The Effects of US Unconventional Monetary Policies in Latin America

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Abstract

This paper offers an empirical analysis of how US unconventional monetary policy has affected Latin American countries. First, we estimate the effects of US monetary policy announcements on sovereign bond interest rates, exchange rates, and stock market indices for a set of emerging countries, including five Latin American economies. We found that QE announcements in 2008/2009 and the tapering talk in 2013 generated sizable sovereign yield and exchange rate fluctuations. We further find, just in a few cases, some excessive response of asset prices in Latin American countries. In the second part of the paper, we estimate a simple model that measures the influence of country-specific macroeconomic fundamentals on the transmission of US financial

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disturbances. An estimated model including the inflation rate, the CDS spread, the ratio of official reserves and market capitalization explains some of the observed cross-country heterogeneity of spillovers from US monetary policy announcements. Under this model, a greater impact from the normalization of US monetary policy can be expected in Latin America relative to other emerging economies.

Keywords: unconventional monetary policy, spillovers, emerging economies, event study.

JEL classification: E52, F32, G11.

1. INTRODUCTION

After the 2007-2008 global financial crisis, once central banks in the major advanced economies had used up conventional instruments, these central banks resorted to new, unconventional monetary policy tools to help improve the weak economy. This unprecedented monetary policy reaction–and, perhaps more importantly, the perception that major central banks were firmly committed to adopting any measure needed to preserve an orderly financial intermediation–helped to calm financial markets. Against this background, from late 2009 until the beginning of the tapering tantrum in the spring of 2013, emerging market economies (EME) received a high volume of capital flows that ran in parallel with asset appreciation and the reduction of interest rates.

The opposite movement occurred after the Federal Reserve's announcement in May 2013 that anticipated the end of expansionary monetary policy in the United States. There were sudden reversals of capital inflows in several episodes between May 2013 and early 2014, as market perceptions of the Federal Reserve's intention to gradually withdraw its asset purchase program. Capital outflows from emerging markets during these episodes led to exchange rate depreciations of emerging market currencies, increases in the risk premia on their financial assets and falls in their equity markets.

In this paper, we analyze the effects of US unconventional monetary policy announcements on sovereign bond yields,

exchange rates, and stock market indices for 20 EMEs, including five from Latin America, and we also explore how the transmission of such monetary impulses is influenced by country-specific variables, such as macroeconomic variables, market conditions, and the external position, reflecting the countries' fundamentals. Thus, we analyze spillover effects by focusing on the reaction of the prices of financial assets. But, admittedly, we disregard other dimensions of the international transmission of monetary policy, namely changes in quantities (gross capital flows) and policy reactions.

This paper contributes to an already extensive literature which has explored the effects of the new unconventional instruments, mainly asset purchase programs in the United States. A number of papers have focused on the impact of these programs on US economy. Although results differ across studies depending on their methodology, sample periods, and variables analyzed, a number of general conclusions can be drawn. First, quantitative easing programs have been successful in improving financial conditions, sustaining activity and mitigating deflation risks (IMF, 2013). There is an ample literature that quantifies the effects of balance sheet policies on asset pricing (Neely, 2010; Gagnon et al., 2011; Meaning and Zhu, 2011; Krishnamurthy and Vissing-Jorgenson, 2011; among many others) and there is also some evidence, although admittedly scarcer, documenting the fact that asset purchases provided significant stimulus to activity and counteracted disinflationary pressures (Chen et al., 2014, for US LSAP, and Joyce et al., 2011, or Kapetanios et al., 2012, for UK APF programs). Second, the effects of the subsequent programs have been documented as being progressively smaller (Krishnamurthy and Vissing-Jorgensen, 2011, and Bauer, 2012). Third, three main transmission channels of unconventional monetary policy (UMP) measures are identified: the *portfolio-balance channel* (increase in the demand for other riskier assets, reducing financing costs), the *signaling channel* (reinforcement of the perception that the monetary policy stance will remain loose for

a prolonged period), and the *confidence channel* (increasing investors' risk appetite) (Woodford, 2012; IMF, 2013).

