IMF2 (brown) are seasonal components, IMF3 (purple) political cycles, IMF4 (blue) business cycles, and IMF5 (green) financial cycles. (a) Consumer credit/GDP, (b) Mortgage credit/GDP, (c) Corporate credit/GDP, (d) House to rent ratio, (e) Stock market capitalization/GDP. Dashed black lines are long-term trends. Gray shaded areas represent the GFC and the COVID-19 shock.

The house to rent ratio shows a convex and increasing long-term trend in Argentina, Chile, and Mexico, although with notable differences among countries. In Mexico, the upward trend is only seen in the last seven years, as before that, it was declining at a fast rate, even during the GFC. In Chile, the trend increased moderately at the time of the global crisis and became much steeper at the end of the study period. In Argentina, the trend is quasilinear, revealing minor increases

in house prices versus rental prices. However, in these three countries house prices can be considered overvalued since they have been growing faster than rental ones. The opposite result is found for Brazil, Colombia, Ecuador, and Peru, which shows concave and increasing trends around the GFC and decreasing trends in recent years.

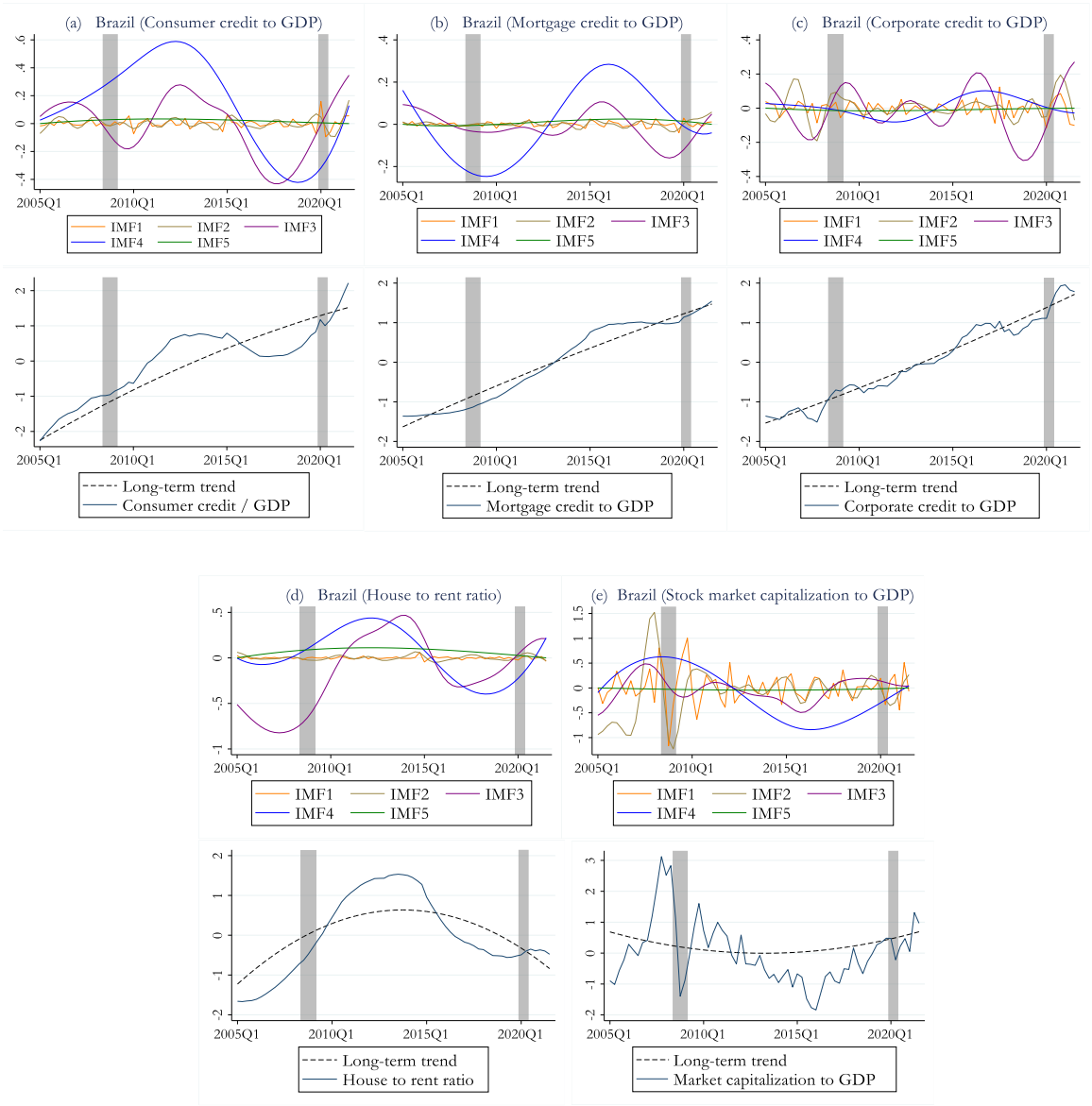


Figure 3. Results obtained with the EEMD method - Brazil -
Notes: IMF1 (orange) and IMF2 (brown) are seasonal components, IMF3 (purple) political cycles, IMF4 (blue) business cycles, and IMF5 (green) financial cycles. (a) Consumer credit/GDP, (b) Mortgage credit/GDP, (c) Corporate credit/GDP, (d) House to rent ratio, (e) Stock market capitalization/GDP. Dashed black lines are long-term trends. Gray shaded areas represent the GFC and the COVID-19 shock.

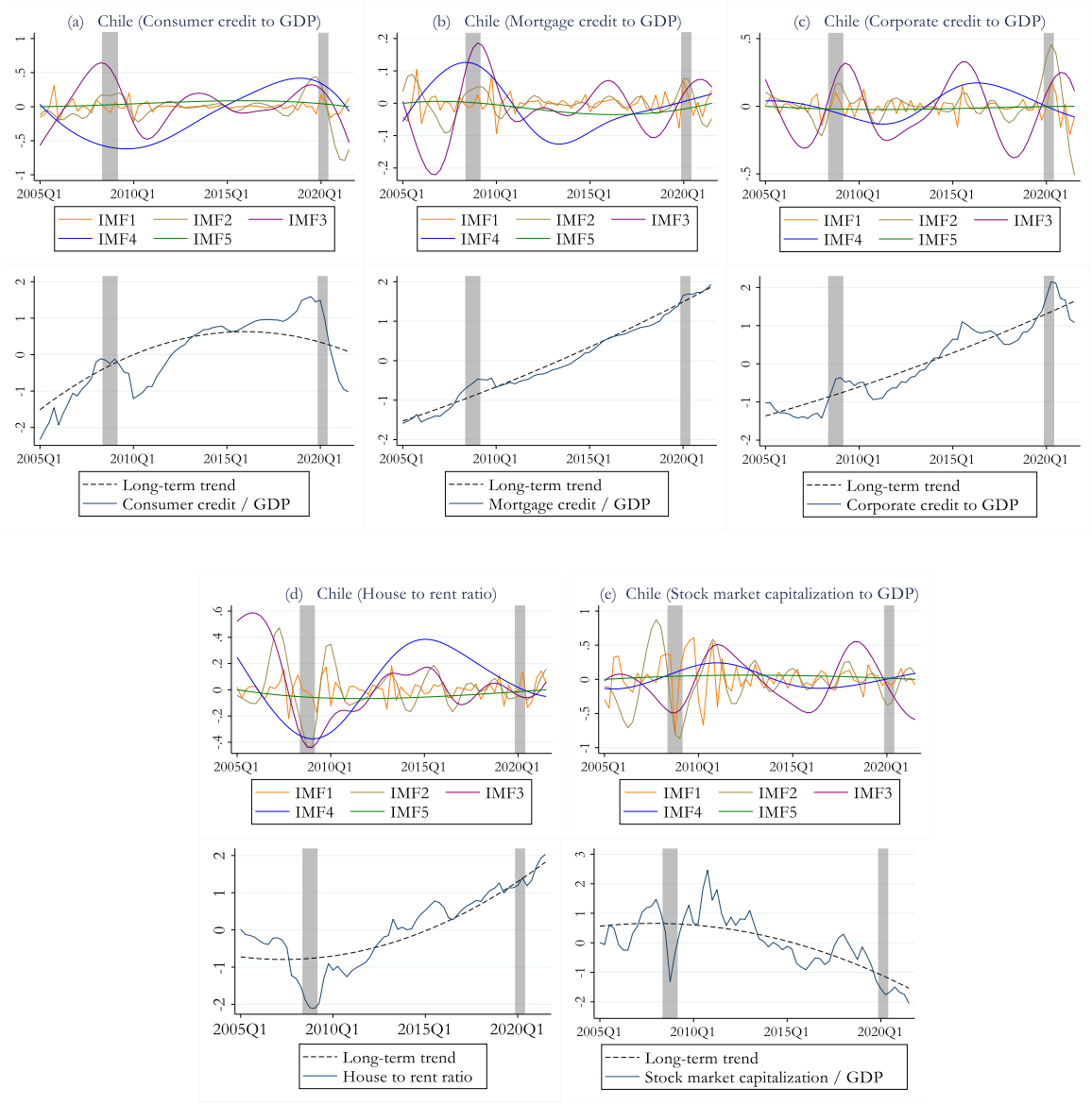


Figure 4. Results obtained with the EEMD method – Chile -

Notes: IMF1 (orange) and IMF2 (brown) are seasonal components, IMF3 (purple) political cycles, IMF4 (blue) business cycles, and IMF5 (green) financial cycles. (a) Consumer credit/GDP, (b) Mortgage credit/GDP, (c) Corporate credit/GDP, (d) House to rent ratio, (e) Stock market capitalization/GDP. Dashed black lines are long-term trends. Gray shaded areas represent the GFC and the COVID-19 shock.

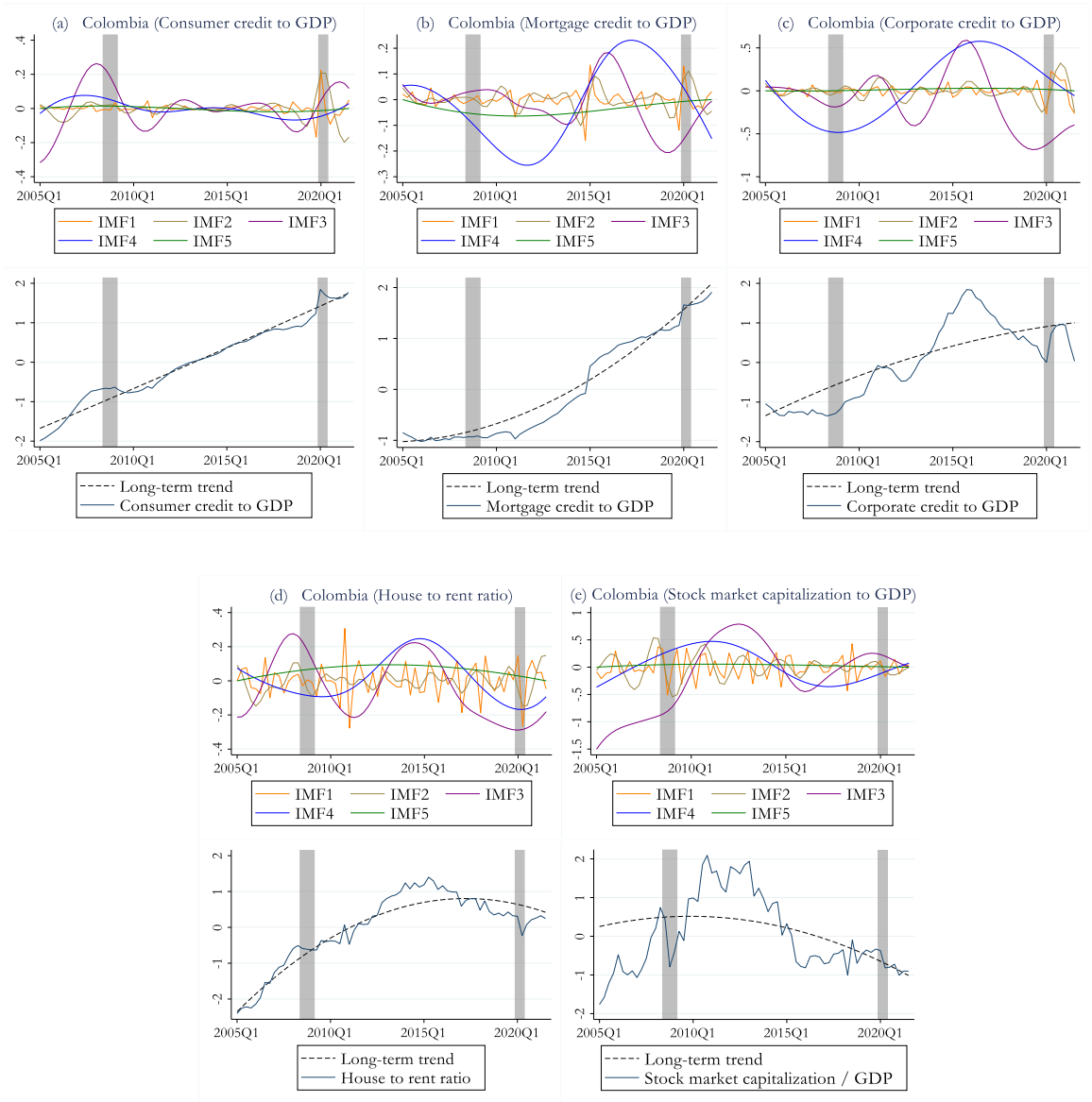


Figure 5. Results obtained with the EEMD method – Colombia -
Notes: IMF1 (orange) and IMF2 (brown) are seasonal components, IMF3 (purple) political cycles, IMF4 (blue) business cycles, and IMF5 (green) financial cycles. (a) Consumer credit/GDP, (b) Mortgage credit/GDP, (c) Corporate credit/GDP, (d) House to rent ratio, (e) Stock market capitalization/GDP. Dashed black lines are long-term trends. Gray shaded areas represent the GFC and the COVID-19 shock.

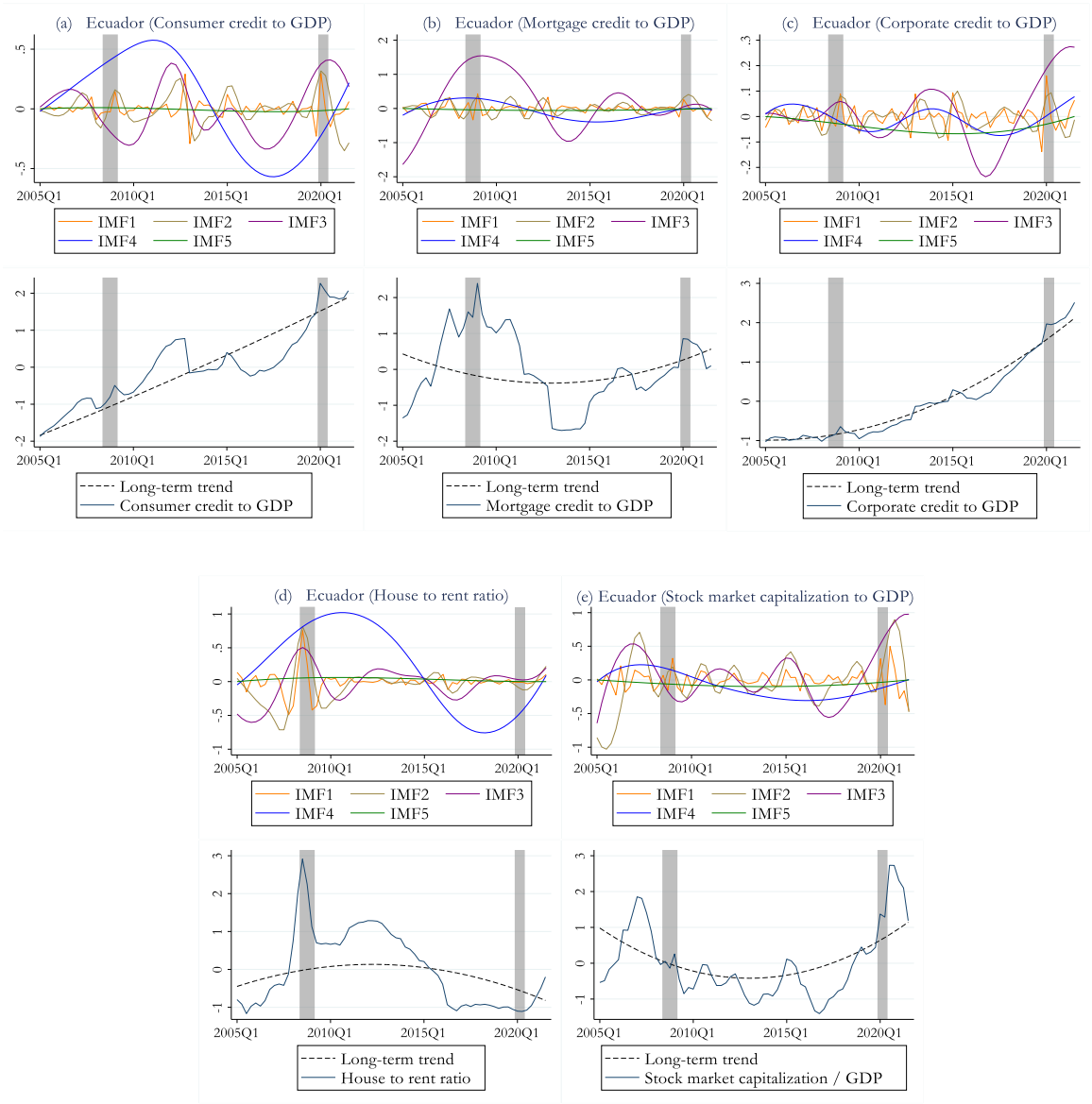


Figure 6. Results obtained with the EEMD method – Ecuador -
Notes: IMF1 (orange) and IMF2 (brown) are seasonal components, IMF3 (purple) political cycles, IMF4 (blue) business cycles, and IMF5 (green) financial cycles. (a) Consumer credit/GDP, (b) Mortgage credit/GDP, (c) Corporate credit/GDP, (d) House to rent ratio, (e) Stock market capitalization/GDP. Dashed black lines are long-term trends. Gray shaded areas represent the GFC and the COVID-19 shock.

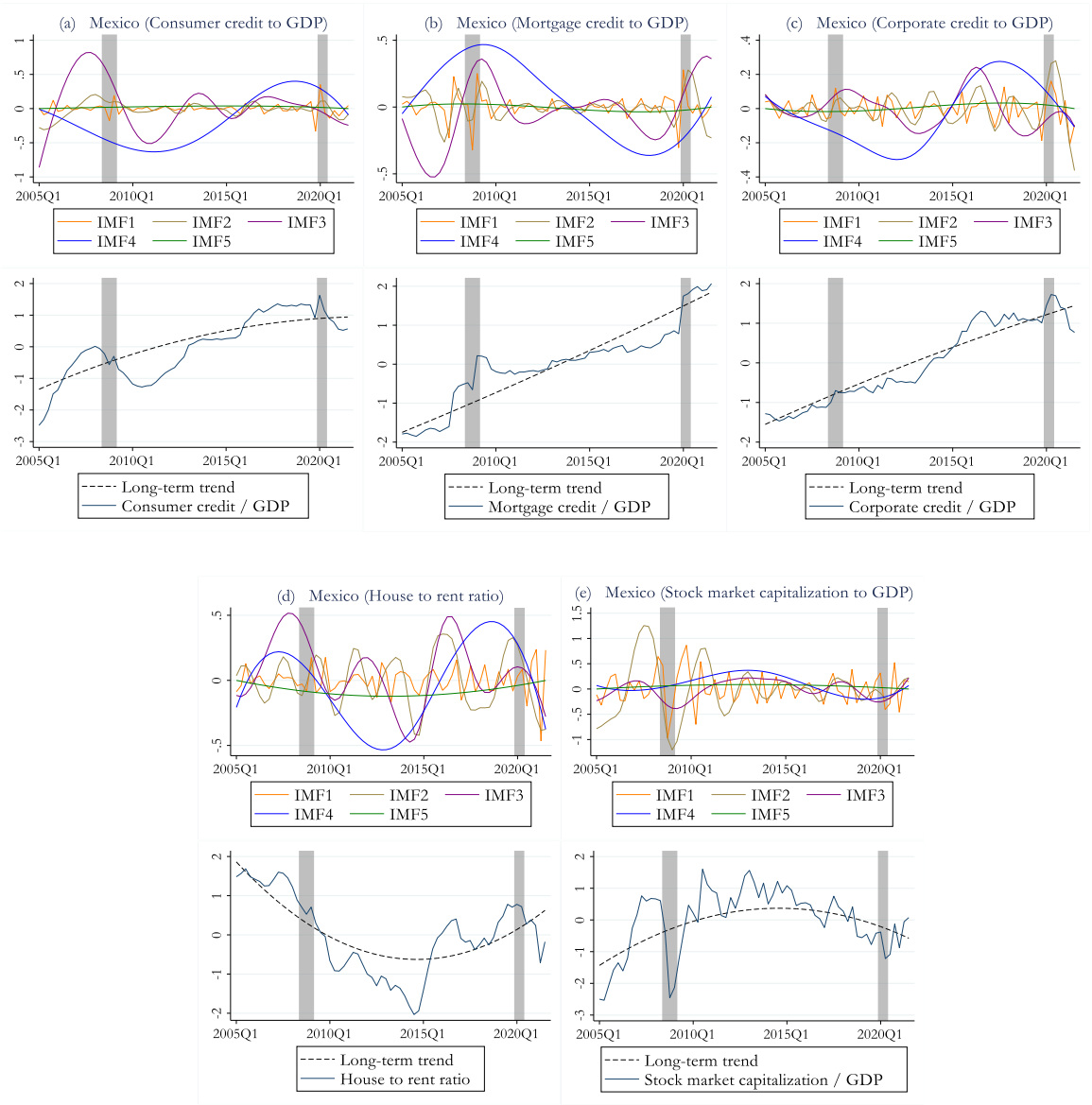


Figure 7. Results obtained with the EEMD method – Mexico -
Notes: IMF1 (orange) and IMF2 (brown) are seasonal components, IMF3 (purple) political cycles, IMF4 (blue) business cycles, and IMF5 (green) financial cycles. (a) Consumer credit/GDP, (b) Mortgage credit/GDP, (c) Corporate credit/GDP, (d) House to rent ratio, (e) Stock market capitalization/GDP. Dashed black lines are long-term trends. Gray shaded areas represent the GFC and the COVID-19 shock.

As regards market capitalization, most countries except Brazil and Ecuador show a downward long-term trend, indicating that the market cap as ratio of GDP is declining. The fall has been more pronounced in Chile, Colombia, and Mexico (their trends are concave) than in Peru (linear) or Argentina (convex). Conversely, these ratios have risen in Brazil (since mid-2015) and Ecuador (since 2014), as shown their upward and convex long-term trends.