With regards to the analysis of cross-border spillovers (especially to EMEs) of unconventional monetary policy measures, the recent literature also offers some robust results. The overall picture provided by this literature is that asset purchase programs (especially those of the Federal Reserve) encouraged capital flows to EMEs, leading to appreciations of their exchange rates, increases in their stock market indices and contractions in their credit spreads. A number of papers have focused on more specific features. Fratzscher et al. (2013) document that LSAP1 policies induced a portfolio rebalancing from the rest of the world to US, in particular to US bonds lowering their yields. In contrast, LSAP2 policies triggered a rebalancing from US funds to foreign funds, in particular, EME equities. Bowman et al. (2015) found that the effects of US unconventional monetary policy on EMEs' financial assets prices depend on country-specific time-varying characteristics. Comparing the impact of conventional and unconventional measures, Chen et al. (2014) found that unconventional monetary policies had larger spillovers than conventional policies and they argue that this result is explained by structural issues–related to the instruments used during the UMP period–and, to a lesser extent, to weaker EME growth prospects. Gilchrist et al. (2014) also found a substantial pass-through of unconventional US monetary policy to EME bond yields but with larger heterogeneity than that observed in the transmission to advanced economies.

Finally, more recent papers have focused specifically on the cross-border impact of the *tapering talk*. Market reaction to talk of tapering was initially indiscriminate during the bout of volatility in May-June 2013, although later some differential effects relating to fundamentals were observed (Sahay et al., 2014). In particular, Eichengreen and Gupta (2013) and Aizenman et al. (2014) found that the impact was greater in countries that had accumulated external vulnerabilities in

terms of currency appreciation and a deteriorating current account during the previous expansionary period, although liquidity, market depth, and the size of investors' holdings also influenced the magnitude of the spillover effects. Mishra et al. (2014), in keeping with Bowman et al. (2015), showed that countries with stronger fundamentals, deeper financial markets, and a tighter macroprudential policy stance in the run-up to the tapering announcements experienced smaller currency depreciations and smaller increases in government bond yields. Sahay et al. (2014), reviewing the evidence of the cross-border impact of the tapering period, conclude that those countries that responded earlier and decisively to the initial tapering announcements fared better in later episodes of volatility in international financial markets.

This paper adds to this literature in two respects. Its first contribution is to analyze whether the impact of the US nonstandard monetary policies on Latin American economies differs from the impact on other EMEs. In this connection, there are reasons to expect that Latin American economies might be more vulnerable to increases in US interest rates. First, although many Latin American economies have reduced their reliance on dollar-denominated debt, this is still higher than in other EME economies. Second, financial interdependencies with the United States are particularly high within this region. Third, the main export products for most of these economies are commodities whose prices on international markets are set in US dollars. All these factors support the large and significant responses of Latin American macroeconomic variables to US monetary disturbances found in the literature in *normal times* (Canova, 2005) and the higher estimated sensitivity of sovereign bond yields in Latin America to US yields during the taper tantrum episode (IMF, 2014). Nevertheless, if the normalization of US monetary policy mirrors a better US growth performance, for those economies that are close trading partners (for example, Mexico) the positive impulse from stronger US growth is likely to counteract the impact of the rise in US interest rates.

The second contribution of this paper is to explore whether the role of fundamentals in conditioning the responses in EME economies to US unconventional monetary policy shocks differs across different episodes. More precisely, we explore whether country characteristics were more decisive in explaining differences in the reaction to QE announcements than they were in response to the news on the tapering process.

Taking together these two contributions, we want to test whether the impact of US nonstandard monetary policies on Latin American economies differs from the impact on other EMEs and, secondly, whether these differences remain once we control for fundamentals.

The remainder of the paper is organized as follows. In Section 2, using a daily panel data sample for the period from October 2008 to April 2015, we first analyze the effects of US monetary policy announcements on sovereign bond yields, exchange rates, and stock market indices for 20 countries, including five from Latin America. In Section 3, we explore whether the reaction of EME asset prices to US monetary policy differs depending on country-specific characteristics and whether the impact on Latin American asset prices differs from that found for other EMEs. Section 4 summarizes the main results of the paper and identifies some remaining issues.

2. EVENT STUDIES

This section presents an event study to show the effect of US policy changes on emerging markets. We report the results for 2-day changes (from the day before to the day after) in foreign markets after monetary policy announcements, assuming that economic news does not affect the policy choice in that short period of time. The daily data run from October 1, 2008, to April 24, 2015.

In the literature of event studies, there are different methods to identify monetary policy surprises. And in the case of nonstandard monetary policies, the identification tries to

extract information of the signaling channel, the portfolio rebalancing channel and the confidence channel out of the movements in the long-term interest rates, the yield curve, and other asset prices.[1]

Our analysis is much simpler since we do not try to identify monetary policy shocks. As explained below we follow Fratzscher et al. (2013) and measure the impact of the Federal Reserve announcements controlling for market developments. The strong assumption is that within the 2-day window we are able to measure all the policy effect on asset prices (thus, there has not been an anticipation effect by the investors and all the revision of the asset price expectation is taking place within that period). Moreover, around the Federal Reserve announcement, there is no other information affecting asset prices in that window length and the Federal Reserve is not responding to the state of the economy.[2]

Our analysis covers three types of financial assets: 10-year sovereign bonds in local currency, bilateral exchange rates relative to US dollar, and headline stock market indices. Appendix 1 describes the data sources and defines the variables and Appendix 2 presents a summary of statistics. The sample includes the following 20 emerging economies: Brazil, Chile, China, Colombia, the Czech Republic, Hong Kong, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Singapore, South Africa, Taiwan, Thailand, and Turkey. This country sample is similar to others considered recently in the literature but we will also present some robustness analysis.

Table 1 describes the selected set of official announcements and speeches by the Federal Reserve considered since the

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[1] Wright (2012) and Gertler and Karadi (2015), among others, provide alternative VAR identifications of monetary policy shocks during the recent period of unconditional monetary policy in the US.

[2] The results for 1-day and 7-day windows around events do not differ much from those reported in the next section. And similarly when we consider for Asian asset prices opening times in *t+1*.

establishment of unconventional policies in November 2008. The set of events includes announcements relating to the first two large-scale asset purchases (LSAP1 and LSAP2) in 2008-2009 and in 2010, the maturity extension program in 2011 (MEP), the third LSAP (LSAP3) in 2012, the so-called *tapering tantrum* in May-October 2013 and the official tapering period of asset purchases from December 2013 to October 2014. Besides these QE events, we also consider statements on forwarding guidance policy and some speeches by Bernanke that could prompt potential market reactions.

Table 1

LIST OF RELEVANT FOMC MEETINGS AND EVENTS: NOVEMBER 2008 TO OCTOBER 2014

	First Large Scale Asset Purchase (LSAP)	
Nov 25, 2008	Announcement	The Federal Reserve announces the purchases of MBS backed by government agencies, and the creation of TALF.
Dec 1, 2008	Speech (Austin)	Bernanke hints future Treasury purchases.
Dec 16, 2008	FOMC statement	The Federal Reserve cuts the target Federal Funds rate to zero.
Jan 28, 2009	FOMC statement	The Federal Reserve announces the PDCF, the TLSF and the AMFL.
Mar 18, 2009	FOMC statement	The Federal Reserve extends its purchases of MBS and announces that it will start to purchase Treasury securities.
	Second LSAP	
Aug 10, 2010	FOMC statement	The Federal Reserve announces it is willing to buy long-term Treasury securities through reinvestment of payments of its MBS.
Aug 27, 2010	Speech (Jackson Hole)	Bernanke's speech at Jackson Hole.
Sep 21, 2010	FOMC statement	According to the FOMC, the short-term interest rate will stay at low levels for a long period of time.
Oct 15, 2010	Speech (Indiana)	According to Bernanke, new measures might be necessary.
Nov 2, 2010	FOMC statement	The Federal Reserve decides to purchase additional 600 billions of dollars of long-term Treasury securities.

	Maturity Extension Program (MEP)	
Aug 09, 2011	FOMC statement	According to the FOMC, the short-term interest rate will stay at low levels for a long period of time and will take new measures if necessary.
Aug 26, 2011	Speech	Bernanke's speech at Jackson Hole.
Sep 21, 2011	FOMC statement	The Federal Reserve announces its Maturity Expansion Program.
	Third LSAP	
Aug 22, 2012	FOMC minutes	The Federal Reserve will take new measures if necessary.
Aug 31, 2012	Speech (Jackson Hole)	Bernanke suggests new QE.
Sep 13, 2012	FOMC statement	The Federal Reserve announces new quantitative easing.
	Events in 2013	
Mar 20, 2013	FOMC statement	The Federal Reserve will continue its accommodative monetary policy until certain goals of unemployment and inflation are reached.
May 01, 2013	FOMC statement	FOMC: accommodative monetary policy will be held for a long period of time.
	Taper Talk Period	
May 22, 2013	FOMC minutes and testimony	Bernanke suggests the end of expansive monetary policy.
Jun 19, 2013	FOMC statement	The Federal Reserve suggests that *tapering* could begin next year.
Jul 11, 2013	FOMC minutes and speech (NBER)	Bernanke says that the central bank's easing of monetary policy would continue for the foreseeable future.
Oct 30, 2013	FOMC statement	The Federal Reserve decides to continue its accommodative monetary policy.
Dec 18, 2013	FOMC statement	*Tapering* is officially announced.
	Events in 2014	
Sep 17, 2014	FOMC statement	Announcement of policy normalization principles and plans.
Oct 29, 2014	FOMC statement	Concluded tapering period. Starts *indefinite* forward guidance.