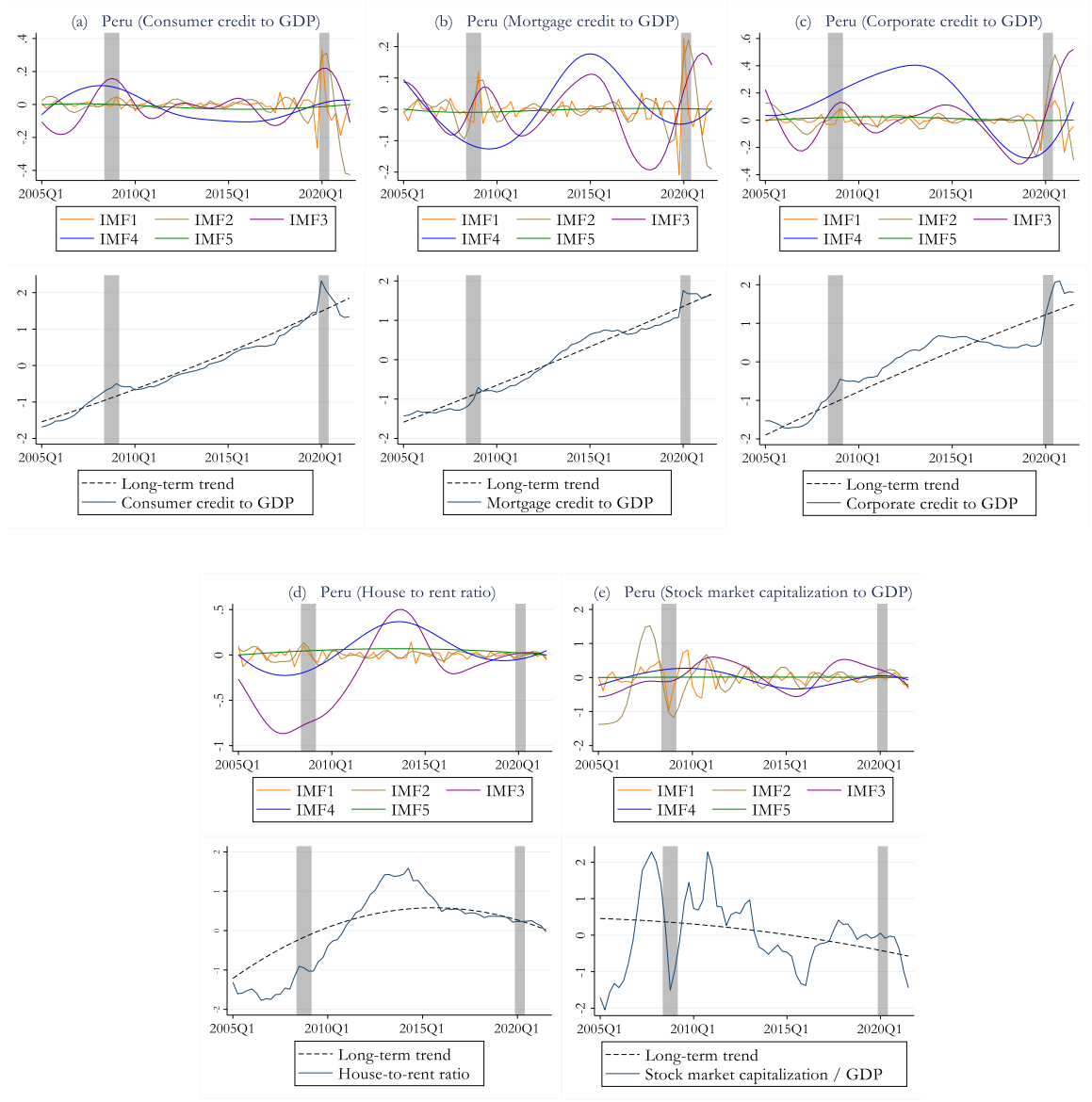


Figure 8. Results obtained with the EEMD method – Peru -
Notes: IMF1 (orange) and IMF2 (brown) are seasonal components, IMF3 (purple) political cycles, IMF4 (blue) business cycles, and IMF5 (green) financial cycles. (a) Consumer credit/GDP, (b) Mortgage credit/GDP, (c) Corporate credit/GDP, (d) House to rent ratio, (e) Stock market capitalization/GDP. Dashed black lines are long-term trends. Gray shaded areas represent the GFC and the COVID-19 shock.

Some indicators exhibit a similar trend for subgroups of countries, suggesting they are somehow linked. That is the case of consumer credit to GDP, which presents a linear and increasing trend in Brazil, Colombia, Ecuador, Mexico, and Peru revealing that before, during and after the GFC and the COVID-19 shock, household consumption financed with credit presented sustained

growth. Conversely, this ratio displays a concave trend in Argentina and Chile, indicating that the consumer credit not only slowed down but rather contracted since 2020. The drivers behind this result will be discussed in the next section.

5.2. Short-term effects

The intrinsic mode functions obtained in the previous sections are used to construct two types of fragility indexes: at the country level and by type of indicator. As mentioned in Section 3.3, the aggregation method used to obtain these indexes is based on a weighting scheme that remains fixed over the entire period. This Section reviews the short-term trends around the GFC and the COVID-19 shock.

5.2.1. Financial Fragility at the country level

One set of results (in magenta) contains all IMFs, while the other (in green) excludes the seasonal components that remained after seasonally adjusting the series (IMF1 and IMF2). Since these latter IMFs do not provide relevant information, the following results focus only on the set of results that excludes them. Credit ratios, assets-based indicators and financial fragility will be related to the measures taken by the economic authorities to tackle the negative effects of these episodes. More information on these economic measures is provided in Appendix A.3.

The GFC

Before the global financial crisis came on scene, financial fragility was increasing in all the countries in the sample, except Argentina. Since the early 2000's, credit booms in the consumption and corporate segments were observed in Brazil, Chile, and Peru, as well as in the ratios of consumer credits from Colombia and Argentina (see Figures 2 to 8 of Section 5.1). Most of these countries are commodity exporters and, therefore, suffered inflationary pressures caused by increases in the international price of these products since the beginning of 2000s, which intensified in 2007. To control inflation levels, the central banks of commodity-exporting countries (BRZ, CHI, COL, MEX, PER) increased their policy rates, which end up increasing bank rates in real terms (Canales-Kriljenko et al., 2010). Thus, when the GFC hit the Latin

American region in the third quarter of 2008, these countries had a wide room to implement rate cuts to alleviate the credit market.

The first-round effects of this crisis took place through the increasing level of global uncertainty that dried up liquidity in many financial markets. In the Latin American region, most central banks reacted by implementing unconventional measures (i.e., quantitative easing) that consisted of providing emergency liquidity to financial institutions. Most commodity-exporting countries (BRZ, CHI, COL, MEX) reduced their policy rate. Other monetary policy measures consisted of reductions in the reserve requirements ratio (ARG, BRZ, COL, PER), repurchases of long-term sovereign bonds and other government securities (ARG, MEX, PER), and foreign exchange swaps to reduce funding problems in US dollars (BRZ, MEX, PER). Some central banks additionally widened the range of eligible collateral for REPO operations with the central bank (CHI), intervened the foreign exchange market to reduce the volatility of the exchange rate against the US dollar (COL) and increased the supply of international reserves in spot market auctions (BRZ). The governments of Chile and Mexico additionally increased the supply of credit to the private sector, especially to small- and medium-sized firms (Banco de Mexico, 2009; CEPAL, 2009). These economic measures coincided with the expansion of corporate credits during the development of the crisis (see Figures 4c and 7c).

The sharp drop in international oil prices that occurred in the second half of 2008 impacted Brazil, Colombia, Ecuador, Mexico, Peru, and Chile. This latter country was also affected by the reduction in copper prices (CEPAL, 2009). Unsurprisingly, consumer credit falls in most of these countries (BRA, CHI, COL, ECU, PER), in the last quarter of 2008 or early 2009.

The situation was much more complex for Mexico, given that its financial and commercial integration with the US (i.e., the NAFTA treaty) further deepened the negative effects of this crisis on the economy (Banco de Mexico, 2009). Indeed, the GFC hit this economy long before the other countries in the sample. As can be seen in Figures 7a and 7c, consumer and corporate credits were declining well before the third quarter of 2008, indicating that the credit market was impacted by the first phase of the GFC that began with the US real-estate crisis.

The situation was also very difficult for Ecuador, as this country was already suffering from an internal economic crisis that began twenty-five years back and left the country without much room to maneuver. One of the biggest challenges for the economic authorities of this country

was the potential illiquidity that could worsen with the dollarization of the economy that was established in January 2000 (Acosta, 2009). As a result, all credit ratios began to fall from the first quarter of 2009.

These results coincide with the expansion in the ratio of house-to-rent prices, which was increasing in all countries except Mexico. It is very unlikely that these short-term trends represent a threat to the financial stability of these countries, given that previous crisis episodes in the real estate markets in the region have generated several changes in the way in which these credits are granted.[11] As for the stock markets, Argentina, Brazil, Ecuador, and Peru exhibited a decreasing market capitalization that reveals the entry of capital flows for speculative purposes. The combination of credit ratios and assets valuations reduced financial fragility long before the GFC hit Brazil, Chile, and Colombia (Figure 9, panels b, c, d).

The second-round effects emerged in 2010, when the policy rates in advanced economies turned negative in real terms, causing excessive growth in global liquidity to the point of substantially increasing the demand for emerging market assets. The increasing capital flows into these economies led to an increase in local credits and caused distortions in the price of domestic assets in countries like Brazil, Colombia, and Mexico (see Pereira and Harris, 2012). Capital flows to Latin America are usually speculative and therefore tend to increase the accumulation of financial vulnerabilities, as can be observed for these countries (see Figure 9, panels b, d, f).

The COVID-19 shock

A very different situation surrounded the emergence of the shock caused by the COVID-19 virus. Prior to that episode, financial fragility was decreasing in all countries in the sample, except Ecuador and Peru (Figure 9, all panels). Credit ratios and equity prices were increasing, but at lower levels than those observed before the GFC. The lockdown measures adopted by governments to contain the spread of the virus at the beginning of 2020, caused the temporary closure of economic activities, negatively affecting the income of households and firms, and

[11] Unlike Argentina and Ecuador, the central banks of the other countries in the sample are independent of the government, which allows them to freely implement their monetary policy measures to achieve price stability. This led to non-orthodox measures like that implemented by the central bank of Argentina, which provided temporary financing to the Treasury, through direct loans and profit transfers to the national government (see Central bank of Argentina, 2021).

therefore, reducing their ability to pay credits. As a result, aggregate demand and supply fell, leading several countries into an economic contraction in 2020.

The economic authorities reacted much faster to the COVID-19 shock than to the GFC. Most central banks eased monetary policy to provide more liquidity to the financial system by reducing the reserves requirements ratios (ARG, BRZ, MEX, PER) and policy rates (BRZ, CHI, COL, PER). Temporary liquidity facilities were put in place (CHI, BRZ, COL, MEX, PER), as well as expansions in the range of eligible collateral to access central bank liquidity (CHI, COL, MEX) and in the type of counterparties that can access these funds (COL). Credit renegotiations were offered to households and private firms (BRZ, ECU), but also special measures to support financial institutions that granted credit to these market segments (CHI, PER) and to the private micro, small- and medium-sized firms (MEX). These measures maintained the flow of credit to these economies and even increased it above the average in all countries except Argentina, as can be seen in the credit ratios during the lockdown period (panels a, b, and c in Figures 3, 4, 5, 6, 7, and 8). Subsidized credits to firms that protected employment also helped to shield and expand the non-financial private sector in Brazil and Ecuador (Banco central do Brasil, 2020; IMF, 2021).

To reduce the volatility of the foreign exchange market and increase the liquidity in US dollars, some central banks implemented spot interventions in this market (ARG, BRZ), FX-swap operations (CHI), offered dollars in the NDF market and undertook auctions of FX non-delivery forwards and FX swaps (COL), widened the currency hedging program in dollars payable in local currency, implemented credit auctions in US dollars and currency hedges (MEX), and carried out derivative transactions and operations in the spot market (PER).

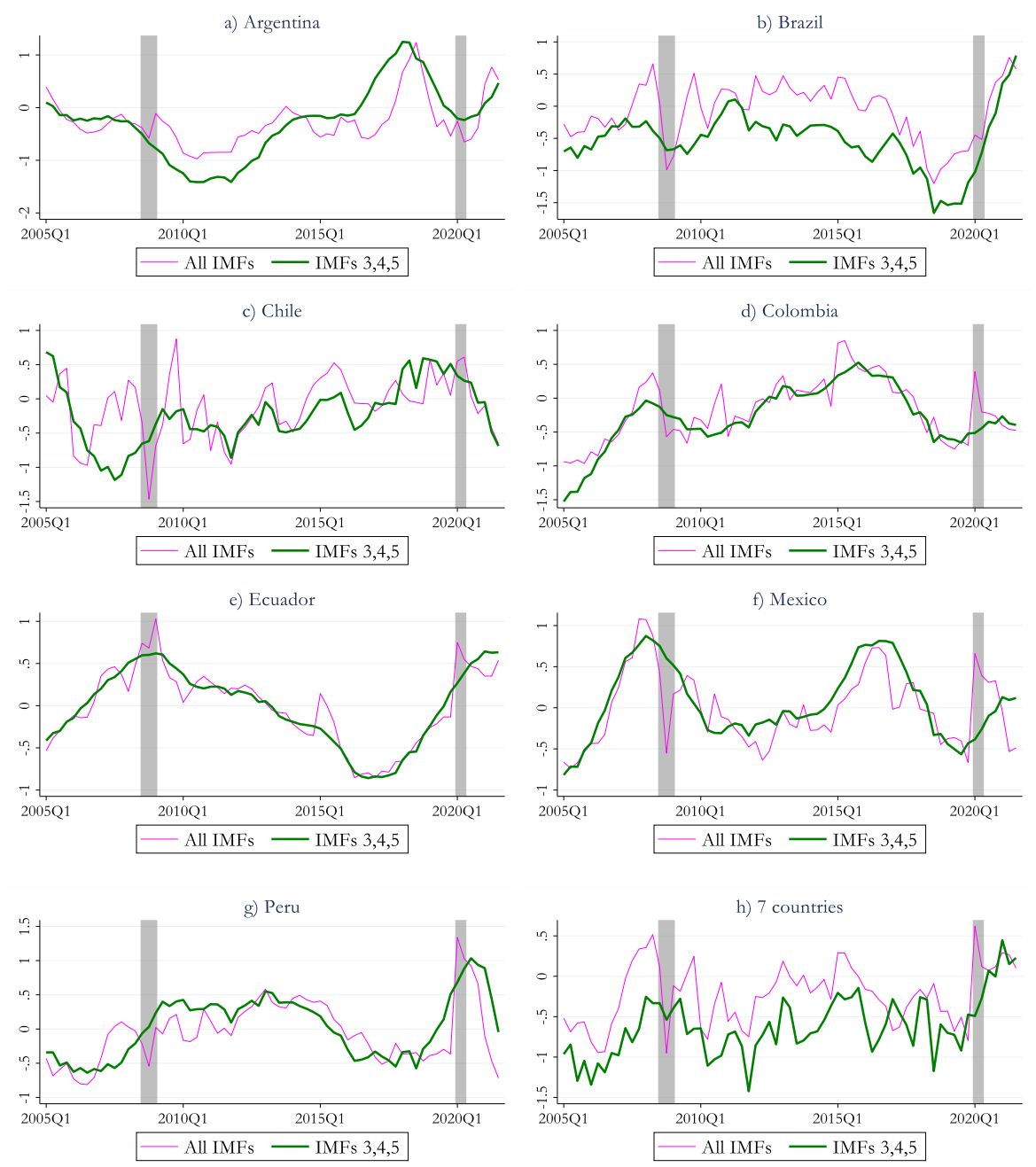


Figure 9. Financial fragility indexes
Notes: These results include 5 financial indicators: Consumer credit/GDP, Mortgage credit/GDP, Corporate credit/GDP, House to rent ratio, and Stock market capitalization/GDP. Gray shaded areas denote the GFC and the COVID-19 shock.

In addition to the policy measures implemented at the country level, the IMF provided emergency financial assistance to Colombia, Mexico, Peru, and Chile, using different credit lines. Also, the US Federal Reserve became the lender-of-last resort to many central banks, extending

swap lines to keep the financial markets working. In the Latin American region, it extended swap lines to Brazil and Mexico, and established a dollar repo facility to countries not participating in these swap lines to ensure the provision of US dollar liquidity (CGD-IDB WG, 2020).

As regards the asset-based indicators, most countries, except Brazil and Mexico, exhibit a sharp fall in the stock market capitalization to GDP, during and after the COVID-19 shock (see panel e in Figures 2, 4, 5, 6, 8). This result can be explained to the increasing level of global uncertainty that was perceived during the development of this episode. It is very likely that local investors preferred to hold liquid funds or that a flight to safety occurred at that time.

Latin American countries entered the COVID-19 shock with strong banking systems that were better capitalized, much more liquid, and had better tools to evaluate the financial risks than those during the GFC. Besides, most of them were on the process of implementing the Basel III accord that allows them to maintain high and stable buffers of capital and liquidity (CGD-IDB WG, 2020). But despite these economic measures (summarized in Section 5.3), the financial fragility of the region continues increasing, even at levels higher than those observed throughout the study period.

5.2.2. Financial fragility by type of indicator

The results by type of indicator were obtained in three steps. First, the data expressed in domestic currency was transformed into US dollars using the quarterly average exchange rates for each country from the IMF-IFS. Second, these data were added into one single result, previously setting all series to the same base quarter (2010Q4=100). Third, the financial indicators were computed following the same procedure used before, as a ratio of the GDP or rental prices calculated for the countries under study. Figure 10 presents the indexes by type of indicator using all IMFs (in green) and those obtained when considering only IMFs 3, 4, and 5 (in orange).

Financial crises are often preceded by credit expansions that lead to the buildup of financial vulnerabilities. The GFC is no exception, as can be seen from the ratios of consumer and corporate credits to GDP, both of which exhibited sustained and prolonged expansions long before the crisis arose. During the crisis, consumer credits fell while corporate credits did so few quarters later, very different from what was observed for mortgage credits, which were not substantially affected.

Conversely, when the COVID-19 shock hit Latin American economies: all credit ratios were rising in a sustained way, but far below their historical records (Figure 10, panels a, b, c). Another symptom that usually precedes financial crises is the overvaluation of the assets used as collateral. The real estate prices did not present such behavior before the GFC arose, as can be seen from an almost flat house-to-rent ratio during the crisis that started to fall by 2014. By contrast, the stock market cap fell during and after the GFC, indicating that the financial structure of these countries is more bank based. The ratios of stock market cap to GDP only showed the opposite trend from 2010.

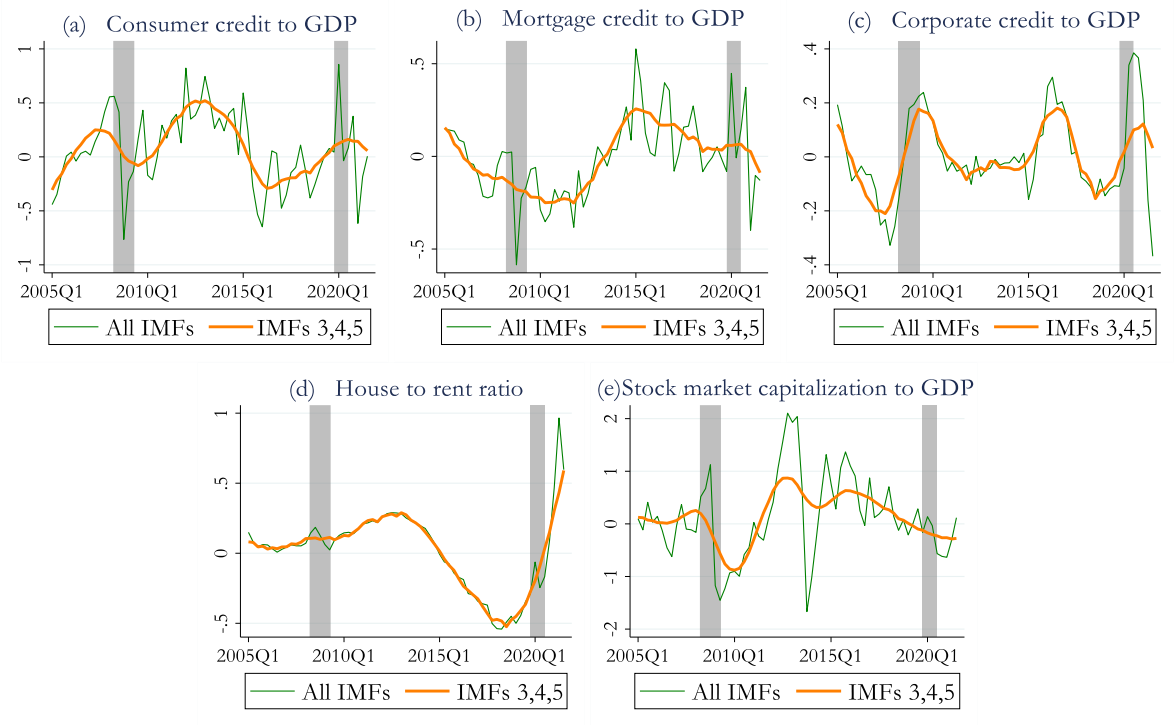


Figure 10. Financial fragility indexes by type of indicator
Notes: Results considering all IMFs are presented in green and considering only IMFs 3,4,5 in orange. (a) Consumer credit to GDP, (b) Mortgage credit to GDP, (c) Corporate credit to GDP, (d) House to rent ratio, (e) Stock market capitalization to GDP. Gray shaded areas denote the GFC and the COVID-19 shock.

At the time that the COVID-19 shock hit the economies, property prices were in the process of recovering from the devaluations suffered in the previous years. Indeed, these prices and mortgage credits were less sensitive to this shock than the other financial indicators, presumably because they were not influenced by a housing bubble as was the case with the GFC. From 2015, the ratio of stock market capitalization to GDP was falling and this trend was reinforced by the COVID-19 shock.

Financial fragility assessed from this group of indicators increased long before the GFC, as revealed the expansion of consumer and corporate credits and the overvaluation of stock markets. This contrasts with the results observed before the COVID-19 shock, since most financial indicators were well-behaved before this episode occurred.

5.2.3. Robustness checks

Our time span (16 years) can be considered short to study financial cycles, which usually last four times the business cycles, i.e., 30 and 40 years (see Drehmann et al., 2010). We attribute the occurrence of these cycles to IMF5, but the results obtained do not allow us to observe a complete cycle. As a robustness check we add these last functions to the long-term trend. As can be seen in Figure 11, the trend of all financial indicators remained almost unchanged for Mexico and the other countries in sample (see Appendix C1).

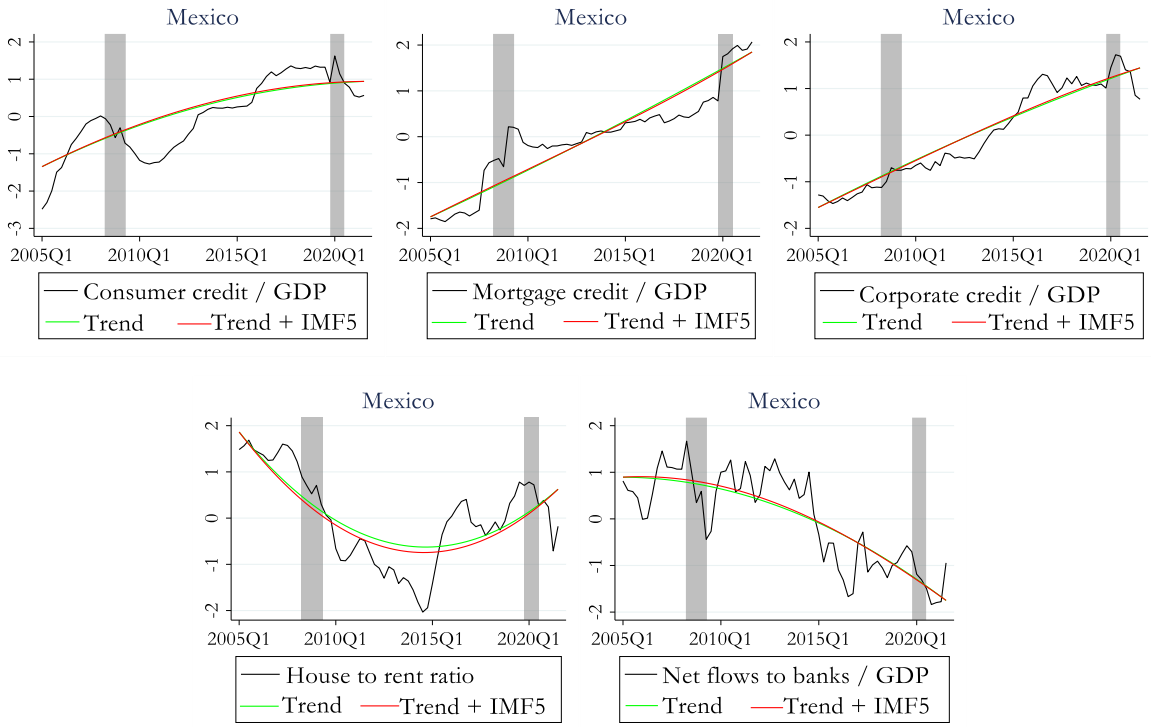


Figure 11. Estimated long-term trends using the EEMD method – Mexico -
Notes: The original long-term trend is presented in green lime, and the new trend in red. Gray shaded areas denote the GFC and the COVID-19 shock.

So far, we have considered local sources of instability to study the financial fragility. However, there are also global sources that can influence the buildup of financial vulnerabilities. Empirical

evidence has shown that global banks played a significant role in the transmission of the GFC to emerging economies (see Cetorelli and Goldberg, 2011). The beginning of the pandemic may also have caused reversals in the lending of global banks to their peers in emerging economies, due to the growing level of uncertainty that this shock caused in the financial markets (see IMF, 2020). This second robustness check studies the effects of global financial conditions on financial systems, including the international flows to the banking sector in the set of financial indicators used to construct the indexes of fragility. To test these effects, we construct for each country the ratio of the net capital flows to the banking sector (i.e., difference between claims and liabilities to banks) and GDP.