Figure 1 shows the time series for the aggregate index for EMEs, Latin American and US sovereign yields (panel A) and the aggregate index for EMEs and Latin American exchange rates with respect to the US dollar (panel B) along with the stock market indices (panel C). This figure provides some insight into the relation between US unconventional monetary policy phases and EME financial asset prices. First, a comovement between US sovereign yields and EME (and Latin American) yields is observed, and it is clearer in the case of the LSAP1 and tapering periods. Second, the relation between US unconventional monetary policy measures and EME stock market prices and exchange rates is less clear. Third, the series of Latin American financial asset prices display wider fluctuations than the corresponding aggregate EME series.

Figure 2 shows the time series for the aggregate capital inflows for different regions. In the aftermath of the global financial crisis, capital flows displayed a steep upward trend in most emerging market regions and particularly in Latin America, while the increase in advanced economies was less marked.

2.1 Emerging (and Latin American) Market Reactions

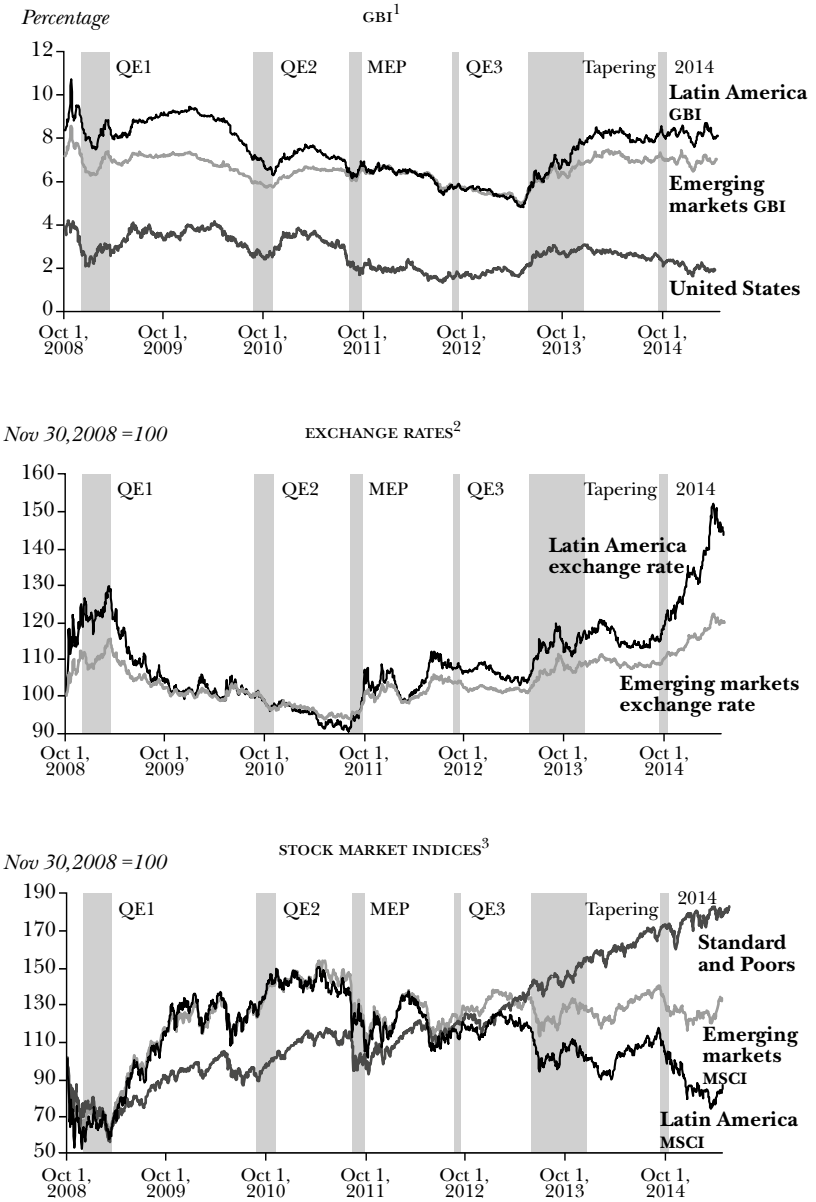
The standard event-study specification to test the impact of unconventional monetary measures would be:

$$\Delta y_{it} = E_{it-1}\left[\Delta y_{it}\right] + \sum_{j=1}^{25} \beta_j * D_j + \varepsilon_{it}, \quad (1)$$

where Δy_{it} is the change in the financial variable of interest, $E_{it-1}\left[\Delta y_{it}\right]$ denotes the expected change in this variable in absence of shocks, and β_j is the coefficient associated with the dummy of each unconventional policy announcements (D_j).

Tables 2, 3 and 4 report the 2-day changes in sovereign yields, exchange rates, and stock prices, respectively, around the 25 selected dates of the announcements. As a reference, in each table, we include a first column that reports the estimated

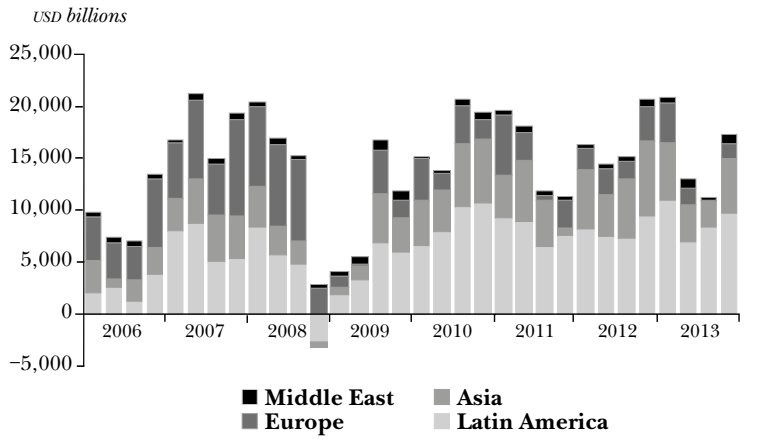
EMERGING MARKET ASSET PRICES AND US FINANCIAL VARIABLES



Sources: [1] JP Morgan and Federal Reserve Board. [2] National sources and own calculations. [3] Standard and Poors, and Morgan Stanley.

Figure 2

EMERGING ECONOMIES: CAPITAL INFLOWS CHANGING DISTRIBUTION (2004-2013)



Source: IFS, International Monetary Fund.

changes in the US variable,[3] a second column with the changes in the corresponding aggregate EME index and a third column with the responses in a similar aggregate LATAM index. The fourth and fifth columns report the coefficients for a regression that considers as dependent variables each of the assets not only with time variation but also with a country variation:

$$\Delta y_{it} = E_{it-1}\left[\Delta y_{it}\right] + \sum_{j=1}^{25} \beta_j * D_j + \sum_{j=1}^{25} \gamma_j * Lat * D_j + \varepsilon_{it}, \quad (2)$$

where β_j is the coefficient associated with the dummy of each event (D_j) and γ_j refers to the interaction coefficient of the event dummy with a Latin American dummy (Lat). Thus, the coefficients reported in column 4 (β_j) represent the average change of the dependent variable at date j for a non-Latin American

[3] This first column is not included in the case of the changes in the exchange rate (Table 3).

country, while the sum of the coefficients reported in columns 4 and 5 ($\beta_j + \gamma_j$) represent the average change of the dependent variable at date j for a Latin American country.[4]

We followed Fratzscher et al. (2013) and included a set of financial variables that approximate the expected component of the variable of interest: the lagged dependent variable, the change in the VIX, the change in the US 10 years sovereign bond yield, a liquidity spread (US 3-months OIS minus US T-bill 3-months), the change in the S&P500 index and the change in the local equity index (all dated in $t-1$). We also considered country fixed effects. The high frequency of the regression (daily data) limited the inclusion of real variables as additional controls.