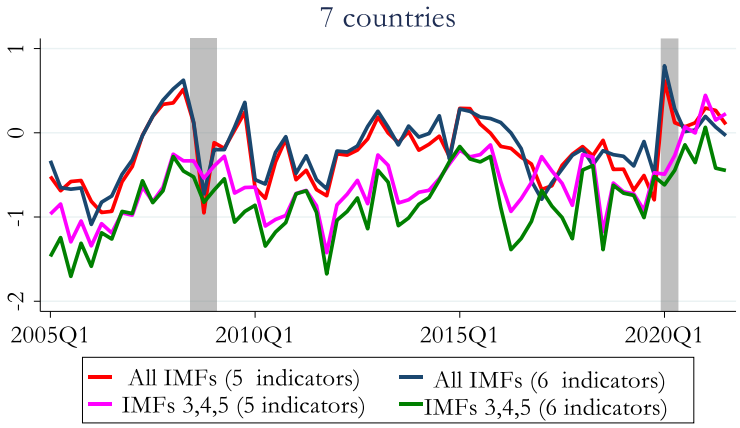


Figure 12. General indexes of fragility
Notes: the financial fragility index with 5 financial indicators in red (all IMFs) and magenta (IMFs 3, 4, 5). The index additionally including the net capital flows to the banking sector in navy blue (all IMFs) and green (IMFs 3, 4, 5). Gray shaded areas denote the GFC and the COVID-19 shock.

The results including the international flows to the banking sector (in navy blue and green) confirm the validity of our previous indexes based on five financial indicators (in red and magenta). Both reveal that financial fragility was increasing before to the GFC but suddenly fell during the crisis (see Figure 12). Conversely, financial fragility was decreasing prior to the COVID-19 shock, increased during the lockdown period, and started to decline as economic activities resumed. The fragility indexes that additionally include net capital flows to the banking sector present only small changes when compared to those obtained from the original five financial indicators. Hence, we can be confident that the results reported in previous sections

properly capture the long-term trends and the cyclical components obtained from their respective IMFs. Results at the country level are presented in Appendix C2.

5.2.4. Subindexes for political and business cycles

An important advantage of the EMD method compared to traditional data decomposition methods is that the resulting IMFs (cycles) are closely related to underlying events (Oladosu, 2009). Since the EEMD is based on the previous method, it also benefits from that property, which we use to relate the identified IMFs to political and business cycles. Thus, as a byproduct of the EEMD method we constructed subindexes for these cycles, conjectured from the average length and the number of cycles in the study period.

The same method of aggregation is used, this time on the IMFs representing each criterion (i.e., IMF3: political cycles, IMF4: business cycles). Financial indicators commonly related to financial fragility can be influenced by politics, to the extent that incumbents shape policies either to get re-elected or to help their political party win elections. This strategic behavior may generate changes in government spending components that are easily observed by voters before and during election periods, giving way to political budget cycles.

Figure 13 presents the political budget cycles (PBCs) extracted with the EEMD method, which we examine at the country level, considering their length, checking whether the incumbent president remained in power through re-election, and the respective electoral periods (shaded areas in aquamarine). We examine these cycles using the average length of estimated PBCs, length of the presidential terms reported in Table 1, and percentage increase in subsidies and other transfers reported in Table 2.

In this last regard, it should be noticed that electoral periods have influenced macroeconomics performance of Latin American countries since the 1980s (see Remmer, 2013). As mentioned in Section 2.2, the literature on political budget cycles suggests that incumbent politicians may be tempted to increase public spending in pre-election periods to win voters' favoritism. Empirical works for some Latin American countries have found evidence of increments in public spending before elections (Ames, 1987), in current spending and public investment during and before election years (Nieto-Parra and Santiso, 2012), in fiscal imbalances during electoral periods in the 2000s (Barberia and Avelino, 2011), and in fiscal deteriorations in electoral periods of

countries that allow immediate reelection, i.e., Argentina, Brazil, Colombia, and Ecuador (Nieto-Parra and Santiso, 2009).

Other studies have made use of indicators that measure redistributive policies in election periods. In this group we found the work of González (2002) that shows the use of targeted subsidies to low-income population and public spending on infrastructure in Mexico during election years, and the work of Carvalho (2014) that provides evidence of the use of subsidized credits to firms with the commitment that the latter temporarily increase employment in politically attractive regions. However, political incumbents of democratic regimes may also increase government transfers in post-election periods (see Franzese, 2002).

Indeed, considering redistributive policies (e.g. subsidies) to study PBC can be more precise than focusing on broad indicators of government spending: the former are directly oriented to temporarily improve the welfare of low-income population while the latter could instead represent increments in government spending with non-electoral purposes (see Han, 2021). Ideally, we should use granular data on subsidies before, during, and after electoral periods to understand the dynamics of the estimated PBCs. But given that only yearly data is available, we will focus on electoral years (see Table 2).

As can be seen in Figure 13 (panels a to g), the cycles identified are not synchronized between countries, which coincides with previous studies that claim there are no reasons to expect such synchronicity given that these cycles mostly depend on the institutional features of each specific country (see Shi and Svensson, 2006). In line with the above, our results identify two groups that exhibit slight co-movements. The first group exhibits higher pair-wise correlations (Colombia and Mexico is 0.80, Brazil and Colombia 0.56, and Brazil and Mexico 0.49) than those observed for the other group (Ecuador and Peru 0.64).

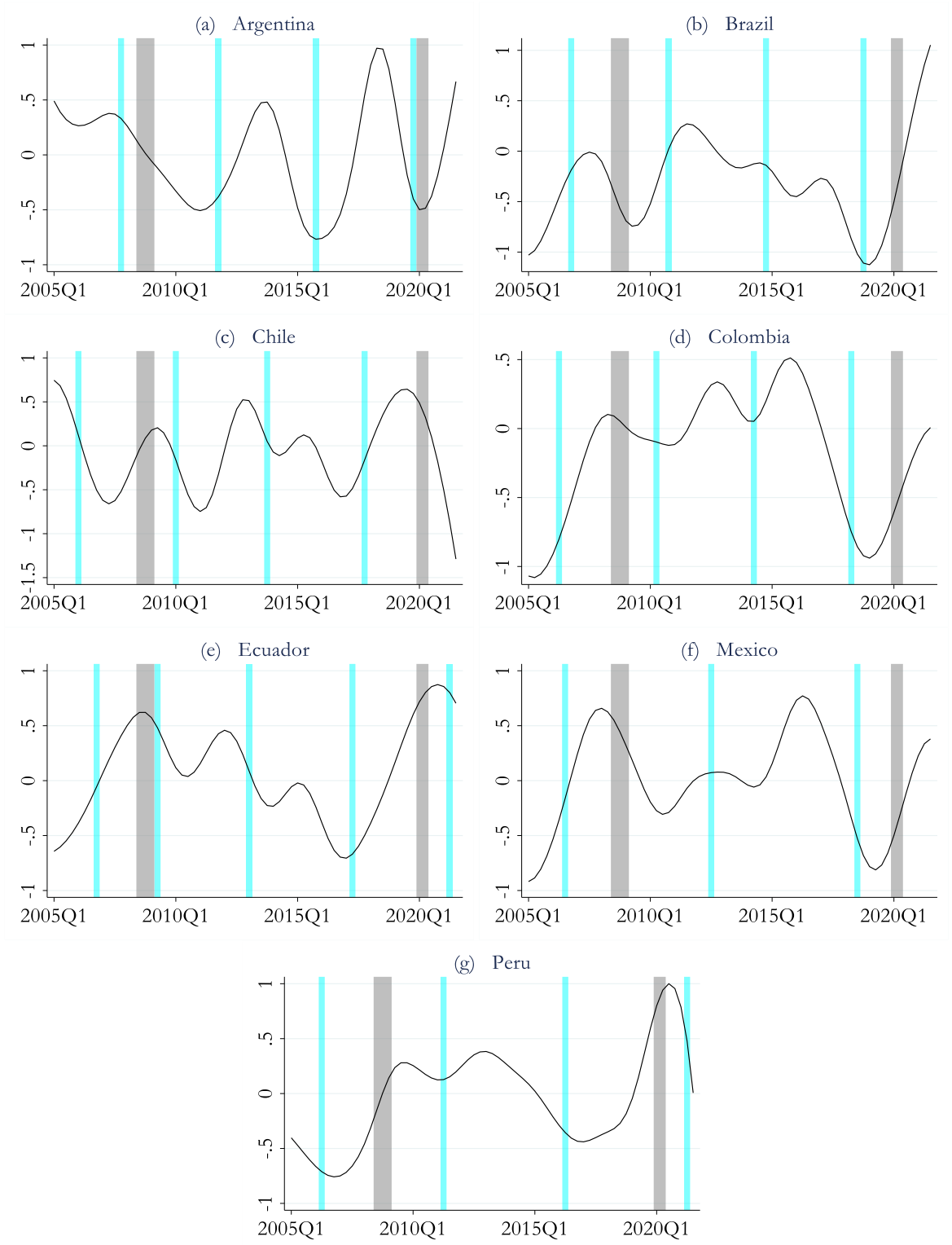


Figure 13. Subindexes for Political budget cycles
Notes: Gray shaded areas denote the GFC and the COVID-19 shock. Blue shaded areas denote electoral periods.

- The PBC estimated for Argentina shows an upward trend before the presidential election of 2007, when the winning candidate succeeded an incumbent from its political party. The same upward trend can be seen before her re-election, in October of 2011. For the last two presidential elections (in November 2015 and October 2019), the estimated PBC presented downward trends. The percentage increment of subsidies and other transfers exhibits a considerable increase (17.41%) a year before this last presidential election, suggesting the possible use of redistributive benefits or compensations to electoral supporters. The estimated PBC is irregular and has an average length (4.6 years) that is closely related to the usual length of presidential periods (4 years).

- Four presidential elections have been held in Brazil during our study period. The former three coincide with a PBC that prior to elections exhibited upward trends: in October 2006 when the presidential incumbent was re-elected, in October 2010 when the wining candidate was from the same political party as the former president, and in October 2014 when the incumbent president was elected again. The lack of specific data on subsidies and transfers do not allow us to check whether these results coincide with the use of government transfers for electoral purposes. This is not the case for the last electoral period (in October 2018), for which it can be seen (in Table 2) that subsidies and transfers increased in 4.52%. The downward trend of the PBC observed in this last presidential election coincides with the change in the political power from left to right. The average length of this PBC (7.5 years) exceeds the presidential term (4 years), a result that could be related to the political instability of this country.[12]

  The PBC estimated for Chile (Figure 13c) is irregular and presents frequent fluctuations. Prior to the three presidential election periods (January 2006, January 2010, and December 2013) this cycle exhibited downward trends. But in the last electoral period (December 2017) this trend became upward. Minor increments in the subsidies provided by the government can be seen in the first and third election periods. A similar increase in subsidies was observed a year after the presidential elections of 2017. The average duration of the PBC (6.4 years) exceeds the presidential term (4 years) possibly due to

[12] This is the case of President's Rousseff second term that was suspended six months before the end of her second term, due to budget manipulation investigations.

presidential re-elections. In this regard it should be noticed that in Chile, non-immediate re-elections are allowed and, accordingly, between 2006 and 2017, the elected politicians alternately held the presidential position.

- Colombia has had four presidential elections between 2005 and 2021 (May 2006, June 2010, June 2014, June 2018). The estimated PBC shows an increasing trend before the first electoral period, a decreasing trend in the second, no trend in the third, and a decreasing trend in the last period. However, when looking at the information of government subsidies (in Table 2) can be seen that this spending component increased during election years and a year after the presidential elections of 2014 and 2018. The former two cases coincide with presidential reelections while the last one with the support of the political party of the incumbent president for the candidate that won elections in 2018. The average length of the estimated PBC (6.2 years) strongly differs from the presidential term (4 years), which could be related to the fact that in Colombia immediate reelection was allowed, until 2014.

- There have been 5 presidential elections in Ecuador during our study period, as can be seen in Figure 13e. The estimated PBC exhibits an increasing trend during the fourth electoral period (April 2017) that coincides with an increase close to 1% in the subsidies and transfers granted by the government. This same result is observed during the last presidential elections (April 2021), when these transfers augmented in 5.04%. The average length of this country's cycle is 5.3 years, which is similar to the duration of the presidential term approved by law. The difference between these periods may be related to both, the presidential re-elections that took place at the beginning of the study period and the political instability suffered in this country before 2018.[13]

[13] The corruption investigations to President Correa in Ecuador, lead voters to use a referendum to reinstate the presidential term limit of two periods in their political constitution, in February 2018.

Table 1. Length and number of cycles by country

(a) CYCLE LENGHT (in years)	ARG	BRA	CHI	COL	ECU	MEX	PER
Political Budget Cyles (IMF3)							
Consumer credit to GDP	5.2	7.9	6.1	3.5	4.7	5.1	4.3
Mortgage credit to GDP	4.6	7.3	5.0	7.5	6.6	5.9	5.1
Corporate credit to GDP	5.8	5.7	5.5	5.4	5.4	6.9	5.3
House to rent ratio	4.2	8.8	8.3	6.5	5.3	4.5	8.3
Stock market capitalization to GDP	3.2	7.8	7.3	8.0	4.5	4.1	7.5
Average lenght	**4.6**	**7.5**	**6.4**	**6.2**	**5.3**	**5.3**	**6.1**
Lenght of presidential terms	**4**	**4**	**4**	**4**	**4**	**6**	**5**
Business Cycles (IMF4)							
Consumer credit to GDP	8.5	16.5	16.5	8.3	16.0	16.3	14.3
Mortgage credit to GDP	15.5	14.3	12.8	13.3	16.0	16.0	11.8
Corporate credit to GDP	16.8	15.3	12.3	16.0	7.5	14.8	16.3
House to rent ratio	7.3	11.8	14.0	11.8	16.3	10.3	12.8
Stock market capitalization to GDP	10.0	16.5	12.8	14.0	16.3	14.0	12.3
Average lenght	**11.6**	14.9	**13.7**	**12.7**	**14.4**	**14.3**	**13.5**
(b) NUMBER OF CYCLES							
Political Budget Cyles (IMF3)							
Consumer credit to GDP	3.0	2.0	2.5	2.0	3.0	2.5	2.5
Mortgage credit to GDP	3.0	1.0	2.5	2.5	2.0	2.0	2.5
Corporate credit to GDP	1.0	3.5	3.0	2.0	1.0	2.5	2.0
House to rent ratio	1.0	1.0	2.0	2.0	2.0	3.0	1.5
Stock market capitalization to GDP	4.0	2.5	2.0	1.5	3.0	3.0	1.5
Average number of cycles	**2.4**	**2.0**	**2.4**	**2.0**	**2.2**	**2.6**	**2.0**
Business Cycles (IMF4)							
Consumer credit to GDP	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mortgage credit to GDP	1.0	1.0	1.0	1.0	1.0	1.0	1.5
Corporate credit to GDP	1.0	1.0	1.0	1.0	2.0	1.0	1.0
House to rent ratio	1.5	1.0	1.0	1.0	1.0	1.5	1.0
Stock market capitalization to GDP	1.0	1.0	1.0	1.0	1.0	1.0	1.5
Average number of cycles	**1.1**	**1.0**	**1.0**	**1.0**	**1.2**	**1.1**	**1.2**

Notes: the cycle length is assessed by averaging the number of quarters of the respective IMF and transforming them into years. The number of cycles is obtained by counting all cycles, each represented by a peak and a trough. The length of presidential term is the period established in the constitution of each country.

- Unlike the other Latin American countries, the Mexican case is particularly interesting because this country is considered a recently established democracy (see González, 2002). The presidential term in Mexico is of 6 years, very similar to the average length of the estimated PBC (5 years), which could be explained by the fact that re-elections in

this country are totally forbidden. The estimated cycle presents an upward trend in the first two electoral periods (July 2006 and July 2012) and a decreasing trend during the last one (July 2018). Data on transfers and subsidies is only available for the last presidential term, for which it can be seen an increase of 0.76% during the election period and 2.03% one year later.

Table 2. Percentage increase in government subsidies and other transfers

Country	Presidential elections	Subsidies and other transfers	
		% increment during the electoral year	% increment one year after elections
Argentina	October 28, 2007	n.d.	n.d.
	October 23, 2011	n.d.	n.d.
	November 22, 2015	-0.94%	-2.62%
	October 27, 2019	-3.13%	17.41%
Brazil	October 29, 2006	n.d.	n.d.
	October 31, 2010	n.d.	n.d.
	October 26, 2014	-0.50%	-11.47%
	October 28, 2018	-0.76%	4.58%
Chile	January 15, 2006	0.37%	0.73%
	January 17, 2010	-5.64%	-2.76%
	December 15, 2013	0.67%	0.30%
	December 17, 2017	-23.93%	0.18%
Colombia	May 28, 2006	n.d.	n.d.
	June 20, 2010	1.09%	-16.57%
	June 15, 2014	7.52%	1.90%
	June 17, 2018	0.80%	1.55%
Ecuador	November 26, 2006	n.d.	n.d.
	April 26, 2009	n.d.	n.d.
	February 17, 2013	n.d.	n.d.
	April 2, 2017	0.94%	-0.78%
	April 11, 2021	5.04%	n.d.
Mexico	July 2, 2006	n.d.	n.d.
	July 1, 2012	n.d.	n.d.
	July 1, 2018	0.76%	2.03%
Peru	June 4, 2006	2.86%	5.81%
	June 5, 2011	4.09%	3.04%
	June 5, 2016	2.03%	4.17%
	June 6, 2021	0.12%	n.d.

Source: World Bank data of subsidies and other transfers (% of expense). Notes: data on subsidies and others transfers correspond to the yearly % increase (authors' calculations). Subsidies and transfers include grants, and other social benefits (e.g., social security, social assistance benefits, and employer social benefits in cash and in kind). Data on presidential elections came from public non-formal sources.

- Peru is the country with the greatest political instability in our sample. This coincides with the fact that, although four presidential elections have been held during the study period, eight presidents have been in power. As can be seen in Figure 13g, the estimated PBC is not only irregular, but also exhibits upward trends during and after electoral periods. In line with the above, data on subsidies and transfers provided by the government presents increments during and after presidential elections, as can be seen in Table 2. The average length of the PBC (6.1) exceeds the current length of presidential terms (5 years), which can be attributed to the abovementioned political instability of this country.

While this statistical description of PBCs cannot be considered a formal approach to study this subject (i.e., it lacks granular data on the effects of control variables like the growth rate of GDP, demographic variables, government spending components different from subsidies, tax reductions and exemptions, etc.), it provides an interesting preliminary view for the countries under study. A more formal approach would be required to reach stronger conclusions about these cycles and its drivers, but this is out of the scope of this document.

Financial fragility can also be related to business cycles, commonly represented by macroeconomic fluctuations that influence the GDP. As can be seen in Figure 14, business cycles, (measured by credit ratios —on consumption, mortgages, and firms— and the collaterals most used in financial markets —housing and equities—), vary across countries, but some of them exhibit similar patterns. That is the case of Colombia (in red) and Chile (in green), which show similar length and amplitude, and the highest pairwise correlation coefficient in the sample of countries (i.e. their correlation coefficient for the study period is 0.57). Indeed, these countries exhibit a kind of convergence from 2012 onwards. Ecuador (in brown) and Peru (in black) also exhibit similar cycles in the sample period, as it indicates their pairwise correlation coefficient (0.53).

The synchronicity of these countries' business cycles may well be considered moderate, as the co-movement measured by the reported correlations suggests. For the other countries, it can be said that business cycles are out of sync. This is particularly true in the case of Peru, which is the only country whose business cycle trend at the end of the study period is downward.

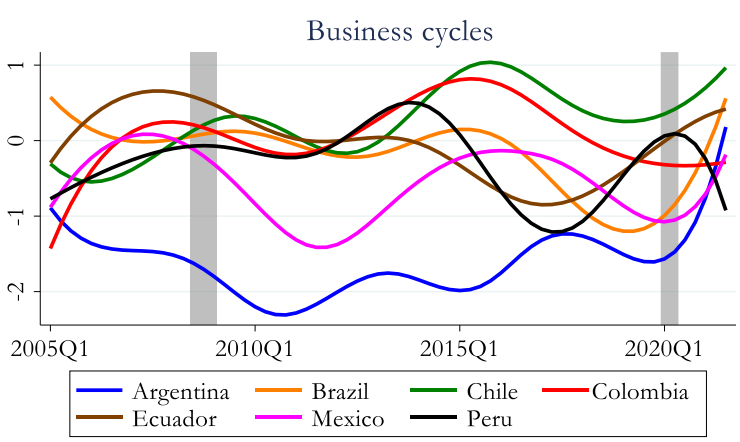


Figure 14. Subindexes for Business cycles
Notes: Gray shaded areas denote the GFC and the COVID-19 shock.

As regards the business cycle length, the average duration for all the countries in the sample lies between eleven and fifteen years (see Table 1), with the shortest length identified for the ratio of consumer credit to GDP (i.e., 8.3 years). Business cycle fluctuations were particularly strong before the GFC compared to those seen around the COVID-19 shock.

5.3. Some lessons and policy recommendations

The study of these episodes leaves us two lessons. Firstly, the drivers for the crisis and shock examined are key to understand their effects on financial fragility. The GFC was caused by financial factors: credit booms and increased risk-taking sowed the seeds for the GFC (Borio, 2014). The COVID-19 shock was caused by a health crisis that led to confinement measures taken by governments to contain the spread of that virus. The level of financial fragility of the countries studied were increasing before the emergence of the GFC due to global uncertainty but also to the rise and subsequent fall of international prices of commodities. Conversely, the level of financial fragility prior to the COVID-19 shock was not worrisome in any of the countries in the sample. However, during and after the confinement period, fragility levels increased considerably, causing pressures on financial markets.

The second lesson that these episodes leave us is that the timely reaction of the economic authorities is key to limit its negative effects on the financial system and economic activities. The

reaction of policymakers to the GFC took some time and the recovery process was also slow, even more so during the second-round impacts of the crisis. In contrast, the monetary policy reaction to the COVID-19 shock was immediate in almost all the countries examined.

If the levels of financial fragility, measured by the indexes at the country level, points to the emergence of crises or periods of financial instability, regulators and policymakers should step in and introduce measures to limit the contagion effects of a developing crisis. As we have largely discussed in Section 5, policy reactions to the two episodes studied were mainly based on central banks' unconventional measures that expanded the provision of liquidity to financial systems. However, the recovery of financial indicators was not immediate. The procliclality of the financial system played a key role in the recovery process observed after the GFC.

Macroprudential policy can provide an alternative solution to these episodes. As argued by De la Torre, Ize, and Schmukler (2012), this policy focuses on achieving sustainable financial system dynamics, which totally differs from the objectives that can be accomplished through monetary and fiscal policies. Monetary policy alone is insufficient to manage financial cycles given that real and financial transactions interact with other forces like financial excess and bubbles that may eventually form a financial crisis. Such forces can end up creating social inefficiencies not related to the main goal of monetary policy (i.e. controlling the inflation level and its volatility). Likewise, fiscal policy alone may not suffice to achieve a sustainable financial system. Indeed, the macrofinancial imperfections in the economy cannot be solved by a single instrument.

The macroprudential framework of the countries in sample is summarized in Table 3, where the existence (absence) of a particular tool is denoted as Yes (No) and where those in place before the GFC are accompanied by an asterisk (i.e. Yes*). The summarized information confirms that prior to the GFC few macroprudential measures were available in these countries.

As regards the tools applied to the banking sector (first panel of Table 3), the information reported unveils that prior to the GFC only three countries (COL, ECU, PERU) counted with measures that could have allowed to increase the resilience to credit booms. However, the battery of tools developed after that crisis suggests that most of these countries were poorly prepared to face its consequences. A very different situation was observed after the pandemic shock, as these countries had more measures in place to address the risks of credit booms.

Macroprudential measures targeting the household sector (second panel in Table 3) were very limited before both incidents. Indeed, only three countries (ARG, CHI, COL) implemented specific tools to mitigate the risks that may arise in this sector. The availability of measures that preceded the GFC exhibit minor changes, as very few measures were introduced in these countries. However, the lack of progress in all the other items makes clear all the work pending to implement.

Like the household sector, the corporate sector count on few measures to mitigate the systemic risks of loans (third panel in Table 3). Indeed, only two countries (ARG, CHI) had implemented tools to address the risk from loans to the corporate sector before the GFC. After this incident, no substantial changes were observed in the tools available, only few new macroprudential measures were introduced in Brazil, Mexico, and Peru.