US yields (first column in Table 2) dropped significantly around the first LSAP announcements, except for the January 28, 2009, event, at which time the yield rose. Fluctuations in US yields are smaller and less significant around the second and third LSAP, and they are again significant around two of the MEP announcements. Finally, the only significant reversal event with respect to yields is on June 19, 2013, when the FOMC suggested that tapering could begin in 2014. Other US assets such as the stock market index (reported in Table 4) show more mixed results. The number of significant events is lower and in some cases a fall is observed after the expansionary QE announcements.

Looking now at foreign assets, the changes in the EME aggregate yield index (GBI-EM in column 2, Table 2) are less uniform and of a lower magnitude. As in the case of the United States, the most significant events are those around the LSAP1 and the tapering. The changes in EME exchange rates and the stock market indices are relevant around the same dates although in general with a lower significance. The results for the LATAM

[4] It is worth mentioning that the sample includes only five Latin American countries (the five largest inflation targeters in the region). For this reason, the results should not be extrapolated to other economies of the region, that in many cases have very different characteristics.

Table 2

EVENT STUDY FOR CHANGES IN SOVEREIGN YIELDS: DAILY DATA
(November 30, 2008 to April 24, 2015)

$$\Delta y_{it} = E_{it-1}\left[\Delta y_{it}\right] + \sum_{j=1}^{25} \beta_j * D_j + \sum_{j=1}^{25} \gamma_j * Lat * D_j + \varepsilon_{it}$$

Dates	*US yields*	*EME GBI index*	*LATAM GBI index*	*Event effect* (β)	*LATAM effect* (γ)
			First LSAP		
Nov 25, 2008	−33.84[c]	−21.46[c]	−22.24[b]	−4.80[a]	12.12[b]
Dec 1, 2008	−26.46[c]	−2.86	−25.04[b]	−1.54	−40.16[c]
Dec 16, 2008	−33.23[c]	−16.86[b]	12.74	−2.26[c]	4.08
Jan 28, 2009	29.88[c]	9.24	10.46	3.73	3.75
Mar 18, 2009	−40.31[c]	−5.86	9.84	−0.78	−1.44
			Second LSAP		
Aug 10, 2010	−14.59[a]	−2.96	−6.84	−1.31	−3.53
Aug 27, 2010	5.28	4.14	7.36	−0.00	0.04
Sep 21, 2010	−14.25[a]	−3.26	−2.84	2.28	−4.26
Oct 15, 2010	0.64	1.34	3.66	2.40	4.80
Nov 3, 2010	−12.58	−2.06	0.00	1.73	0.83
			MEP		
Aug 9, 2011	−19.87[b]	−8.06	−13.14	−2.61	6.62
Aug 26, 2011	5.33	−5.56	−10.44	1.13	−6.04
Sep 21, 2011	−22.57[c]	17.24[b]	21.36[b]	2.82	14.16[b]

			Third LSAP		
Aug 22, 2012	−13.87[a]	−7.36	−11.94	−1.71	−0.14
Aug 31, 2012	−6.47	−3.87	−1.94	−1.39	3.55
Sep 13, 2012	10.63	4.04	4.36	0.63	4.70
			Events in 2013		
Mar 20, 2013	2.19	2.01	3.06	0.02	3.45
May 1, 2013	−4.49	−3.89	−1.84	−0.53	−0.66
May 22, 2013	8.03	9.84	12.86	3.23	6.56
Jun 19, 2013	23.84[c]	36.64[c]	46.76[c]	16.61[c]	7.77
Jul 11, 2013	−7.56	−5.26	−9.54	−2.42	−1.06
Oct 30, 2013	3.76	18.04[b]	35.06[c]	4.15	4.05
Dec 18, 2013	8.37	1.84	−0.24	3.64	4.95
			Events in 2014		
Sep 17, 2014	4.15	1.54	0.02	1.94	3.03
Oct 29, 2014	2.44	5.24	0.12	1.07	−0.75

Note: Column 2 reports the changes in US 10-year sovereign yields. Columns 3 and 4 report the changes in two aggregate indices. Columns 5 and 6 report the average country changes and their significance level. [a], [b] and [c] represent significance at the standard 10, 5 and 1 percent confidence level. $E_{it-1}\left[\Delta y_{it}\right]$ represents the expected change in the dependent variable in the absence of shocks. This expected component is captured by including the following controls (all dated in *t−1*): the lagged dependent variable, the change in the VIX, the change in US 10 years sovereign bond yield, a liquidity spread (US 3-months OIS minus US T-bill 3-months), the change in the S&P500 index, the change in the local equity index, and country fixed effects.