Table 3. Macroprudential policy survey by country

	ARG	BRA	CHI	COL	ECU	MEX	PER
Broad-Based Tools Applied to the Banking Sector							
Countercyclical capital buffer	Yes	Yes	Yes	No	No	Yes	Yes
Capital conservation buffer	Yes	Yes	Yes	Yes	No	Yes	No
Limit on leverage ratio	Yes	Yes	Yes	Yes	Yes	Yes	No
Forward-looking loan loss provisioning requirement	Yes	Yes	Yes	Yes*	No	Yes	Yes*
Cap on credit growth	No	No	No	No	No	No	No
Limit on distributions	Yes	Yes	No	No	Yes*	Yes	No
Other broad-based measures to increase resilience or address risks from broad-based credit booms	Yes	Yes	No	No	No	Yes	Yes*
Household Sector Tools							
Household sector capital requirements	Yes*	Yes	Yes*	No	No	Yes	Yes
Cap on credit growth to the household sector	No	No	No	No	No	No	No
Loan restrictions or Borrower eligibility criteria	No	Yes	Yes	Yes*	Yes	Yes	Yes
Exposure caps on household credit	No	No	No	Yes	No	No	Yes
Fiscal measures to contain systemic risks	No	No	No	No	No	No	No
Other measures to mitigate systemic risks from loans to the household sector	No	No	No	No	No	No	No
Corporate Sector Tools							
Corporate sector capital requirements	Yes*	Yes	Yes*	No	No	Yes	Yes
Cap on credit growth to the corporate sector	No	No	No	No	No	No	No
Loan restrictions or Borrower eligibility criteria	Yes	No	Yes*	No	No	No	No
Exposure caps on corporate credit	No	No	Yes*	No	No	No	No
Fiscal measures to contain systemic risks	No	No	No	No	No	No	No
Other measures to mitigate systemic risks from loans to the corporate sector	No	No	No	No	No	Yes	No
Liquidity Tools Applied to the Banking Sector							
Liquidity buffer requirements	Yes	Yes	Yes	Yes	Yes*	Yes	Yes
Stable funding requirements	Yes	Yes	Yes	Yes	Yes	Yes	No
Levies or charges on noncore funding	No	No	No	No	No	No	No
Reserve requirements for macroprudential purposes	Yes*	Yes	Yes	Yes	No	No	Yes
Limits on foreign exchange positions	Yes	Yes	Yes	Yes*	No	Yes*	Yes
Constraints on foreign exchange funding	No	No	No	No	No	No	No
Other measures to mitigate systemic liquidity risks	Yes	No	No	No	Yes	No	No

Notes: the existence (absence) of a particular tool is denoted as Yes (No). Results marked with an asterisk represent macroprudential measures put in place before the GFC. All the other results represent measures introduced after the GFC and prior to the COVID-19 shock. Source: Authors' design using the Macroprudential Policy Survey of the IMF.

Macroprudential measures geared towards lessening liquidity risks in the banking sector (fourth panel in Table 3) were also scarce prior to the global financial crisis, when measures of this type were only available in Argentina, Colombia, Ecuador, and Mexico.

Hence, a crucial step to stabilize the financial system in the face of financial crises consists of fully implementing countercyclical measures (COL, ECU), such as building up capital and liquidity buffers in good times to face financial tensions in bad times. Much progress has been made in this regard, given that unlike Basel I and II which were inherently procyclical prudential norms, Basel III added macroprudential elements to the regulatory framework. For instance, the introduction of capital buffers build-up in good times to be used in bad times and capital buffers to address the externalities created by systemically important banks (see BCBS, 2017). Indeed, most of the countries in the sample have already started to implement the Basel III accord by the time the COVID-19 shock hit these economies (see CGD-IDB WG, 2020).

Another policy implication would be to consider the design and implementation of a special regulatory framework for the non-bank financial sector. The activities conducted by credit unions and leasing companies, among others, may benefit from setting regulatory standards like the Basel III framework adapted to their specific businesses. The design of this special regulatory approach is currently under examination in countries like Ireland (see Makhlouf, 2023).

Conclusions

Financial fragility builds up gradually over time, commonly driven by domestic financial conditions (i.e., credit booms and busts, and large appreciations in house and equity prices) and, to a lesser extent, by global imbalances in capital flows. We examine this issue by applying the EEMD method on financial indicators of seven Latin American countries in a period in which two global episodes hit financial markets: the GFC and the COVID-19 shock.

Our results show that, although there is considerable heterogeneity in these countries, most of them accumulated financial vulnerabilities before and during the GFC and most of them showed signs of financial health before the COVID-19 shock but experienced financial imbalances during and after the confinement period. The differences in the levels of financial fragility are also related to the reactions of the economic authorities to these episodes, as well as to

idiosyncratic aspects such as local economic conditions, dollarization schemes, among others. Policy implication derived from this study underline the relevance of fully implementing macroprudential policies based on countercyclical measures to mitigate the effects of shocks and crises on financial markets. Central banks and supervisory authorities should continue implementing countercyclical policies (i.e., easing of capital requirements) to weather economic stress in crisis periods. Similarly, it is advisable that they consider the design and implementation of a special regulatory framework for non-bank activities (conducted by credit unions and leasing companies). Another key point is the linkages between countries related to the trade and financial sectors, given that these could increase the odds of facing global imbalances. Specific actions should be considered to limit the effects that substantial capital flows can generate in emerging markets, before and during those stressed periods.

As byproducts of the EEMD method, we obtain subindexes of the political and business cycles. There was found evidence of slight co-movements that reveals similarities in the political budget cycles but also in the business cycles of some countries in the Latin American region. Again, trade and financial linkages are the main drivers of these co-movements.

References

Acosta, A. (2009). Ecuador: ¿Un País Maniatado Frente a la Crisis?, *Fundación Friedrich Ebert Stiftung*

Adrian, T., Ashcraft, A., Cetorelli, N. (2015). "Shadow Bank Monitoring", *The Oxford Handbook of Banking*, Second Edition, Oxford University Press, 378-407

Alesina, A. (1987). "Macroeconomic Policy in a Two-party System as a Repeated Game", *Quarterly Journal of Economics,* 102, 651-678

Ames, B. (1987). Political Survival: Politicians and Public Policy in Latin America. Berkeley: University of California Press

Antoniades, A., Calomiris, Ch. (2020). "Mortgage Market Credit Conditions and US Presidential Elections", *European Journal of Political Economy*, 64

Banco Central de Chile (2008). Memoria Anual 2008

Banco Central de Chile (2020). Recuadro II.1. Medidas del Banco Central de Chile para Enfrentar el Covid-19, Informe de Política Monetaria, March

Banco Central de Chile (2021). El Rol de las Políticas Macroeconómicas en la Mitigación de la Crisis del Covid-19, Informe de Política Monetaria, September

Banco Central de Reserva del Perú (2009). Medidas Monetarias del BCRP Frente a la Crisis Internacional. Reporte de Inflación, September

Banco Central de la República Argentina (2008). Informe al Honorable Congreso de la Nación

Banco central do Brasil (2020). Dealing with The Effects of the COVID-19 Crisis, Press Conference, March

Banco de la República (2009). "Informe de la Junta Directiva al Congreso de la República", March

Banco de la República (2020a). Banco de la República Expands Support to Liquidity of The Economy in Pesos and US dollars, March

Banco de la República (2020b). Banco de la República Injects Permanent Liquidity to The Market by Reducing Reserve Requirements and Reinforces Intervention in The Public Debt Market, April

Banco de México (2009). Consideraciones sobre La Crisis Financiera y sus Efectos Sobre La Economía Mexicana, January

Banco de México (2020). Políticas Económicas Consideradas en México para Enfrentar el Panorama Adverso generado por la Pandemia de COVID-19, Informe Trimestral enero – marzo, May

Barberia, L., Avelino, G. (2011). "Do Political Budget Cycles Differ in Latin American Democracies?, *Economia*, 11, 101-134

Baxter, M., King, R. (1999). "Measuring Business Cycles: Approximate Band-pass Filters for Economic Time Series", *The Review of Economics and Statistics*, 84 (1), 575 - 593

Benink, H.A. (1996). *Financial Fragility*, PhD Thesis, Maastricht University

Benink, H.A. (2020). "Global Bank Capital and Liquidity After 30 Years of Basel Accords", *Journal of Risk and Financial Management*, 13, 73

BCBS – Basel Committee on Banking Supervision – (2017). "High-level Summary of Basel III Reforms", December

Blaydes, L. (2010). Electoral Budget Cycles and Economic Opportunism, in Elections and Distributive Politics in Mubarak's Egypt. Cambridge University Press

Block. S., Ferree, K., Singh, S. (2003). "Multiparty Competition, Founding Elections and Political Business Cycles in Africa", *Journal of African Economies*, 12 (3), 444-468

Borio, C. (2014). "The Financial Cycle and Macroeconomics: What Have We Learnt?", *Journal of Banking and Finance*, 45, 182-198

Borio, C., Disyatat, P., Juselius, M. (2017). "Rethinking Potential Outcome: Embedding Information About the Financial Cycle", *Oxford Economic Papers* 69 (3), 655-677

Borio, C., Drehmann, M. (2009). "Assessing The Risk of Banking Crises— Revisited", *BIS Quarterly Review*, March

Borio, C., Lowe, P. (2002). "Asset Prices, Financial and Monetary Stability: Exploring the Nexus", BIS Working Paper No. 114

Borio, C., McCauley, R., McGuire, P. (2011). "Global Credit and Domestic Credit Booms", *BIS Quarterly Review*, 43–57

Brender, A., Drazen, A. (2005). "Political Budget Cycles in New Versus Established Democracies", *Journal of Monetary Economics*, 52, 1271-1295

Burns, A., Mitchell, W. (1946). Measuring Business Cycles. New York: NBER

Caballero, R., Krishnamurthy, A. (2009). "Global Imbalances and Financial Fragility", *American Economic Review* 99, 584-588

Calomiris, Ch. (1995). "Financial fragility", *Journal of Financial Services Research*, 9, 241-247

Canales-Kriljenko, J., Jácome, L., Alichi, A., Oliveira, I. (2010). "Weathering the Global Storms: The Benefits of Monetary Policy Reform in The LA5 Countries", IMF WP/10/292

Carvalho, D. (2014). "The Real Effects of Governments-owned Banks: Evidence from an Emerging Market", *The Journal of Finance*, 69(2), 577-609

Castillo, L., Ruiz, M. (2020). "Covid en el Perú: Medidas de Soporte a Hogares y Empresas", Revista Moneda 182, June

Central bank of Argentina (2021). "The Covid-19 Crisis Response, Monetary and Fiscal Policy Interactions: The Case of Argentina", BIS papers No. 122

CEPAL (2009). Balance Preliminar de las Economías de América Latina y el Caribe

Cetorelli, N., Goldberg, L. (2011). "Global Banks and International Shock Transmission: Evidence from the Crisis", *IMF Economic Review* 59, 41-76

CGD-IDB WG - Working group - (2020). "Sound Banks for Healthy Economies: Challenges for Policy Makers in Latin America and The Caribbean in Times of Coronavirus", October

CGFS (2010). "Funding Patterns and Liquidity Management of Internationally Active Banks", CGFS Paper 139

Claessens, S., Kose, M., Terrones, M. (2009). "What Happens During Recessions, Crunches, and Busts?", *Economic Policy*, 24 (October), 653–700

Claessens, S., Kose, M., Terrones, M. (2011). Financial Cycles: What? How? When?, NBER

CLAF —Latin American Committee on Macroeconomic and Financial Issues— (2020). "The COVID-19 Attack on Latin America: Proposals for an Effective Response", Statement 43, July

Claessens, S., Feijen, E., Laeven, L. (2008). "Political Connections and Preferential Access to Finance: The Role of Campaign Contributions", *Journal of Financial Economics*, 88, 554-580

Cole, S. (2009). "Fixing Market Failures or Fixing Elections?: Agricultural Credit in India", *American Economic Journal of Applied Economics*, 1 (1), 219-250

Crockett, A.D. (1995), "Financial Fragility: Sources, Prevention and Treatment", in: H.A. Benink (ed.), *Coping with Financial Fragility and Systemic Risk*, Kluwer Academic Publishers, Boston/Dordrecht/London, pp. 267-277

Croux, C., Forni, M., Reichlin, L. (2001). A Measure of Comovement for Economic Variables: Theory and Empirics. *The Review of Economics and Statistics*, 83, 232–241de Haan, J., Inklaar, R., Jong-A-Pin, R. (2008). "Will Business Cycles in the Euro Area Converge? A Critical Survey of Empirical Research", *Journal of Economic Surveys*, 22 (2), 234-273

de Haan, J., Klomp, J. (2013). "Conditional Political Budget Cycles: A Review of Recent Evidence", *Public Choice*, 157, 387-410

De la Torre, A., Ize, A., and Schmukler, S. (2012). "Financial Development in Latin America and The Caribbean: The Road Ahead", The World Bank

Delgado, O. (2013). "El Banco de México en el Contexto de la Crisis Financiera Global", Análisis No. 15, May-August

Dell'Ariccia, G., Igan, D., Laeven, L., Tong, H. (2012). "Policies for Macrofinancial Stability: How to Deal with Credit Booms", IMF Discussion Note, April

Dinç, S. (2005). "Politicians and Banks: Political Influences on Government-owned Banks in Emerging Markets", *Journal of Financial Economics*, 77, 453-479

Drazen, A. (2000). The Political Business Cycle After 25 Years. In Bernanke B, Rogoff (Eds), NBER Macroeconomics Annual 2000. MIT Press, Cambridge, MA pp 75-117

Drazen, A. Eslava, M. (2010). "Electoral Manipulation Via Voter-friendly Spending: Theory and Evidence", *Journal of Development Economics*, 92 (1), 39-52

Drehmann, M., Borio, C., Gambacorta, L., Jiménez, G., Trucharte, C. (2010). "Countercyclical Capital Buffers: Exploring Options", BIS Working Paper 317

Drehmann, M., Borio, C., Tsatsaronis, K. (2012). "Characterizing the Financial Cycle: Don't Lose Sight of the Medium Term!", BIS Working Paper 380, June

Egorov, G., Sonin, K. (2020). "Elections in Non-democracies", *The Economic Journal*, 131, 1682–1716

European Shadow Financial Regulatory Committee (2016). "Towards Banking Union and Capital Markets Union in Europe: The Role of Shadow Banks", Statement No. 41, Brussels

Franzese, R. (2002). Macroeconomic policies of developed democracies. Cambridge University Press.

Gatti, delli D., Gallegatti, M. (1995). "Financial Fragility and Economic Fluctuations: Keynesian Views", *Economic Notes* (Banca Monte dei Paschi di Siena), Vol. 24, 513-554

Giordani, P., Spector, E., Zhang, X. (2017). "An Early Warning Indicator of Financial Fragility in Sweden", *Economic Commentaries*, 1, January

Giordani, P., Kwan, S. (2019). "Tracking Financial Fragility", Federal Reserve Bank of San Francisco, Working Paper 2019-06, February

Gonzalez, M. (2002). "Do Changes in Democracy Affect the Political Budget Cycle? Evidence from Mexico", *Review of Development Economics*, 6(2), 204-224

Hamilton, J. (2018). "Why you Should Never Use the Hodrick-Prescott Filter", *The Review of Economics and Statistics*, 100(5), 831-843

Han, K. (2022). "Political Budgetary Cycles in Autocratic Redistribution", *Comparative Political Studies*, 55(5) 727–756

Harding, D., Pagan, A. (2002). "Dissecting the Cycle: A Methodological Investigation", *Journal of Monetary Economics*, 49(2), 365–381

Helske, J., Luukko, P. (2021). "Ensemble Empirical Mode Decomposition (EEMD) and Its Complete Variant (CEEMDAN)", CRAN repository

Hibbs, D. (1977). "Political Parties and Macroeconomic Policy", *American Political Science Review*, 71, 1467-1487

Higashijima, M. (2022). Economic Maneuvering, in The Dictator's Dilemma at the Balot Box: Electoral Manipulation, Economic Maneuvering, and Political Order in Autocracies, (Chapter 5), University of Michigan Press

Hodrick, R., Prescott, E. (1997). "Post-war U.S. Business Cycles: An Empirical Investigation", *Journal of Money Credit and Banking*, 29, 1-16

IDB (2020). "Summary of The Main Economic, Monetary and Financial Policy Measures taken in the Face of the Global Pandemic COVID-19", March

IMF (2020). Global Financial Stability Report: Markets in times of COVID-19, April

IMF (2021). Policy Responses to COVID-19

IMF (2022). "Navigating the High-Inflation Environment", *Global Financial Stability Report*, October

Kaminsky, G., Reinhart, C. (1999). "The Twin Crisis: The Causes of Banking and Balance-of-Payments Problems", *American Economic Review*, Vol. 89 (3), 473-500

Khwaja, A., Mian, A. (2005). "Do Lenders Favor Politically Connected Firms? Rent Provision in an Emerging Financial Market, *The Quarterly Journal of Economics,* 120(4), 1371-1411

Knight, F.K. (1921). *Risk, Uncertainty and Profit*, University of Chicago Press, Chicago (published in book form in 1992)

MacRae, D. (1977). "A Political Model of the Business Cycle", *Journal of Political Economy*, 85 (2), 239-263

Makhlouf, G. (2023). "Has Europe Moved Beyond Financial Fragility?", Speech at Hertie School, Berlin, February 14

Mao, X., Yang, A., Peng, Ch., Shang, P. (2020). "Analysis of Economic Growth Fluctuations based on EEMD and Causal Decomposition", *Physica A*, 553

Massmann, M., Mitchell, J. (2004). Reconsidering The Evidence: Are Eurozone Business Cycles Converging?, *Journal of Business Cycle Measurement and Analysis*, 1(3), 275–308

Miller. M.H. (1986). "Financial Innovation: The Last Twenty Years and The Next", *Journal of Financial and Quantitative Analysis*, 21, 459-471

Miller, M.H. (1988). "The Modigliani-Miller Propositions After Thirty Years, *Journal of Economic Perspectives*, 2, 99-120

Miller, M.H. (1991). "Leverage", *Journal of Finance*, 46, 479-488

Ministerio de Hacienda (2021). Fondo de Mitigación de Emergencias -FOME: Medidas Económicas Adoptadas para la Atención de la Emergencia Ocasionada por el COVID-19

Minsky, H.P. (1975). *John Maynard Keynes*, Columbia University Press, New York

Minsky, H.P. (1977). "A Theory of Systemic Fragility", in: E.I. Altman and A.W. Sametz (eds.), *Financial Crises: Institutions and Markets in a Fragile Environment*, John Wiley & Sons, New York, 138-152

Montoro, C., Pérez, F., Herrada, R. (2020). Medidas de BCRP Frente a la Pandemia del Nuevo Coronavirus", Revista Moneda 182, June

Moura, A. (2022). "Why You Should Never Use the Hodrick-Prescott Filter: Comment", MPRA Paper No. 114922, https://mpra.ub.uni-muenchen.de/114922/

Nieto-Parra, S., Santiso, J. (2009). "Revisiting Political Budget Cycles in Latin America", OECD Working Paper 281

Nordhaus, W. (1975). "The Political Business Cycle", *Review of Economic Studies*, 42, 169-190

OCDE (2020). Impacto Macroeconómico del COVID-19 en Ecuador: Desafíos y Respuestas, Making Development Happen Vol. 5

Oladosu, G. (2009). "Identifying the Oil Price-macroeconomy Relationship: An Empirical Mode Decomposition Analysis of US Data". *Energy Policy* 37, 5417-5426

Output Gap WG (2019). "A Practitioner's Guide to Potential Output and the Output Gap", *Network of European Union Independent Fiscal Institutions*

Parlamento Andino (2021). Principales Medidas Adoptadas por el Gobierno Ecuatoriano frente a la Emergencia Provocada por la COVID-19, April 13

Pepinsky, P. (2007). "Malaysia: Turnover Without Change", *Journal of Democracy*, 18 (1), 113-127

Pereira, L., Harris, R. (2012). "Sailing Through The Global Financial Storm: Brazil's Recent Experience with Monetary and Macroprudential Policies to Lean Against The Financial Cycle and Deal with Systemic Risks", Working Paper Series 290, Banco central do Brasil

Persson, T., Tabellini, G. (2009). "Democratic Capital: The Nexus of Political and Economic Change", *American Economic Journal: Macroeconomics*, 1(2), 88-126

Ravn, M., Uhlig, H. (2002). "Notes On Adjusting The Hodrick-Prescott Filter for The Frequency of Observations", *The Review of Economics and Statistics*, 84 (2), 371-380

Remmer, K. (2013). The Political Economy of Elections in Latin America, 1980-1991, Cambridge University Press

Rogoff, K., Siebert, A. (1988). "Elections and Macroeconomic Policy Cycles", *Review of Economic Studies*, 55, 1-16

Rogoff, K. (1990). "Equilibrium Political Budget Cycles" *American Economic Review*, 80, 21-36

Sapienza, P. (2004). "The Effects of Government Ownership on Bank Lending", *Journal of Financial Economics*, 72, 357-384

Sensoy, A., Ozturk, K., Hacihasanoglu, E. (2014). "Constructing a Financial Fragility Index for Emerging Countries", *Finance Research Letters*, 11, 410-419

Shi, M., Svensson, J. (2000). "Political Business Cycles in Developed and Developing Countries", The World Bank, Working Paper

Shi, M., Svensson, J. (2006). Political Budget Cycles: Do They Differ Across Countries and Why? *Journal of Public Economies*, 90, 1367-1389

Shmuel, A. (2020). "The Political Budget Cycle Across Varying Degrees of Democracy", *Electoral Studies*, 68

Socoloff, I. (2020). "Subordinate Financialization and Housing Finance: The Case of Indexed Mortgage Loans' Coalition in Argentina", *Housing Policy Debate*, 30 (4), 585-605

Soh, B. (1988). "Political Instability and Economic Fluctuations in the Republic of Korea", *Public Choice*, 57, 259–274

Stallone, A., Cicone, A., Materassi, M. (2020). "New Insights and Best Practices for The Successful Use of Empirical Mode Decomposition, Iterative Filtering and Derived algorithms", *Scientific Reports*, 10

Stock, J., Watson, M. (1999). "Business Cycle Fluctuations in US Macroeconomic Time Series." In Handbook of Macroeconomics, vol. 1., ed. John B. Taylor and Michael Woodford. Amsterdam: North-Holland

Superintendencia de Bancos (2020). Resolución No. SB-2020-504, March 23

Wolf, M. (2014). "Financial Reform: Call to Arms", *Financial Times*, September 3

Wu, Z., Huang, N.E. (2009). "Ensemble Empirical Mode Decomposition: A Noise Assisted Data Analysis Method", *Advances in adaptive data analysis*, 01(01), 1-41

Appendix

Table A.1 Description of variables

Country	Variable	Description or proxy variable used	Source
Argentina	GDP		National Bureau of Statistics (INDEC)
	Private gross domestic credit		Banco Central de la República Argentina
	Private credit to GDP ratio	Credit to the private non-financial sector	BIS
	Consumer credit		Banco Central de la República Argentina
	Mortgage debt		Banco Central de la República Argentina
	House price	Construction cost index in Greater Buenos Aires	National Bureau of Statistics (INDEC)
	Rent price	Housing costs of the CPI in Greater Buenos Aires	National Bureau of Statistics (INDEC)
	Stock market capitalization		Ibero-American Federation of Stock Exchanges
	Net flows to the banking sector	Claims and liabilities to commercial banks	BIS
Brazil	GDP		Federal Reserve Bank of St. Louis
	Private gross domestic credit		IMF-Financial Soundness Indicators (FSI)
	Private credit to GDP ratio	Credit to the private non-financial sector	BIS
	Consumer credit		Banco Central do Brasil
	Mortgage debt		IMF-Financial Soundness Indicators (FSI)
	House price	Residential property prices	BIS
	Rent price	Housing costs of the CPI	National Bureau of Statistics (IBGE)
	Stock market capitalization		Ibero-American Federation of Stock Exchanges
	Net flows to the banking sector	Claims and liabilities to commercial banks	BIS
Chile	GDP		Federal Reserve Bank of St. Louis
	Private gross domestic credit		IMF-FSI
	Private credit to GDP ratio	Credit to the private non-financial sector	BIS
	Consumer credit		Banco Central de Chile
	Mortgage debt		Banco Central de Chile
	House price	Residential property prices	BIS
	Rent price	Housing costs of the CPI	Cámara Chilena de la Construcción
	Stock market capitalization		Ibero-American Federation of Stock Exchanges
	Net flows to the banking sector	Claims and liabilities to commercial banks	BIS
Colombia	GDP		National Bureau of Statistics (DANE)
	Private gross domestic credit		IMF-FSI
	Private credit to GDP ratio	Credit to the private non-financial sector	BIS
	Consumer credit		Financial Superintendency of Colombia
	Mortgage debt		Financial Superintendency of Colombia
	House price	Residential property prices	BIS
	Rent price	Housing costs of the CPI	National Bureau of Statistics (DANE)
	Stock market capitalization		Ibero-American Federation of Stock Exchanges
	Net flows to the banking sector	Claims and liabilities to commercial banks	BIS
Ecuador	GDP		Banco Central del Ecuador
	Private gross domestic credit		IMF-FSI
	Consumer credit		Banks Superintendency
	Mortgage debt		Banks Superintendency
	House price	IPC Construction; by type of construction	National Bureau of Statistics (INEC)
	Rent price	Housing costs of the CPI	National Bureau of Statistics (INEC)
	Stock market capitalization		Ibero-American Federation of Stock Exchanges
	Net flows to the banking sector	Claims and liabilities to commercial banks	BIS
Mexico	GDP		Banxico
	Private gross domestic credit		IMF-FSI
	Private credit to GDP ratio	Credit to the private non-financial sector	BIS
	Consumer credit		Banxico
	Mortgage debt		Banxico
	House price	Residential property prices	BIS
	Rent price	Housing costs of the CPI	National Bureau of Statistics (INEGI)
	Stock market capitalization		Ibero-American Federation of Stock Exchanges
	Net flows to the banking sector	Claims and liabilities to commercial banks	BIS
Peru	GDP		National Bureau of Statistics (INEI)
	Private gross domestic credit	Credit to the private non-financial sector	IMF-FSI
	Consumer credit		Superintendency of banks
	Mortgage debt		Superintendency of banks
	House price	Residential property prices	BIS
	Rent price	Housing costs of the CPI	National Bureau of Statistics (INEI)
	Stock market capitalization		Ibero-American Federation of Stock Exchanges
	Net flows to the banking sector	Claims and liabilities to commercial banks	BIS

Table A.2 Summary statistics

		Obs.	Mean	Std deviation	Min	Max
Argentina	Consumer credit-to-GDP ratio	67	0,039	0,010	0,014	0,057
	Mortgage credit-to-GDP ratio	67	0,011	0,003	0,006	0,016
	Corporate credit-to-GDP ratio	67	0,192	0,040	0,138	0,298
	House price to rent ratio	67	1,478	0,673	0,617	3,183
	Stock market capitalization-to-GDP	68	0,122	0,051	0,056	0,261
	Net flows to the banking sector	67	0,002	0,004	-0,008	0,010
Brazil	Consumer credit-to-GDP ratio	67	0,094	0,020	0,048	0,138
	Mortgage credit-to-GDP ratio	67	0,053	0,030	0,012	0,101
	Corporate credit-to-GDP ratio	67	0,509	0,087	0,381	0,687
	House price to rent ratio	67	0,865	0,196	0,536	1,168
	Stock market capitalization-to-GDP	68	0,521	0,133	0,281	0,986
	Net flows to the banking sector	67	0,034	0,023	-0,003	0,133
Chile	Consumer credit-to-GDP ratio	67	0,089	0,009	0,066	0,104
	Mortgage credit-to-GDP ratio	67	0,195	0,049	0,113	0,291
	Corporate credit-to-GDP ratio	67	0,955	0,187	0,685	1,359
	House price to rent ratio	67	1,147	0,110	0,904	1,367
	Stock market capitalization-to-GDP	68	0,978	0,210	0,486	1,522
	Net flows to the banking sector	67	0,014	0,025	-0,044	0,050
Colombia	Consumer credit-to-GDP ratio	67	0,103	0,032	0,039	0,160
	Mortgage credit-to-GDP ratio	67	0,039	0,019	0,018	0,076
	Corporate credit-to-GDP ratio	67	0,394	0,049	0,326	0,485
	House price to rent ratio	67	1,029	0,068	0,870	1,128
	Stock market capitalization-to-GDP	68	0,425	0,133	0,190	0,734
	Net flows to the banking sector	67	0,013	0,009	-0,006	0,029
Ecuador	Consumer credit-to-GDP ratio	67	0,078	0,019	0,041	0,121
	Mortgage credit-to-GDP ratio	67	0,021	0,003	0,016	0,027
	Corporate credit-to-GDP ratio	67	0,182	0,065	0,111	0,346
	House price to rent ratio	67	0,940	0,079	0,850	1,177
	Stock market capitalization-to-GDP	68	0,074	0,010	0,061	0,101
	Net flows to the banking sector	67	-0,018	0,016	-0,066	0,006
Mexico	Consumer credit-to-GDP ratio	67	0,049	0,008	0,029	0,061
	Mortgage credit-to-GDP ratio	67	0,096	0,012	0,072	0,122
	Corporate credit-to-GDP ratio	67	0,201	0,051	0,125	0,292
	House price to rent ratio	67	1,047	0,045	0,958	1,142
	Stock market capitalization-to-GDP	68	0,344	0,057	0,200	0,443
	Net flows to the banking sector	67	-0,029	0,011	-0,051	-0,009
Peru	Consumer credit-to-GDP ratio	67	0,070	0,023	0,031	0,121
	Mortgage credit-to-GDP ratio	67	0,048	0,018	0,022	0,080
	Corporate credit-to-GDP ratio	67	0,227	0,060	0,118	0,357
	House price to rent ratio	67	1,066	0,270	0,579	1,500
	Stock market capitalization-to-GDP	68	0,428	0,090	0,254	0,652
	Net flows to the banking sector	67	-0,021	0,024	-0,071	0,029

Notes: This table presents general descriptive statistics of financial fragility measures at the country level, computed with quarterly data between the first quarter of 2005 and the first quarter of 2021.

Appendix A.3 Economic measures against the crises

This Appendix reviews the economic measures introduced by policy makers (central banks, supervisory agencies, and governments) to face the GFC and the COVID-19 shock.

The Global Financial Crisis

- **Argentina**

Banco Central de la República Argentina reacted to the crisis anticipating the repurchase of notes issued by the central bank (LEBAC, NOBAC), and conducting put options and open market operations on sovereign bonds. It additionally launched a temporary liquidity window that accepted non-traditional collateral (i.e., bonds and secured loans) and modified the discount window to make its use more agile when required. Along with these measures, the central bank carried out foreign exchange operations and reductions in the reserve requirements ratio for US dollars to provide financial institutions with more liquidity in foreign currency (Banco Central de la República Argentina, 2008).

- **Brazil**

Within the countercyclical measures introduced by Banco central do Brasil are the reduction in the reserve requirements in an amount equivalent to 4% of GDP (which allowed commercial banks to grant credits in US dollars to the private sector) and the reduction the policy rate from 13.75% in end-2008 to 8.75% in July 2009. Besides, the central bank offered 7% of international reserves at the end of 2008 in spot markets auctions and foreign exchange swap contracts to reduce the large foreign exchange derivative exposures of domestic corporations. The Brazilian government implemented tax exemptions and credit extensions by public financial institutions in an amount equivalent to 3.3% of GDP (Pereira and Harris, 2012).

- **Chile**

The central bank of Chile implemented several reductions in the policy rate (from 8.25% in September 2008 to 0.5% in July 2009) and authorized banks and other credit institutions to

temporarily hold reserve requirements in foreign currency (i.e., US dollars, euros, and yens). It additionally allowed that term deposit certificates and privately issued securities were accepted in the range of collateral eligible for REPO operations, with the aim of increasing liquidity in financial institutions. The government implemented a countercyclical fiscal policy directed to stop the slowdown in economic activity. These measures were equivalent to 2.8% of the GDP, and included subsidies, programs to promote employment, public investment, and credits to support small- and medium-sized firms (CEPAL, 2009; Banco Central de Chile, 2008).

- **Colombia**

The low levels of inflation registered when the crisis hit the economy allowed the central bank to implement countercyclical measures, such as the elimination of the non-remunerated marginal reserve requirement ratio on bank deposits, and the reduction of the ordinary reserve requirement ratio for current and deposits accounts (from 11.5% to 11.0%) and term deposits certificates (from 6% to 4.5%) in November 2008. The policy rate (intervention interest rate) was cut in 300 basis points between December 2008 and March 2009, placing it at 7%. In addition to the above, the central bank intervened the foreign exchange market to lessen the volatility of the exchange rate against the US dollar. The fiscal space for the Colombian government was very limited at that time, which prevented the use of expansionary fiscal measures to face the crisis (Banco de la República, 2009).[14]

- **Ecuador**

To tackle the negative effects of this crisis, the Ecuadorian government bought part of the mortgage loans from commercial banks to support the liquidity in the financial system. The central bank kept interest rates unchanged, but bank deposits were substantially reduced in the first quarter of 2009 due to the strong restrictions on new credits that commercial banks imposed to preserve liquidity and take fewer risks. In face of the impossibility to devaluate its currency due to the dollarization process active since January 2000, the government adopted a trade

[14] The inflation targeting regime and the flexible exchange rate adopted in Colombia since 1999 allowed the central bank to use macroprudential measures before and during the GFC (Banco de la República, 2009).

protectionism to safeguard employments through the reduction of imports. Besides, the government increased its external debt with international organizations (the Latin American Reserve Fund, Inter-American Development Bank, and the Development Bank of Latin America) to continue financing investment projects (Acosta, 2009).

- **Mexico**

Banco de Mexico's measures are comprised by the repurchase of government securities issued by the Institute for the Protection of the Banking Savings, swaps on interest rates, provision of liquidity to investment societies, and the repurchase of long-term sovereign bonds. The central bank gradually reduced the policy rate (i.e., reference rate, from 8.25% in November 2008 to 4.50% in August 2009), introduced FX swaps to reduce the funding problems in US dollars, and implemented programs to capitalize financial institutions. The government also intervened, implementing fiscal measures to promote consumption and investment, such as freezing gas prices during 2009, reducing electricity costs, increasing investment in infrastructure, offering loans to refinance the non-financial private sector, and granting subsidies to protect employment in small- and medium-sized firms. The cost of the fiscal measures was estimated in 2.2% of GDP (Banco de Mexico, 2009; Delgado, 2013).

- **Peru**

The central bank of Peru responded to the GFC by reducing the reserve requirements ratio and introducing repos with maturities of up to a year, FX swaps, and repurchasing the central bank's term certificates. The policy rate (reference rate) was not reduced before 2009 to avoid the risk that inflation expectations did not fall and that a currency crisis and a sharp credit crunch occurred, as these episodes usually arise in highly dollarized economies as the Peruvian. Since July 2009, the central bank conducted FX swaps operations of up to one year to reduce the funding costs of financial institutions and reduced the interest rate on credits denominated in US dollars, especially those directed to microfinance. These measures neutralized the extreme volatility of the exchange rate that strongly affects dollarized economies in times of crisis (Banco Central de Reserva del Perú, 2009).

The COVID-19 shock

- **Argentina**

The central bank of Argentina reduced the reserve's requirement ratio, which allowed that special credit lines were offered to micro, small- and medium-sized private firms (to cover their operating costs, including wages) and independent workers in the lowest tax brackets. It additionally provided temporary financing to the Treasury, through direct loans and profit transfers to the national government (for a total of 7.6% of GDP in 2020), given that the access to international debt markets was restricted (a debt restructuring process was underway), and the domestic debt market was also awaiting a reconstruction process (Central bank of Argentina, 2021). The government increased health spending and offered subsidies for the low-income families and unemployed, as well as to the productive sectors producing food and basic supplies. The cost of the fiscal measures was 5% of total GDP in 2020 (IMF, 2021).

- **Brazil**

The central bank of Brazil reduced the policy rate from 4.25% in February to 2% in August 2020, the bank's reserve requirements on time deposits from 31% to 17% in March 2020, and the remuneration on reserve requirements on savings accounts. It additionally launched a temporary liquidity line for financial institutions collateralized with private corporate bonds and introduced changes to the regulation to renegotiate non-overdue debt of households and firms and offered credits to the agribusiness sector. The central bank additionally conducted one-year term repos backed by sovereign bonds to increase short-term liquidity and undertook spot interventions in the foreign exchange market to safeguard the exchange rate stability. The government provided subsidies to vulnerable households, tax breaks and credits for firms protecting employments, transfers to strengthen the health system, cash transfers to informal and low-income workers, and the expansion of the government welfare program Bolsa de Familia. These measures were equivalent to 21.2% of GDP (IDB, 2020; Banco central do Brasil, 2020; IMF 2021).

- **Chile**

The central bank of Chile reduced the monetary policy rate from the 2% to 0.5% in March 2020, launched two temporary liquidity facilities. One of these facilities was the Financing Conditional on the Increase in Credit placements (collateralized facility offered at a cost given by the policy rate or its lowest level in the six-month period in which this program was available) and the Liquidity Credit Line (based on the average legal reserve of each bank in local currency). Access to these facilities was conditional on the increase in credits that each bank granted to households and firms. In addition to the above, the central bank added corporate bonds to the range of eligible collateral to access central bank's liquidity operations, put in place the forex sales program and the extension of the terms in repo and FX-swap operations (to facilitate the access to financing in foreign currency). The fiscal measures used in 2021, were mostly directed at household support programs and employment subsidies for a value that represented 4.7% of GDP (Banco Central de Chile, 2020, 2021).

- **Colombia**

The central bank of Colombia gradually reduced the rate at which it lends to financial institutions from 4.25% to 1.75% in September 2020 and kept that rate at that same level until July 2021. It additionally introduced temporary liquidity through repo operations, expanded the type of counterparties that can access these operations and the range of eligible collateral, and extended maturities. The repo quota against private debt was also increased. Furthermore, the central bank bought sovereign bonds (TES) to increase the liquidity in the public debt market and reduced the percentage of required reserves as of April 22, 2020 (including the reserves requirements ratio for current and savings accounts (from 11% to 8%) and term deposits certificates with a maturity below 18 months (from 4.5% to 3.5%)). To stabilize the foreign exchange market and strengthen the liquidity in dollars, the central bank offered dollars in the NDF market and undertook auctions of FX non-delivery forwards and FX swaps (Banco de la República, 2020a, 2020b). The government created the Emergency Mitigation Fund (FOME) to support the health sector and productive activities, and to provide subsidies to low-income households (Ministerio de Hacienda, 2021).

- **Ecuador**

The central bank of Ecuador reduced the banks' contribution rate to the Liquidity Fund, from 5% to 2%, in April 2020, and revised the caps on interest rates. From that same month, the Banking Superintendency launched a special mechanism to allow commercial banks offer extraordinary credit deferrals and renegotiations to reduce financial pressures on individuals and private firms (Superintendencia de Bancos, 2020). The government additionally introduced a temporary credit line (*Reactívate Ecuador*) at the end of May 2020, aimed at allowing that micro, small- and medium-sized private firms could cover operating costs (including salaries). These measures were complemented by the fiscal incentives that the government offered to credit institutions that channeled credits to promote economic reactivation and protect employment in the private sector (OCDE, 2020; Parlamento Andino, 2021; IMF 2021).

- **Mexico**

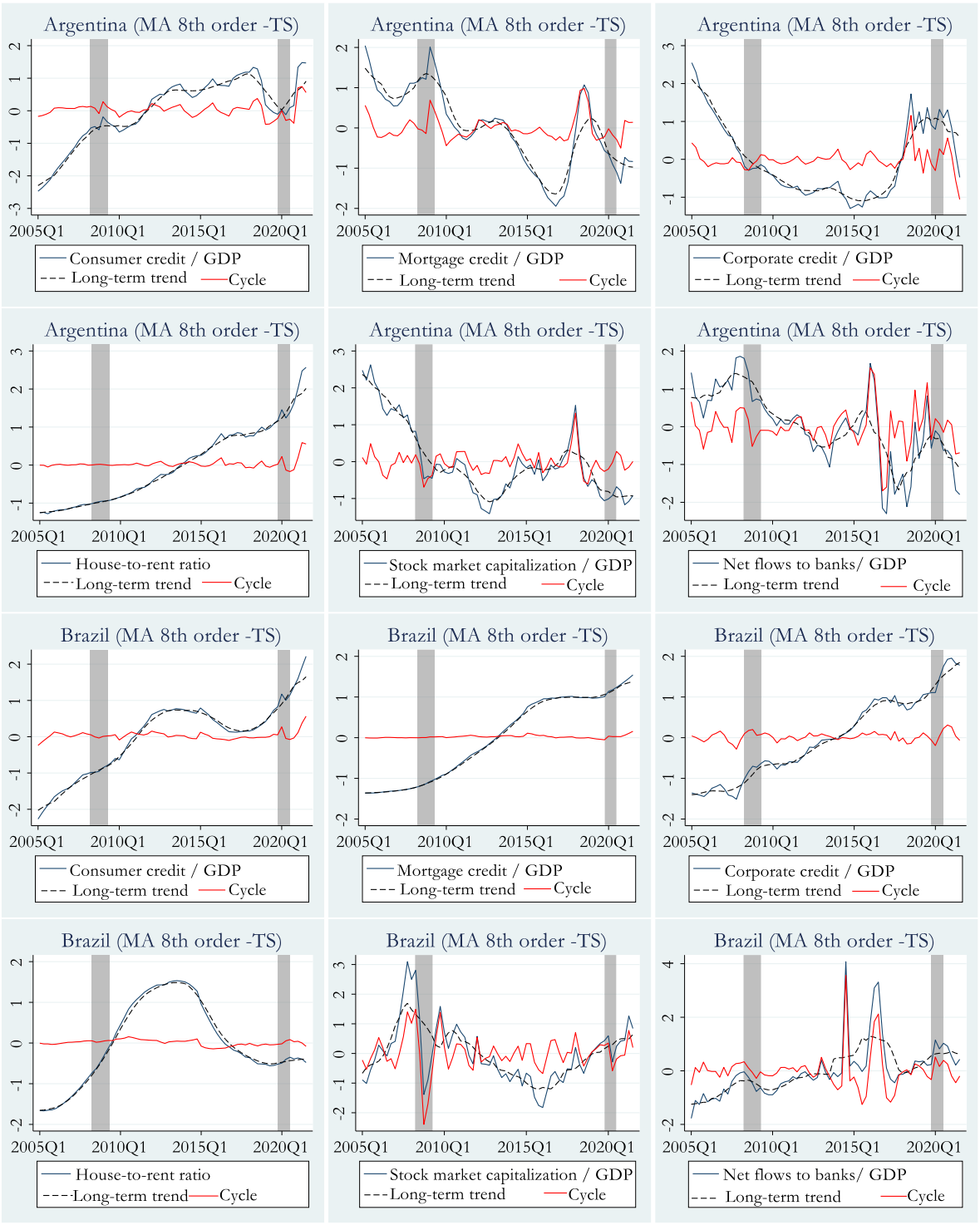
Banco de Mexico reduced the reserve requirements to depository institutions and the interest rate of the collateralized ordinary liquidity facility, widened the range of eligible collateral (to access collateralized liquidity, currency hedging, and operations in dollars), opened a repurchase window for term government securities, and opened the repo facility (to increase the liquidity of corporate securities in the secondary market). To promote the markets of government and corporate securities, it offered government securities with a maturity of up to 3 years in exchange for long-term government securities (to more than 10 years) and modified the conditions under which financial institutions operate as market makers so that they can increase their participation in the government debt market. To support loans to micro, small- and medium-sized firms, the central bank channeled special loans from Instituto Central through banking institution for terms between 18 and 24 months. To promote the orderly behavior of the foreign exchange market, it widened the currency hedging program in dollars payable in local currency and implemented credit auctions in US dollars and currency hedges. The total value of all these temporary measures was equivalent to 3.3% the GDP. The government introduced a package of social programs to provide liquidity to the most vulnerable population and increased spending on infrastructure to expand access to drinking water, pavement, and housing in the poorest areas. The total value of these fiscal measures is equivalent to 1.0% of GDP (Banco de Mexico, 2020).

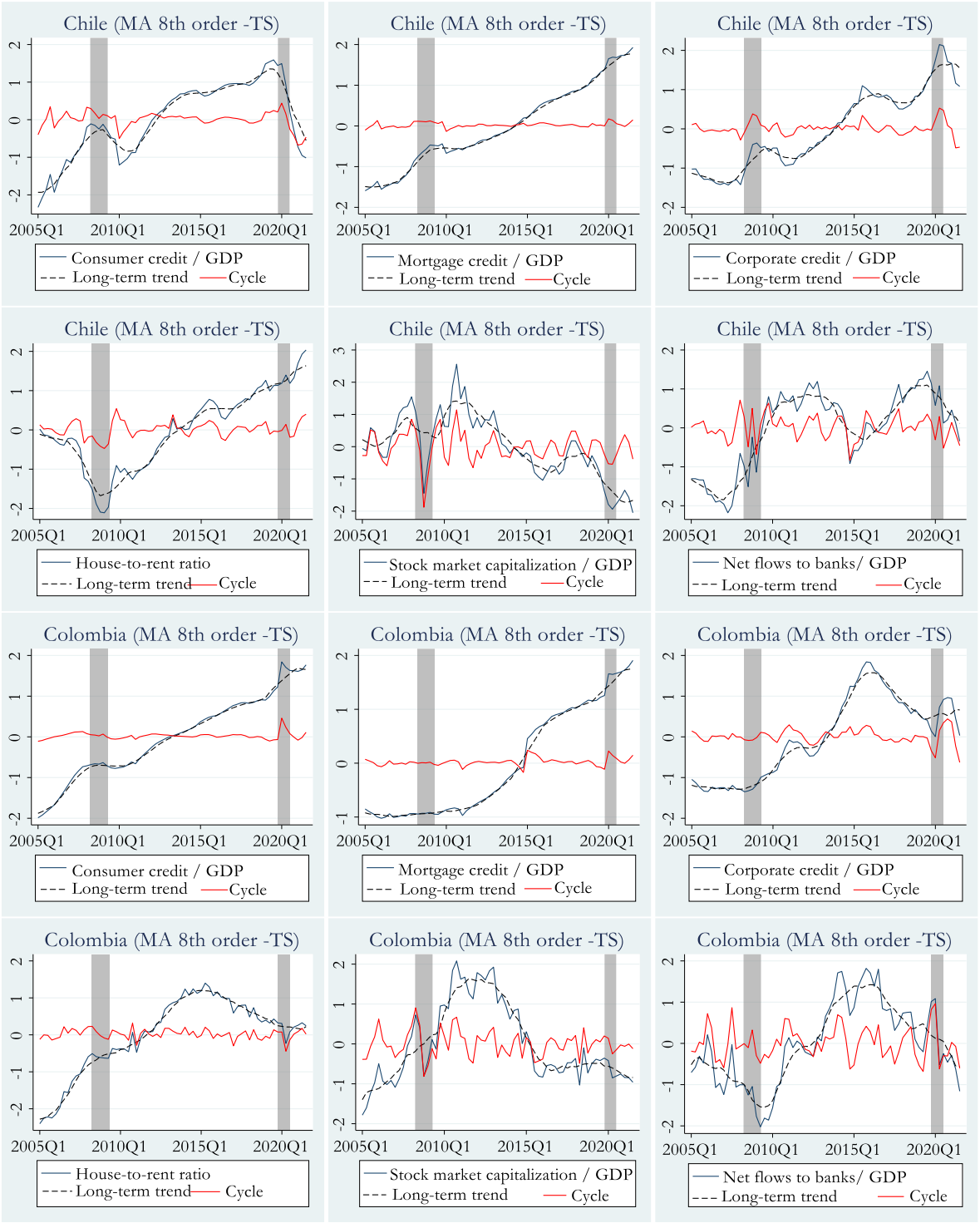
- **Peru**

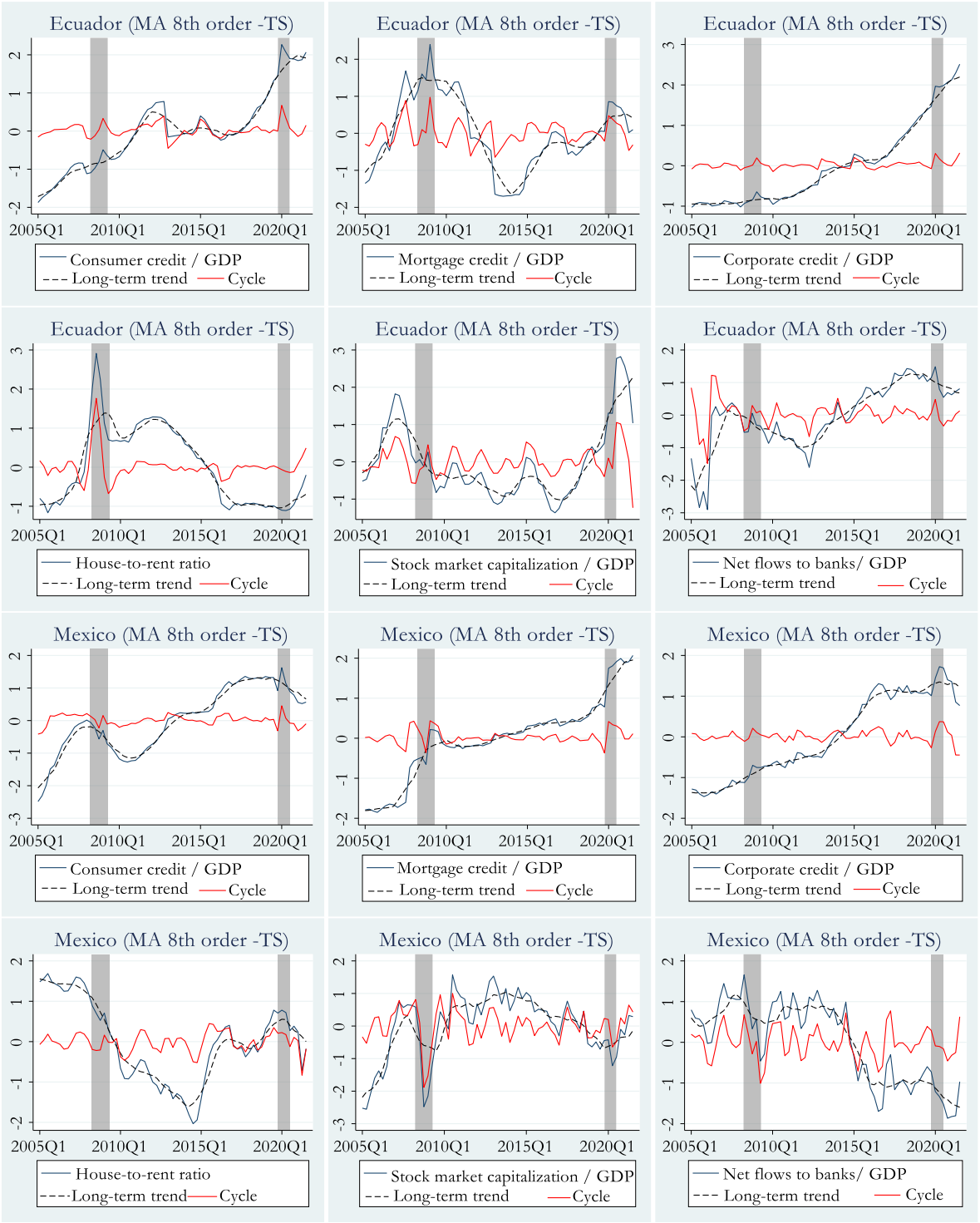
Like most of the countries in the Latin American region, the central bank of Peru reduced the policy rate, from 2.25% to 1.25% on March 19, 2020. It additionally reduced the reserve requirement ratios in local currency (from 5% to 4%), dollar-denominated debt with foreign financial institutions with terms below 2 years (from 50% to 9%), and current accounts in local currency (from 1.0% to 0.75%). The maturity of repos in government securities and foreign currencies was extended from 6 months to 3 years. The central bank introduced a new repo facility (in April 2020) to allow financial institutions receive central bank liquidity using as collateral part of their credit portfolios, created temporary programs to maintain the flow of bank credits to the economy, and provided firms with loans guaranteed by the government at very low interest rates. Lastly, it carried out derivative transactions (foreign exchange swaps, selling US dollars and receiving the local currency) and operations in the spot market to reduce the volatility of the exchange rate (Montoro, et al, 2020). On the fiscal side, the government released an economic stimulus package worth around 12% GDP, made up of transfers of cash subsidies or basic goods to the most vulnerable households and credit guarantees to support companies' payments chains and the reactivation of production activities in the mining sector (Castillo and Ruiz, 2020; IDB, 2020).

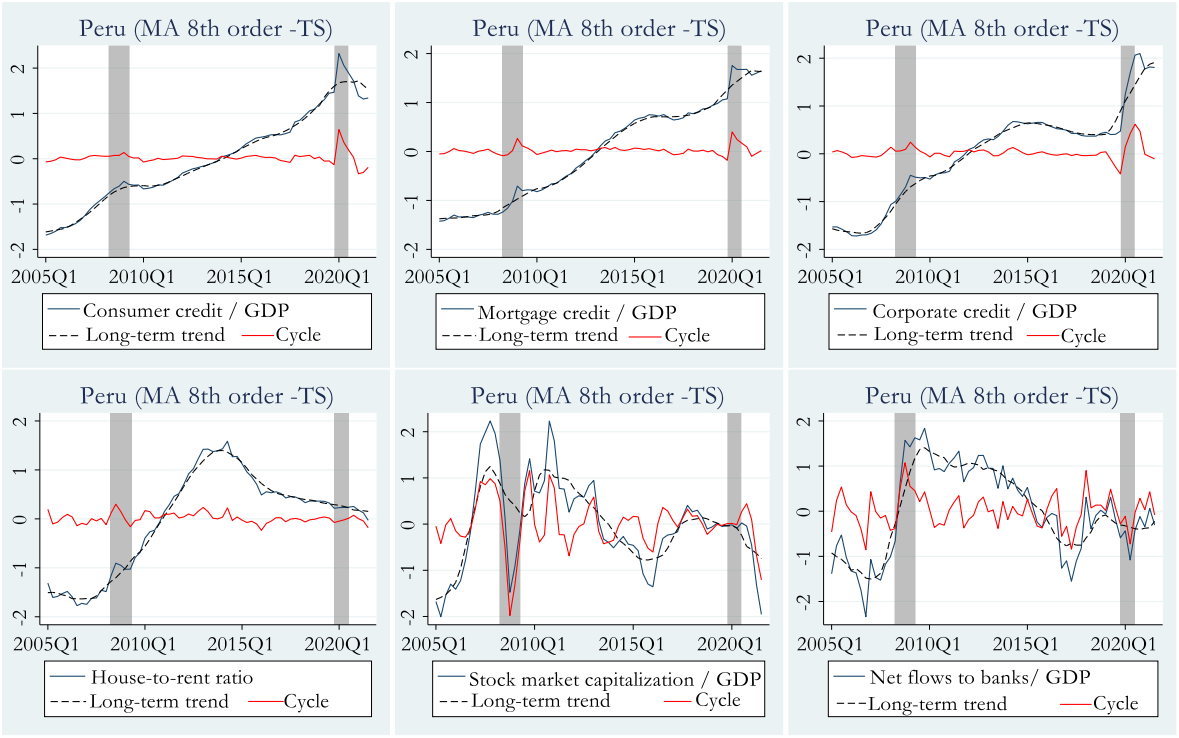
Appendix B. Results from traditional filters

B.1 Moving average filter

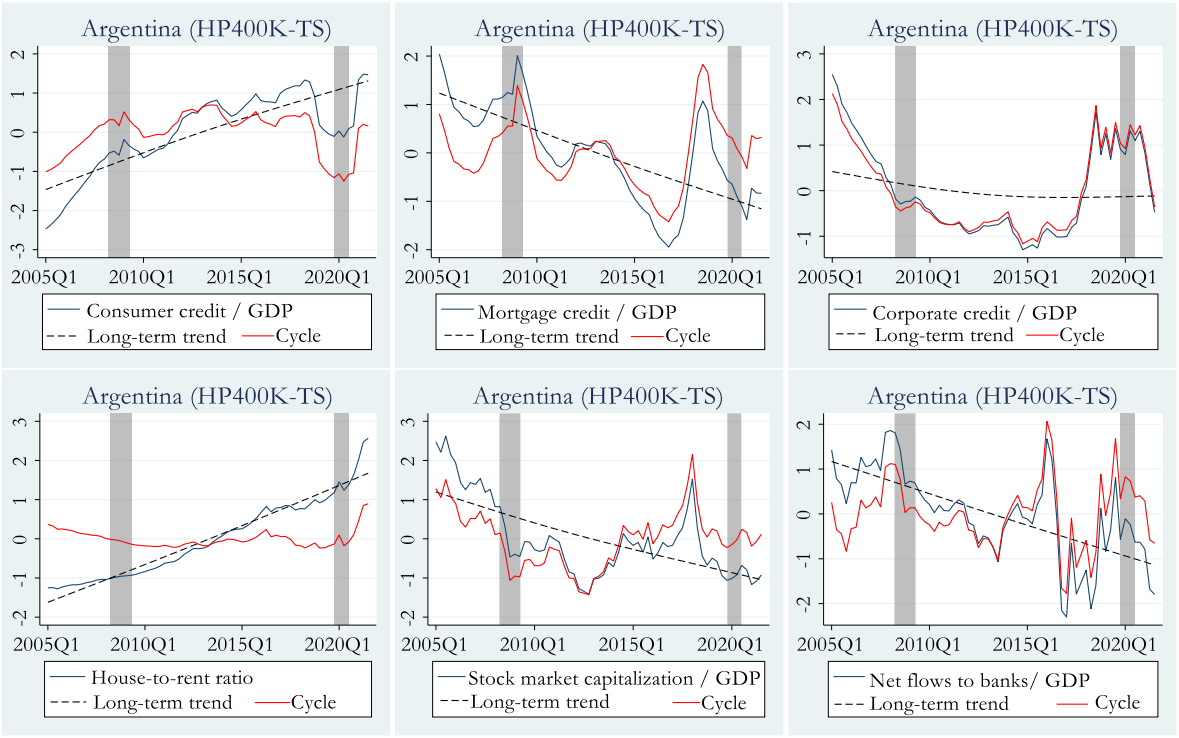


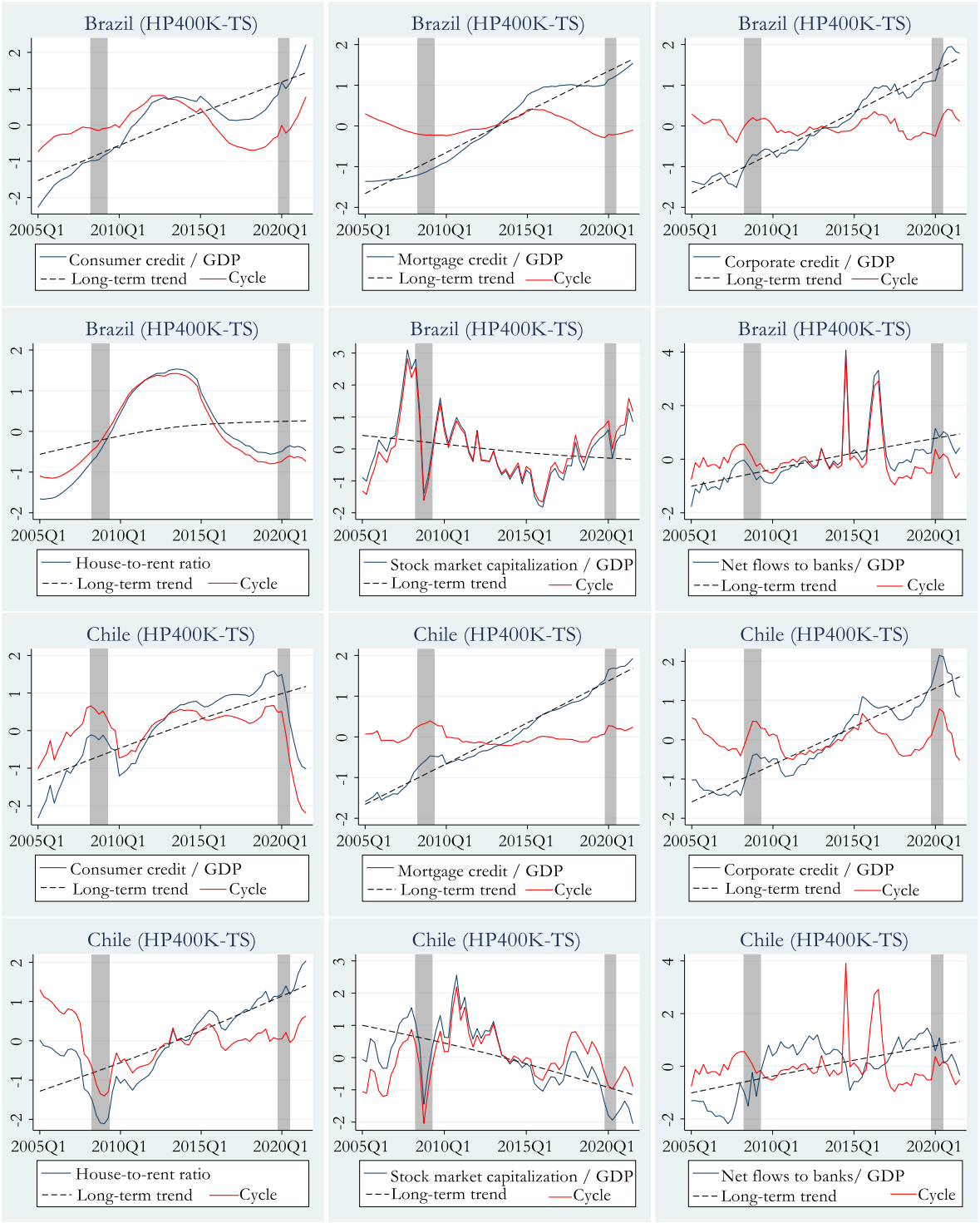

Chile (MA 8th order -TS)
Consumer credit / GDP
Long-term trend
Cycle
Chile (MA 8th order -TS)
Mortgage credit / GDP
Long-term trend
Cycle
Chile (MA 8th order -TS)
Corporate credit / GDP
Long-term trend
Cycle
Chile (MA 8th order -TS)
House-to-rent ratio
Long-term trend
Cycle
Chile (MA 8th order -TS)
Stock market capitalization / GDP
Long-term trend
Cycle
Chile (MA 8th order -TS)
Net flows to banks/ GDP
Long-term trend
Cycle
Colombia (MA 8th order -TS)
Consumer credit / GDP
Long-term trend
Cycle
Colombia (MA 8th order -TS)
Mortgage credit / GDP
Long-term trend
Cycle
Colombia (MA 8th order -TS)
Corporate credit / GDP
Long-term trend
Cycle
Colombia (MA 8th order -TS)
House-to-rent ratio
Long-term trend
Cycle
Colombia (MA 8th order -TS)
Stock market capitalization / GDP
Long-term trend
Cycle
Colombia (MA 8th order -TS)
Net flows to banks/ GDP
Long-term trend
Cycle
2005Q1
2010Q1
2015Q1
2020Q1

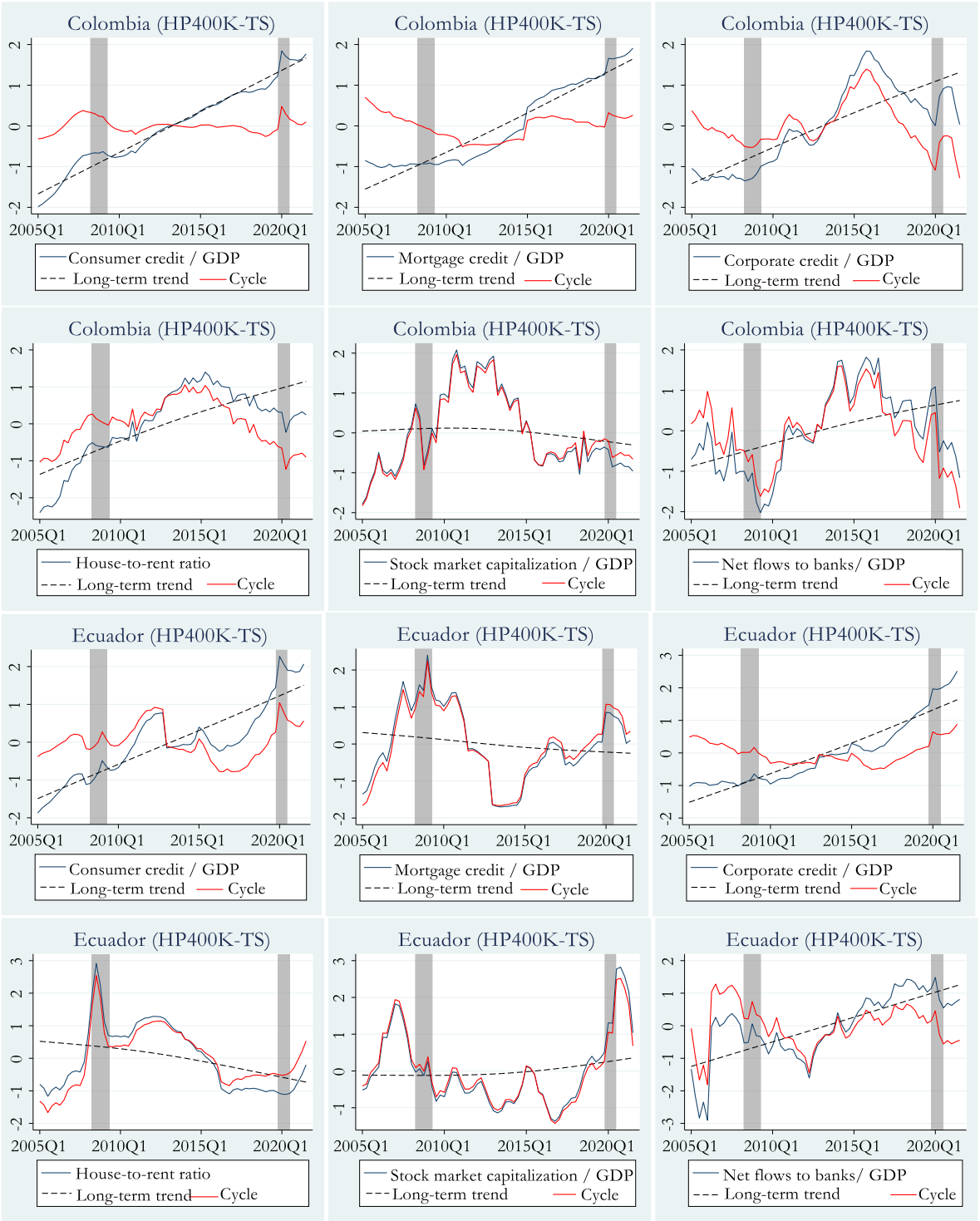

Ecuador (MA 8th order -TS)
Consumer credit / GDP
Long-term trend
Cycle
Ecuador (MA 8th order -TS)
Mortgage credit / GDP
Long-term trend
Cycle
Ecuador (MA 8th order -TS)
Corporate credit / GDP
Long-term trend
Cycle
Ecuador (MA 8th order -TS)
House-to-rent ratio
Long-term trend
Cycle
Ecuador (MA 8th order -TS)
Stock market capitalization / GDP
Long-term trend
Cycle
Ecuador (MA 8th order -TS)
Net flows to banks/ GDP
Long-term trend
Cycle
Mexico (MA 8th order -TS)
Consumer credit / GDP
Long-term trend
Cycle
Mexico (MA 8th order -TS)
Mortgage credit / GDP
Long-term trend
Cycle
Mexico (MA 8th order -TS)
Corporate credit / GDP
Long-term trend
Cycle
Mexico (MA 8th order -TS)
House-to-rent ratio
Long-term trend
Cycle
Mexico (MA 8th order -TS)
Stock market capitalization / GDP
Long-term trend
Cycle
Mexico (MA 8th order -TS)
Net flows to banks/ GDP
Long-term trend
Cycle
2005Q1
2010Q1
2015Q1
2020Q1

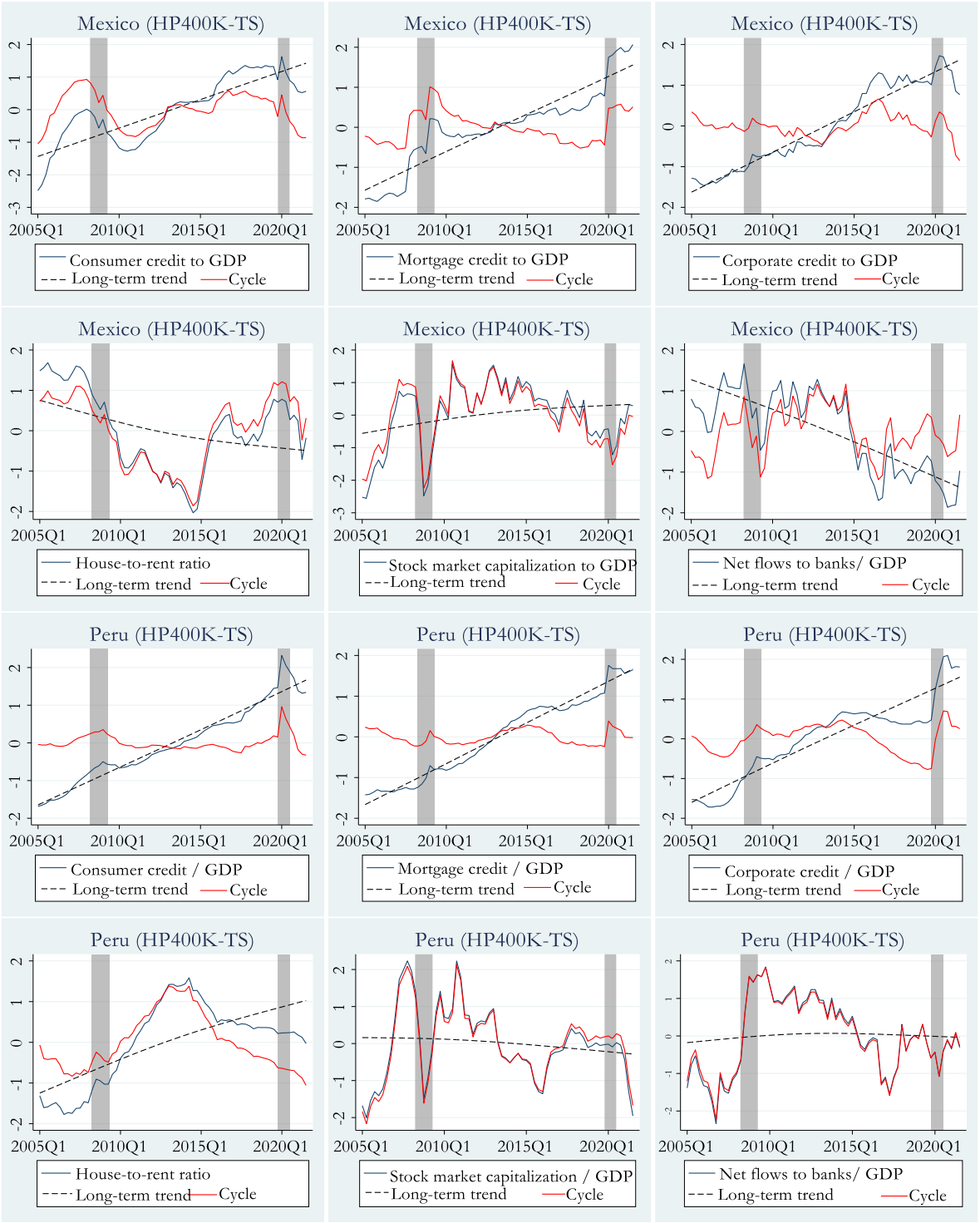


B.2 Hodrick-Prescott filter (λ = 400.000)

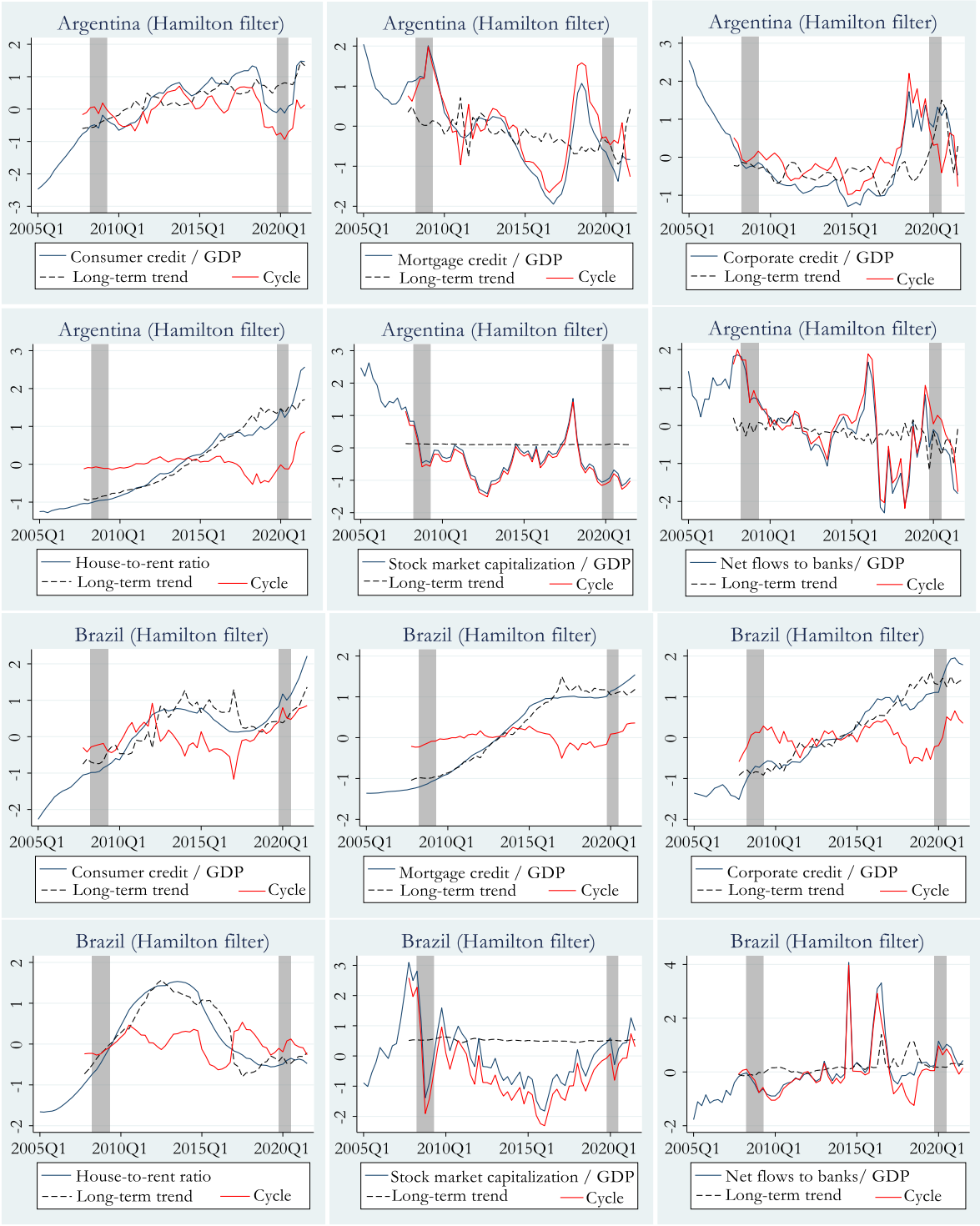


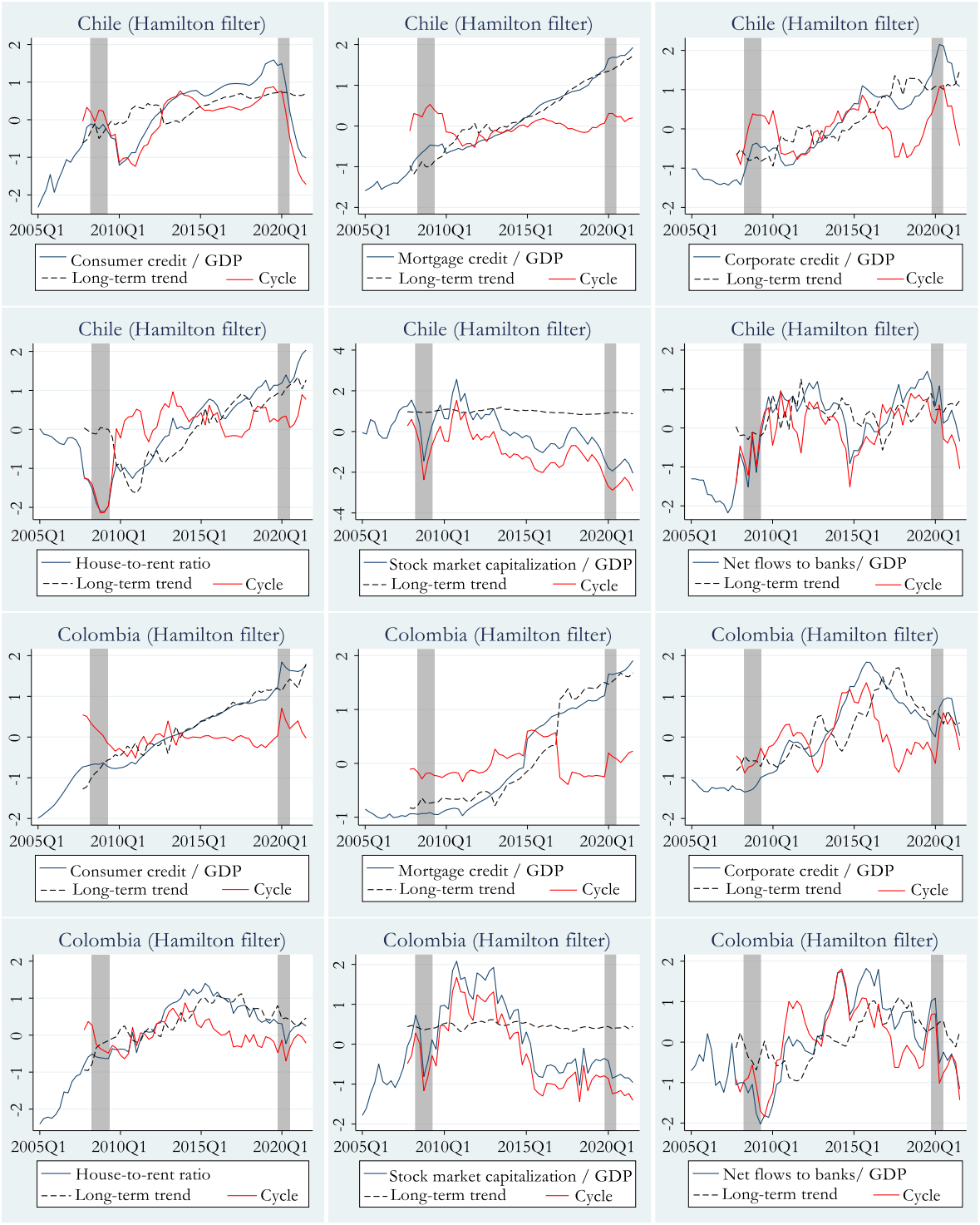

Brazil (HP400K-TS)
Consumer credit / GDP
Long-term trend
Cycle
Brazil (HP400K-TS)
Mortgage credit / GDP
Long-term trend
Cycle
Brazil (HP400K-TS)
Corporate credit / GDP
Long-term trend
Cycle
Brazil (HP400K-TS)
House-to-rent ratio
Long-term trend
Cycle
Brazil (HP400K-TS)
Stock market capitalization / GDP
Long-term trend
Cycle
Brazil (HP400K-TS)
Net flows to banks/ GDP
Long-term trend
Cycle
Chile (HP400K-TS)
Consumer credit / GDP
Long-term trend
Cycle
Chile (HP400K-TS)
Mortgage credit / GDP
Long-term trend
Cycle
Chile (HP400K-TS)
Corporate credit / GDP
Long-term trend
Cycle
Chile (HP400K-TS)
House-to-rent ratio
Long-term trend
Cycle
Chile (HP400K-TS)
Stock market capitalization / GDP
Long-term trend
Cycle
Chile (HP400K-TS)
Net flows to banks/ GDP
Long-term trend
Cycle
2005Q1
2010Q1
2015Q1
2020Q1

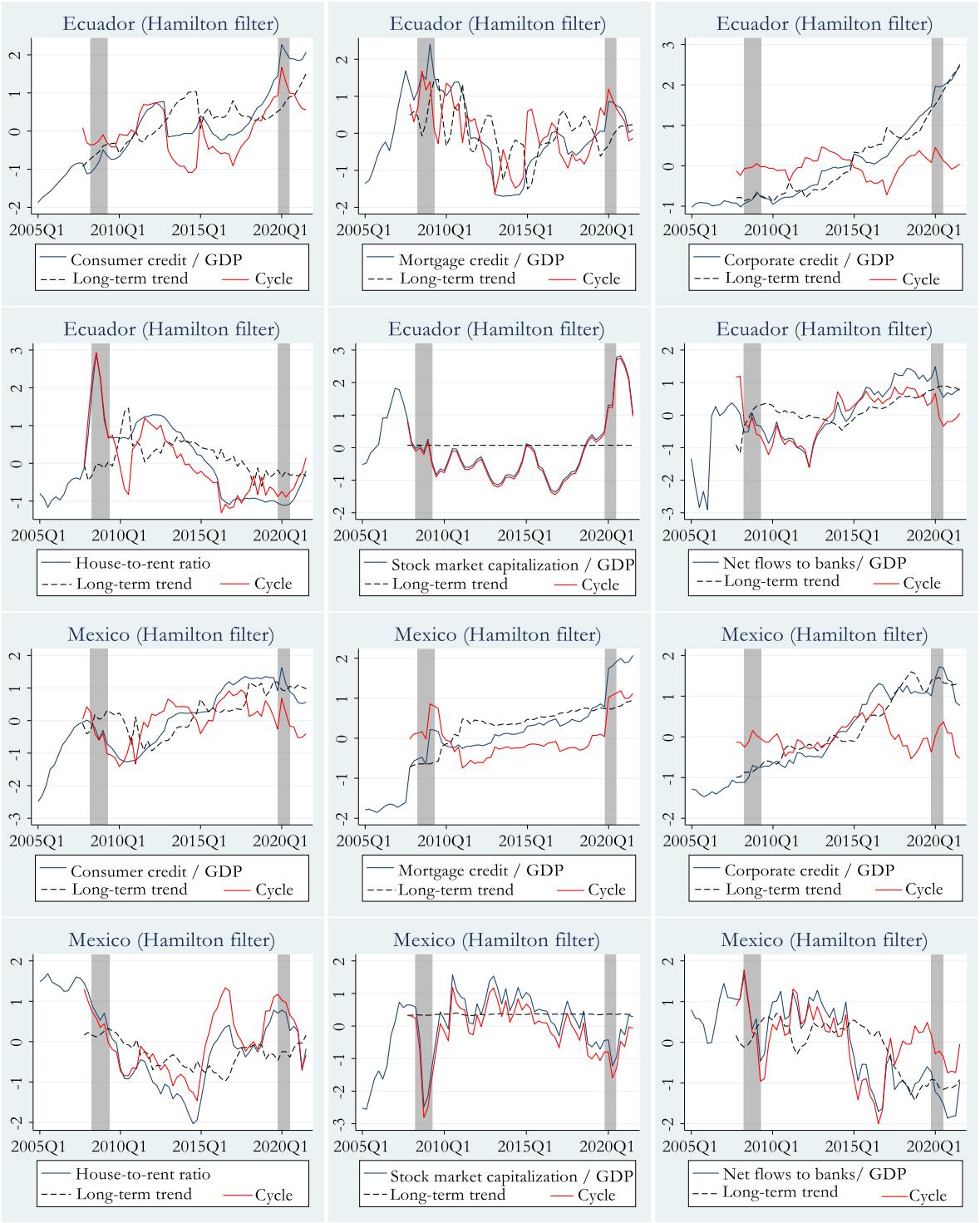

Colombia (HP400K-TS)
Consumer credit / GDP
Long-term trend
Cycle
Colombia (HP400K-TS)
Mortgage credit / GDP
Long-term trend
Cycle
Colombia (HP400K-TS)
Corporate credit / GDP
Long-term trend
Cycle
Colombia (HP400K-TS)
House-to-rent ratio
Long-term trend
Cycle
Colombia (HP400K-TS)
Stock market capitalization / GDP
Long-term trend
Cycle
Colombia (HP400K-TS)
Net flows to banks/ GDP
Long-term trend
Cycle
Ecuador (HP400K-TS)
Consumer credit / GDP
Long-term trend
Cycle
Ecuador (HP400K-TS)
Mortgage credit / GDP
Long-term trend
Cycle
Ecuador (HP400K-TS)
Corporate credit / GDP
Long-term trend
Cycle
Ecuador (HP400K-TS)
House-to-rent ratio
Long-term trend
Cycle
Ecuador (HP400K-TS)
Stock market capitalization / GDP
Long-term trend
Cycle
Ecuador (HP400K-TS)
Net flows to banks/ GDP
Long-term trend
Cycle
2005Q1
2010Q1
2015Q1
2020Q1

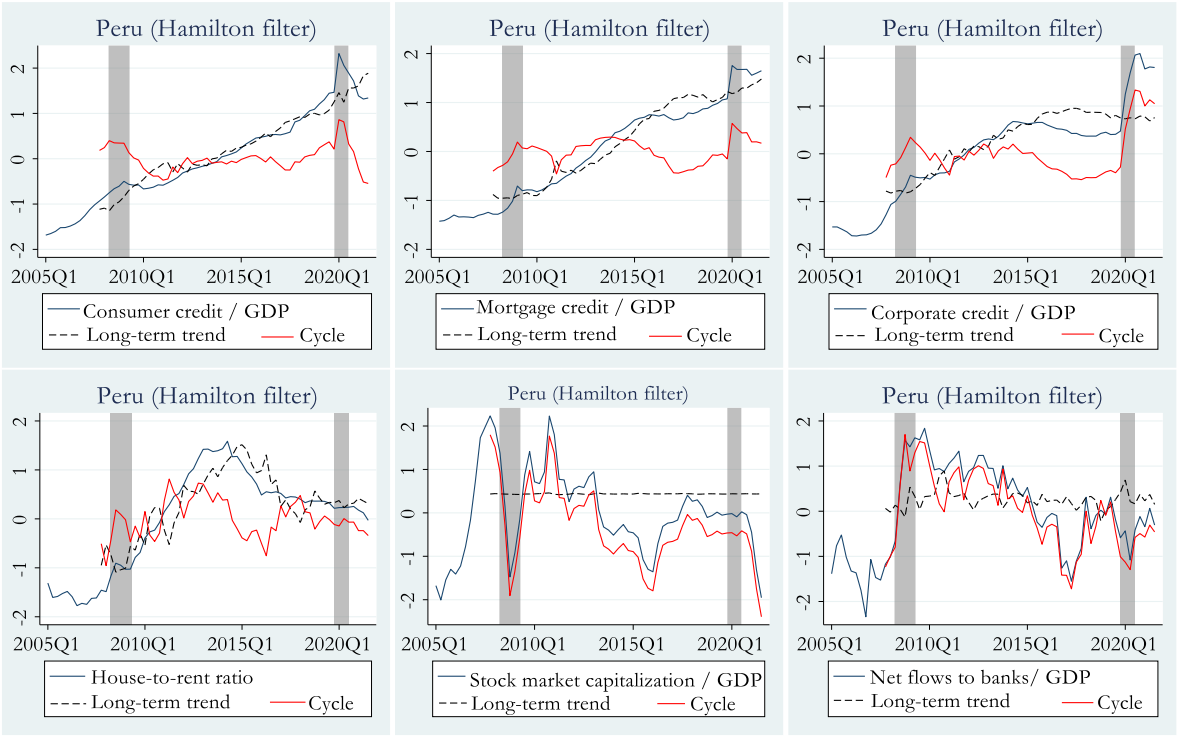

Mexico (HP400K-TS)
2005Q1 2010Q1 2015Q1 2020Q1
Consumer credit to GDP
Long-term trend
Cycle
Mexico (HP400K-TS)
2005Q1 2010Q1 2015Q1 2020Q1
Mortgage credit to GDP
Long-term trend
Cycle
Mexico (HP400K-TS)
2005Q1 2010Q1 2015Q1 2020Q1
Corporate credit to GDP
Long-term trend
Cycle
Mexico (HP400K-TS)
2005Q1 2010Q1 2015Q1 2020Q1
House-to-rent ratio
Long-term trend
Cycle
Mexico (HP400K-TS)
2005Q1 2010Q1 2015Q1 2020Q1
Stock market capitalization to GDP
Long-term trend
Cycle
Mexico (HP400K-TS)
2005Q1 2010Q1 2015Q1 2020Q1
Net flows to banks/ GDP
Long-term trend
Cycle
Peru (HP400K-TS)
2005Q1 2010Q1 2015Q1 2020Q1
Consumer credit / GDP
Long-term trend
Cycle
Peru (HP400K-TS)
2005Q1 2010Q1 2015Q1 2020Q1
Mortgage credit / GDP
Long-term trend
Cycle
Peru (HP400K-TS)
2005Q1 2010Q1 2015Q1 2020Q1
Corporate credit / GDP
Long-term trend
Cycle
Peru (HP400K-TS)
2005Q1 2010Q1 2015Q1 2020Q1
House-to-rent ratio
Long-term trend
Cycle
Peru (HP400K-TS)
2005Q1 2010Q1 2015Q1 2020Q1
Stock market capitalization / GDP
Long-term trend
Cycle
Peru (HP400K-TS)
2005Q1 2010Q1 2015Q1 2020Q1
Net flows to banks/ GDP
Long-term trend
Cycle

B3. Hamilton filter

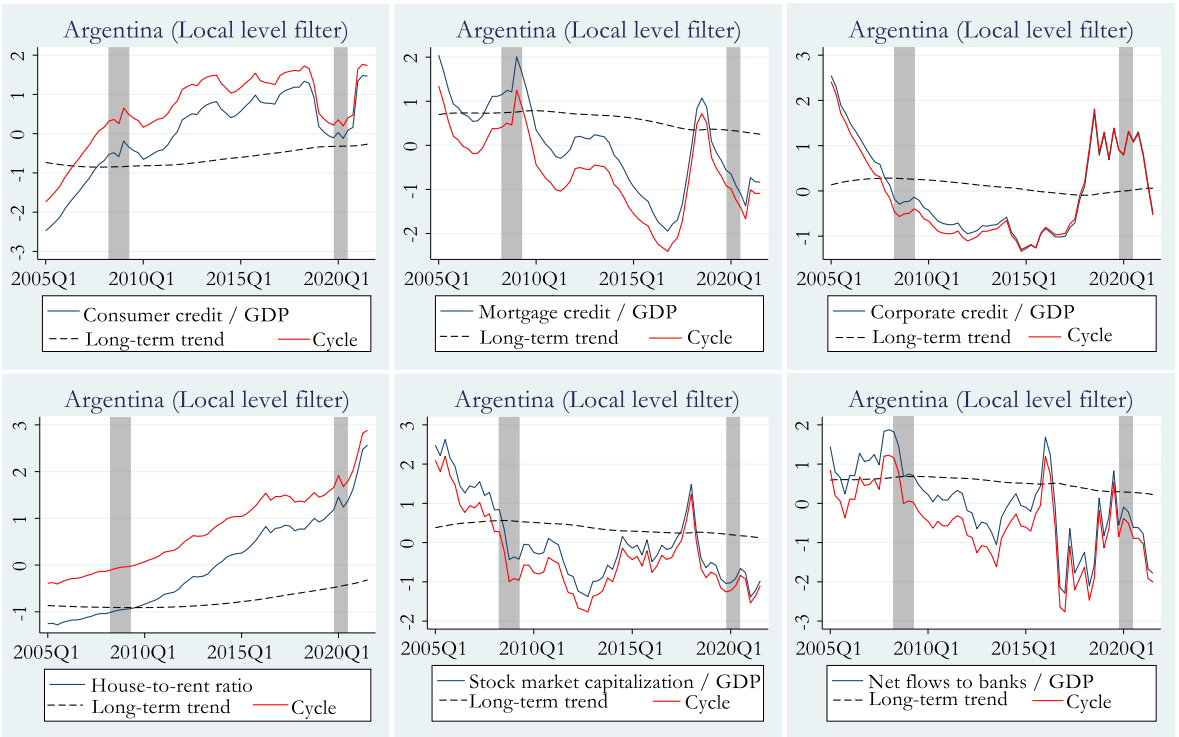


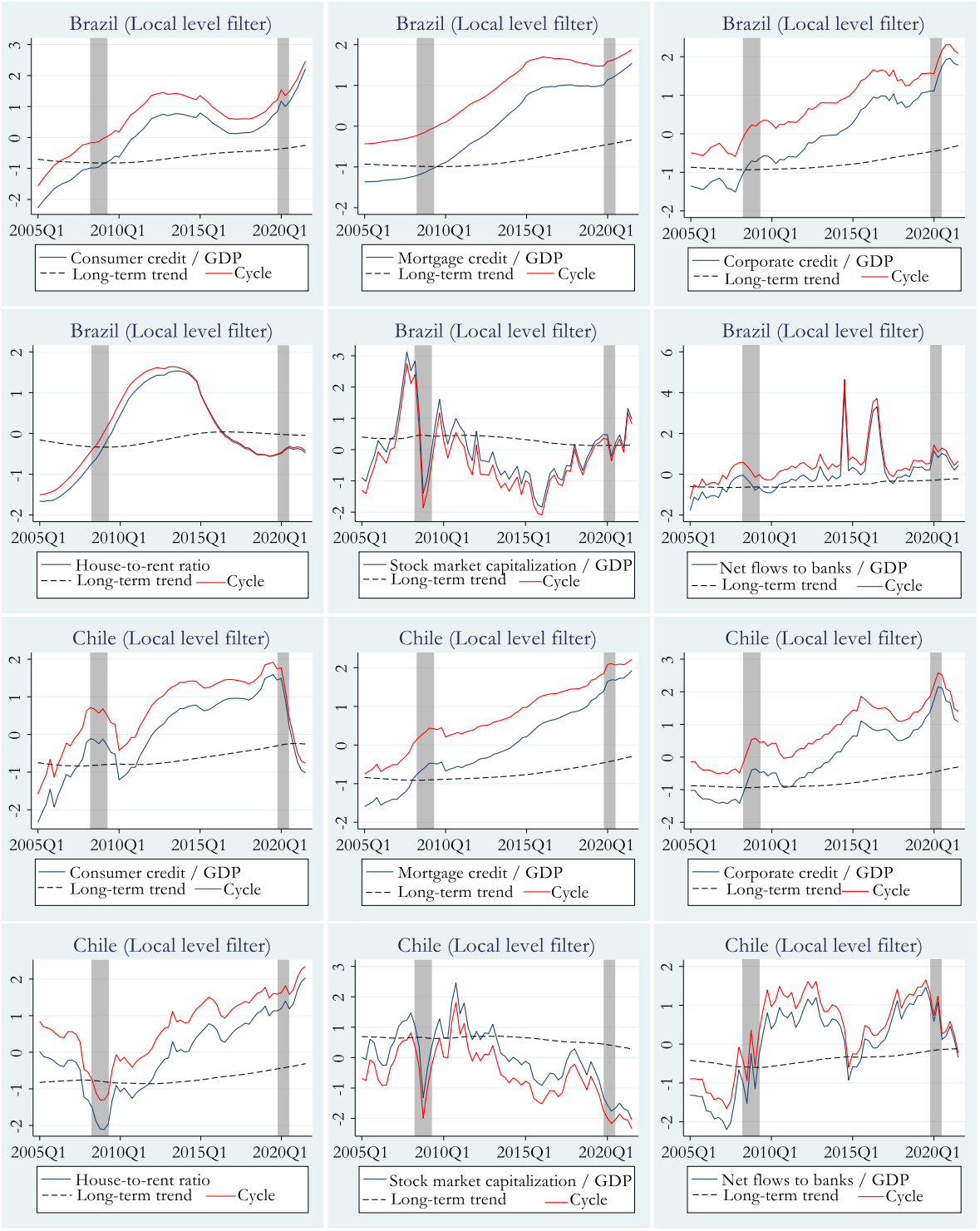

Chile (Hamilton filter)
2005Q1 2010Q1 2015Q1 2020Q1
Consumer credit / GDP
Long-term trend
Cycle
Chile (Hamilton filter)
2005Q1 2010Q1 2015Q1 2020Q1
Mortgage credit / GDP
Long-term trend
Cycle
Chile (Hamilton filter)
2005Q1 2010Q1 2015Q1 2020Q1
Corporate credit / GDP
Long-term trend
Cycle
Chile (Hamilton filter)
2005Q1 2010Q1 2015Q1 2020Q1
House-to-rent ratio
Long-term trend
Cycle
Chile (Hamilton filter)
2005Q1 2010Q1 2015Q1 2020Q1
Stock market capitalization / GDP
Long-term trend
Cycle
Chile (Hamilton filter)
2005Q1 2010Q1 2015Q1 2020Q1
Net flows to banks/ GDP
Long-term trend
Cycle
Colombia (Hamilton filter)
2005Q1 2010Q1 2015Q1 2020Q1
Consumer credit / GDP
Long-term trend
Cycle
Colombia (Hamilton filter)
2005Q1 2010Q1 2015Q1 2020Q1
Mortgage credit / GDP
Long-term trend
Cycle
Colombia (Hamilton filter)
2005Q1 2010Q1 2015Q1 2020Q1
Corporate credit / GDP
Long-term trend
Cycle
Colombia (Hamilton filter)
2005Q1 2010Q1 2015Q1 2020Q1
House-to-rent ratio
Long-term trend
Cycle
Colombia (Hamilton filter)
2005Q1 2010Q1 2015Q1 2020Q1
Stock market capitalization / GDP
Long-term trend
Cycle
Colombia (Hamilton filter)
2005Q1 2010Q1 2015Q1 2020Q1
Net flows to banks/ GDP
Long-term trend
Cycle

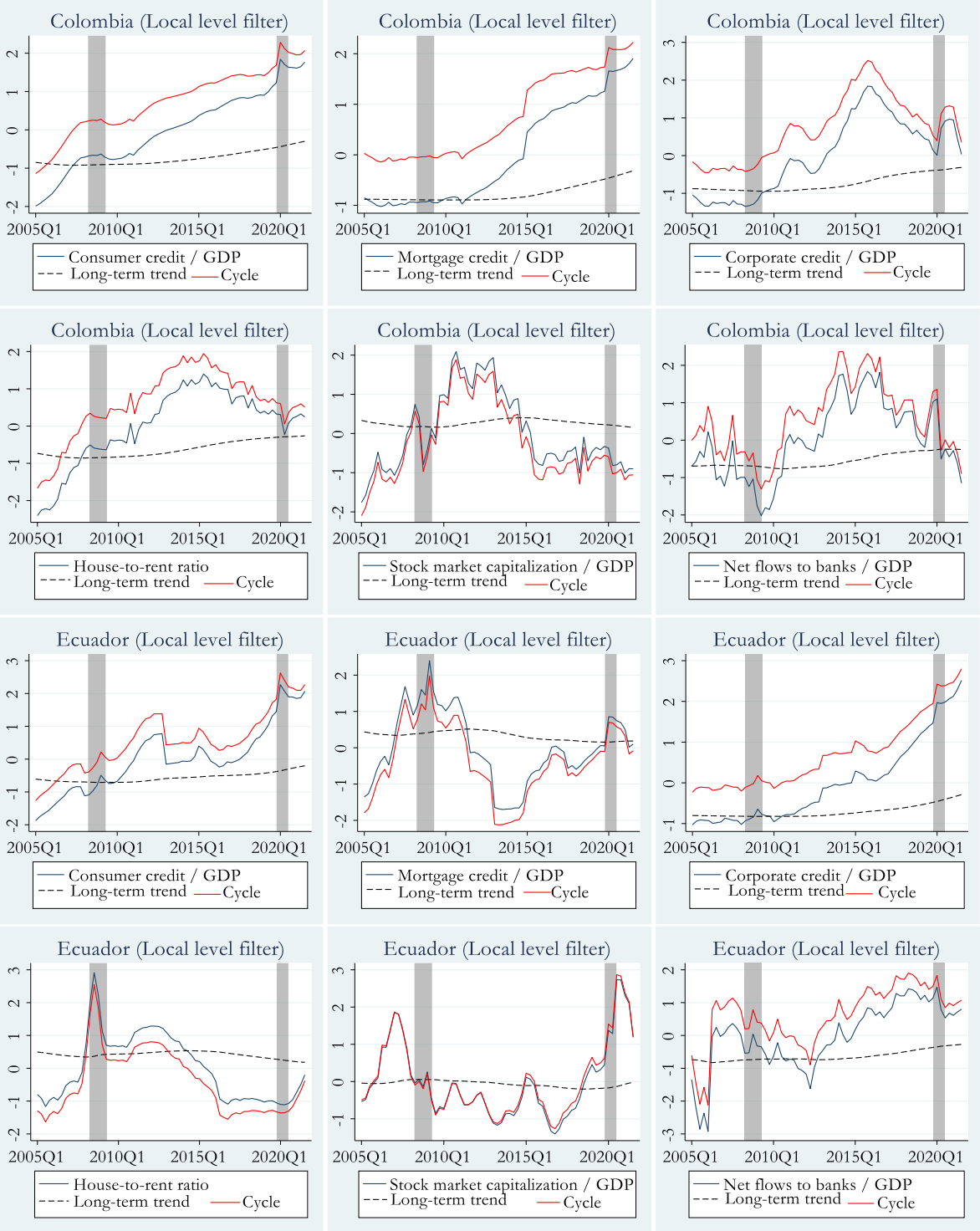

Ecuador (Hamilton filter)
Consumer credit / GDP
Long-term trend
Cycle
Ecuador (Hamilton filter)
Mortgage credit / GDP
Long-term trend
Cycle
Ecuador (Hamilton filter)
Corporate credit / GDP
Long-term trend
Cycle
Ecuador (Hamilton filter)
House-to-rent ratio
Long-term trend
Cycle
Ecuador (Hamilton filter)
Stock market capitalization / GDP
Long-term trend
Cycle
Ecuador (Hamilton filter)
Net flows to banks/ GDP
Long-term trend
Cycle
Mexico (Hamilton filter)
Consumer credit / GDP
Long-term trend
Cycle
Mexico (Hamilton filter)
Mortgage credit / GDP
Long-term trend
Cycle
Mexico (Hamilton filter)
Corporate credit / GDP
Long-term trend
Cycle
Mexico (Hamilton filter)
House-to-rent ratio
Long-term trend
Cycle
Mexico (Hamilton filter)
Stock market capitalization / GDP
Long-term trend
Cycle
Mexico (Hamilton filter)
Net flows to banks/ GDP
Long-term trend
Cycle
2005Q1
2010Q1
2015Q1
2020Q1

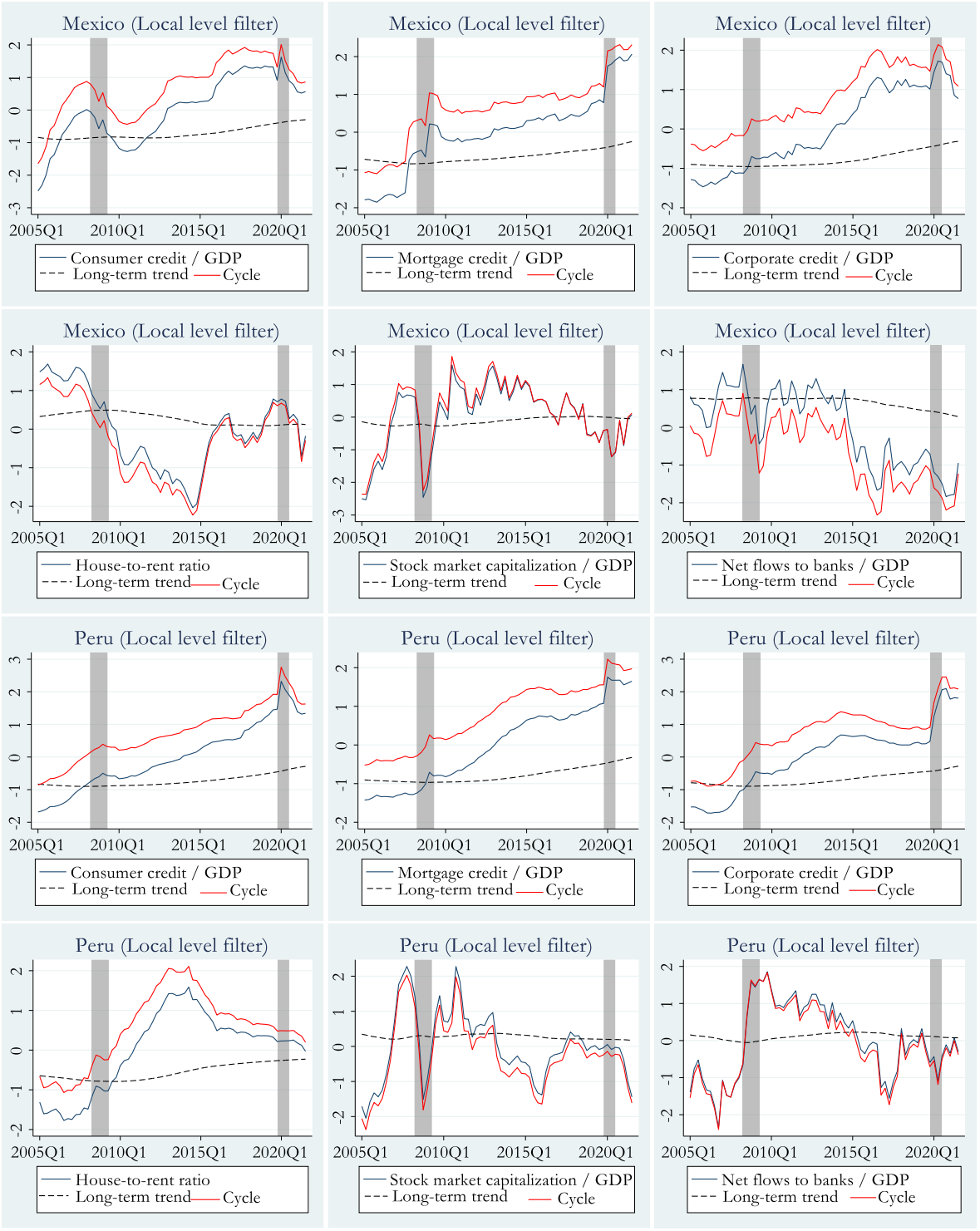


B4. Local Level Filter ($1-\delta^H = 0.011485979647$)



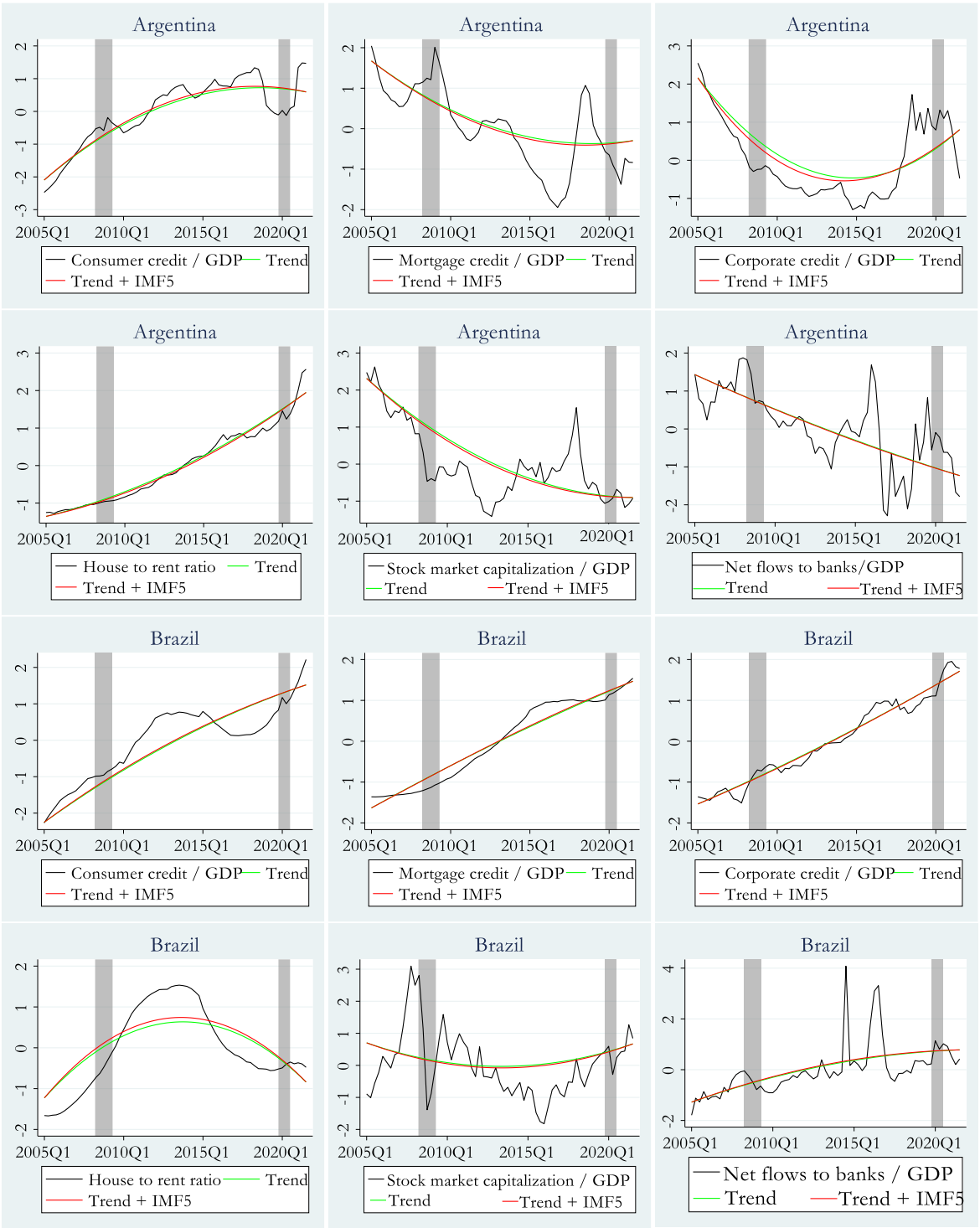

Brazil (Local level filter)
Consumer credit / GDP
Long-term trend
Cycle
Brazil (Local level filter)
Mortgage credit / GDP
Long-term trend
Cycle
Brazil (Local level filter)
Corporate credit / GDP
Long-term trend
Cycle
Brazil (Local level filter)
House-to-rent ratio
Long-term trend
Cycle
Brazil (Local level filter)
Stock market capitalization / GDP
Long-term trend
Cycle
Brazil (Local level filter)
Net flows to banks / GDP
Long-term trend
Cycle
Chile (Local level filter)
Consumer credit / GDP
Long-term trend
Cycle
Chile (Local level filter)
Mortgage credit / GDP
Long-term trend
Cycle
Chile (Local level filter)
Corporate credit / GDP
Long-term trend
Cycle
Chile (Local level filter)
House-to-rent ratio
Long-term trend
Cycle
Chile (Local level filter)
Stock market capitalization / GDP
Long-term trend
Cycle
Chile (Local level filter)
Net flows to banks / GDP
Long-term trend
Cycle
2005Q1
2010Q1
2015Q1
2020Q1

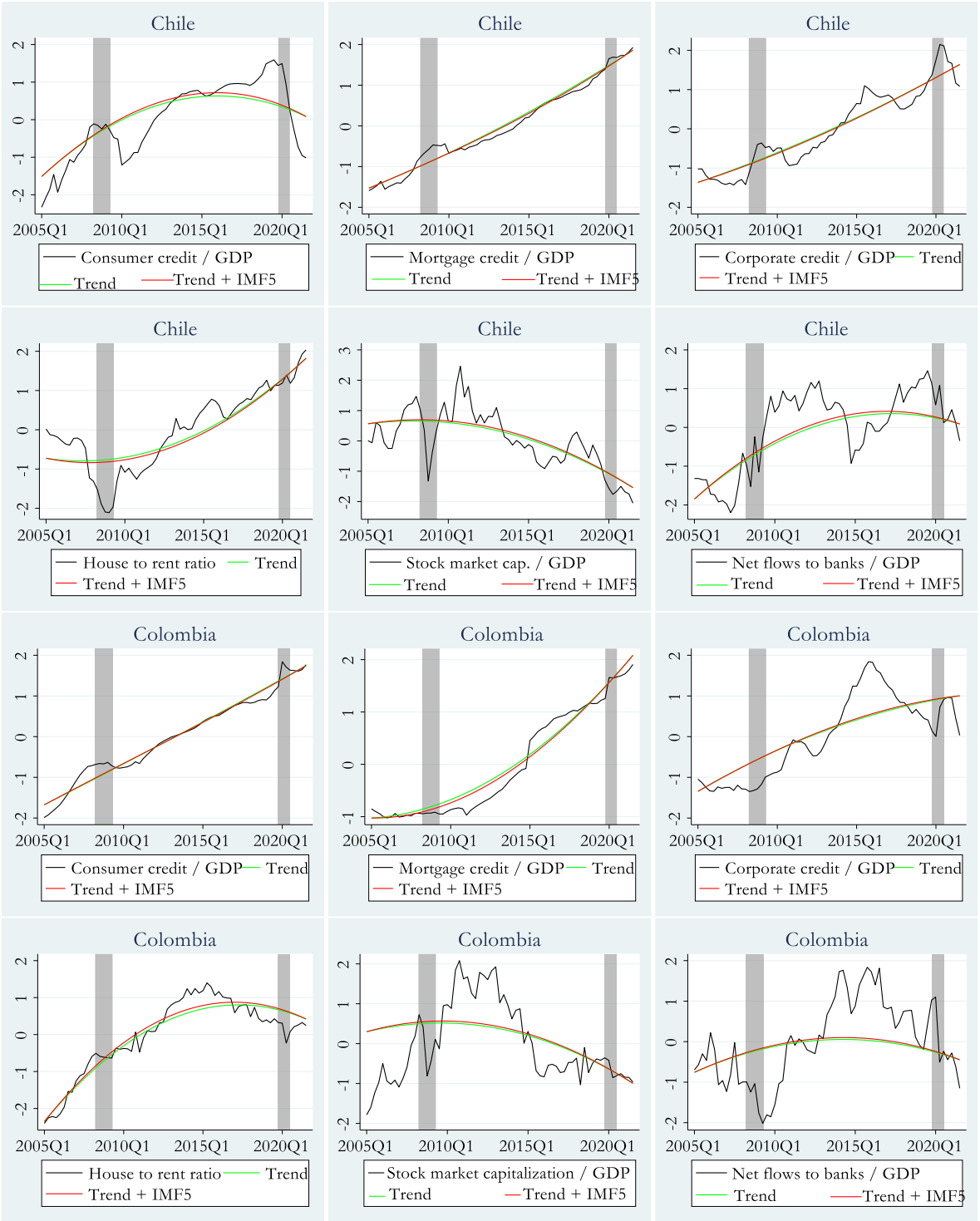

Colombia (Local level filter)
Consumer credit / GDP
Long-term trend
Cycle
Colombia (Local level filter)
Mortgage credit / GDP
Long-term trend
Cycle
Colombia (Local level filter)
Corporate credit / GDP
Long-term trend
Cycle
Colombia (Local level filter)
House-to-rent ratio
Long-term trend
Cycle
Colombia (Local level filter)
Stock market capitalization / GDP
Long-term trend
Cycle
Colombia (Local level filter)
Net flows to banks / GDP
Long-term trend
Cycle
Ecuador (Local level filter)
Consumer credit / GDP
Long-term trend
Cycle
Ecuador (Local level filter)
Mortgage credit / GDP
Long-term trend
Cycle
Ecuador (Local level filter)
Corporate credit / GDP
Long-term trend
Cycle
Ecuador (Local level filter)
House-to-rent ratio
Long-term trend
Cycle
Ecuador (Local level filter)
Stock market capitalization / GDP
Long-term trend
Cycle
Ecuador (Local level filter)
Net flows to banks / GDP
Long-term trend
Cycle
2005Q1
2010Q1
2015Q1
2020Q1

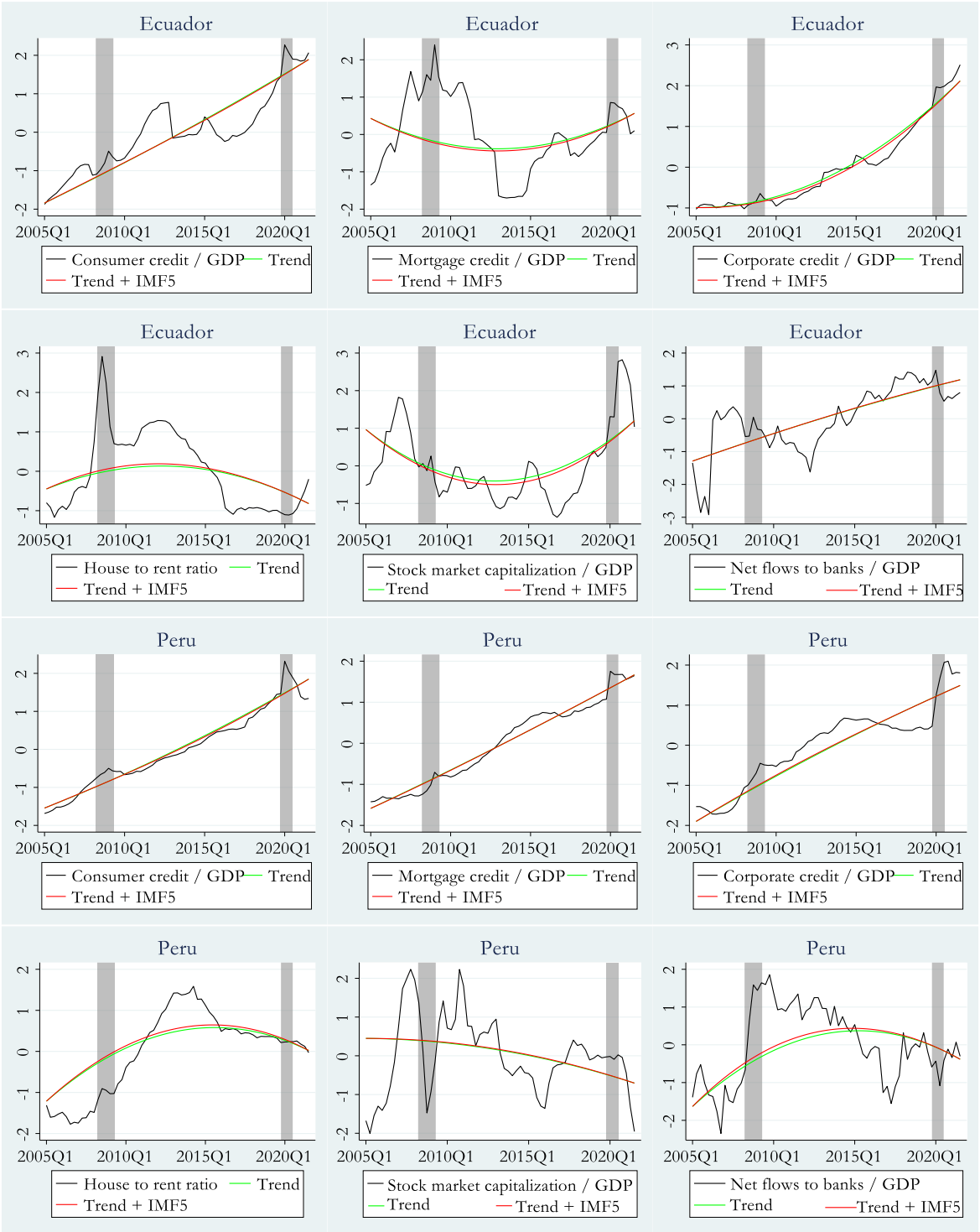

Mexico (Local level filter)
Consumer credit / GDP
Long-term trend
Cycle
Mexico (Local level filter)
Mortgage credit / GDP
Long-term trend
Cycle
Mexico (Local level filter)
Corporate credit / GDP
Long-term trend
Cycle
Mexico (Local level filter)
House-to-rent ratio
Long-term trend
Cycle
Mexico (Local level filter)
Stock market capitalization / GDP
Long-term trend
Cycle
Mexico (Local level filter)
Net flows to banks / GDP
Long-term trend
Cycle
Peru (Local level filter)
Consumer credit / GDP
Long-term trend
Cycle
Peru (Local level filter)
Mortgage credit / GDP
Long-term trend
Cycle
Peru (Local level filter)
Corporate credit / GDP
Long-term trend
Cycle
Peru (Local level filter)
House-to-rent ratio
Long-term trend
Cycle
Peru (Local level filter)
Stock market capitalization / GDP
Long-term trend
Cycle
Peru (Local level filter)
Net flows to banks / GDP
Long-term trend
Cycle
2005Q1
2010Q1
2015Q1
2020Q1

Appendix C

C1. Robustness checks 1. Adding IMF5 to the long-term trend.




Chile
2005Q1 2010Q1 2015Q1 2020Q1
Consumer credit / GDP
Trend
Trend + IMF5
Chile
2005Q1 2010Q1 2015Q1 2020Q1
Mortgage credit / GDP
Trend
Trend + IMF5
Chile
2005Q1 2010Q1 2015Q1 2020Q1
Corporate credit / GDP
Trend
Trend + IMF5
Chile
2005Q1 2010Q1 2015Q1 2020Q1
House to rent ratio
Trend
Trend + IMF5
Chile
2005Q1 2010Q1 2015Q1 2020Q1
Stock market cap. / GDP
Trend
Trend + IMF5
Chile
2005Q1 2010Q1 2015Q1 2020Q1
Net flows to banks / GDP
Trend
Trend + IMF5
Colombia
2005Q1 2010Q1 2015Q1 2020Q1
Consumer credit / GDP
Trend
Trend + IMF5
Colombia
2005Q1 2010Q1 2015Q1 2020Q1
Mortgage credit / GDP
Trend
Trend + IMF5
Colombia
2005Q1 2010Q1 2015Q1 2020Q1
Corporate credit / GDP
Trend
Trend + IMF5
Colombia
2005Q1 2010Q1 2015Q1 2020Q1
House to rent ratio
Trend
Trend + IMF5
Colombia
2005Q1 2010Q1 2015Q1 2020Q1
Stock market capitalization / GDP
Trend
Trend + IMF5
Colombia
2005Q1 2010Q1 2015Q1 2020Q1
Net flows to banks / GDP
Trend
Trend + IMF5


Ecuador
2005Q1 2010Q1 2015Q1 2020Q1
Consumer credit / GDP
Trend
Trend + IMF5
Ecuador
2005Q1 2010Q1 2015Q1 2020Q1
Mortgage credit / GDP
Trend
Trend + IMF5
Ecuador
2005Q1 2010Q1 2015Q1 2020Q1
Corporate credit / GDP
Trend
Trend + IMF5
Ecuador
2005Q1 2010Q1 2015Q1 2020Q1
House to rent ratio
Trend
Trend + IMF5
Ecuador
2005Q1 2010Q1 2015Q1 2020Q1
Stock market capitalization / GDP
Trend
Trend + IMF5
Ecuador
2005Q1 2010Q1 2015Q1 2020Q1
Net flows to banks / GDP
Trend
Trend + IMF5
Peru
2005Q1 2010Q1 2015Q1 2020Q1
Consumer credit / GDP
Trend
Trend + IMF5
Peru
2005Q1 2010Q1 2015Q1 2020Q1
Mortgage credit / GDP
Trend
Trend + IMF5
Peru
2005Q1 2010Q1 2015Q1 2020Q1
Corporate credit / GDP
Trend
Trend + IMF5
Peru
2005Q1 2010Q1 2015Q1 2020Q1
House to rent ratio
Trend
Trend + IMF5
Peru
2005Q1 2010Q1 2015Q1 2020Q1
Stock market capitalization / GDP
Trend
Trend + IMF5
Peru
2005Q1 2010Q1 2015Q1 2020Q1
Net flows to banks / GDP
Trend
Trend + IMF5

C2. Robustness checks 2. Including the Net capital flows to the banking sector to the set of financial indicators.