Table 3

EVENT STUDY FOR CHANGES IN EXCHANGE RATES (DEPRECIATION DATA): DAILY DATA

September 30, 2008 to April 24, 2015

$$\Delta y_{it} = E_{it-1}\left[\Delta y_{it}\right] + \sum_{j=1}^{25} \beta_j * D_j + \sum_{j=1}^{25} \gamma_j * Lat * D_j + \varepsilon_{it}$$

Dates	*EME index*	*LATAM index*	*Event effect* (β)	*LATAM effect* (γ)
		First LSAP		
Nov 25, 2008	−0.76[a]	−1.46	0.01	0.20
Dec 1, 2008	0.89[b]	0.81	−0.16	−0.40
Dec 16, 2008	−0.96[b]	−1.11	−1.00[c]	0.14
Jan 28, 2009	0.05	−0.69	1.13[c]	−0.49
Mar 18, 2009	−0.74[a]	−0.39	−0.53[b]	2.07[c]
		Second LSAP		
Aug 10, 2010	0.55	0.56	0.96[c]	−0.57
Aug 27, 2010	0.01	0.07	0.07	−0.12
Sep 21, 2010	−0.36	−0.44	−0.39	0.56
Oct 15, 2010	0.19	0.07	0.80[c]	−0.73
Nov 3, 2010	−0.62	−0.99	−0.47[b]	0.23
		MEP		
Aug 9, 2011	0.19	0.42	−0.21	0.02
Aug 26, 2011	−0.35	−0.55	−0.42[a]	0.07
Sep 21, 2011	1.67[c]	5.12[c]	1.07[c]	1.50[c]

		Third LSAP		
Aug 22, 2012	−0.19	0.17	−0.14	0.10
Aug 31, 2012	−0.33	−0.95	−0.29	−0.15
Sep 13, 2012	−0.62	−1.00	−0.54[b]	0.23
		Events in 2013		
Mar 20, 2013	0.08	0.11	0.13	−0.07
May 1, 2013	−0.21	0.27	−0.20	0.29
May 22, 2013	0.51	0.66	0.30	0.05
Jun 19, 2013	1.46[c]	3.43[c]	1.08[c]	0.87[a]
Jul 11, 2013	−0.34	−0.42	−0.17	0.02
Oct 30, 2013	0.32	0.83	0.33	0.19
Dec 18, 2013	0.51	0.82	0.64[c]	−0.04
		Events in 2014		
Sep 17, 2014	0.27	0.65	0.44[a]	−0.19
Oct 29, 2014	−0.02	−1.80[a]	0.37	−0.98[b]

Note: Columns 2 and 3 report the changes in two aggregate indices. Columns 3 and 4 report the average country changes and their significance level. [a], [b] and [c] represent significance at the standard 10, 5 and 1 percent confidence levels. $E_{it-1}\left[\Delta y_{it}\right]$ represents the expected change in the dependent variable in the absence of shocks. This expected component is captured by including the following controls (all dated in *t−1):* the lagged dependent variable, the change in the VIX, the change in US 10 years sovereign bond yield, a liquidity spread (US 3-months OIS minus US T-bill 3-months), the change in the S&P500 index, the change in the local equity index, and country fixed effects.

Table 4

EVENT STUDY FOR CHANGES IN STOCK MARKET INDEX: DAILY DATA
November 30, 2008 to April 24, 2015

$$\Delta y_{it} = E_{it-1}\left[\Delta y_{it}\right] + \sum_{j=1}^{25} \beta_j * D_j + \sum_{j=1}^{25} \gamma_j * Lat * D_j + \varepsilon_{it}$$

Dates	*US S&P 500*	*MSCI EME index*	*MSCI LATAM index*	*Event effect* (β)	*LATAM effect* (γ)
			First LSAP		
Nov 25, 2008	4.12[b]	5.66[c]	6.23[b]	0.19	−1.28
Dec 1, 2008	−5.38[c]	−4.94[b]	−7.99[c]	−0.58	1.34
Dec 16, 2008	4.04[b]	4.12[a]	6.25[b]	0.65	1.93[b]
Jan 28, 2009	−0.15	2.50	2.49	−0.75[a]	−0.49
Mar 18, 2009	0.67	2.81	3.10	0.44	−0.28
			Second LSAP		
Aug 10, 2010	−3.49[a]	−3.38	−3.80	−1.67[c]	−0.37
Aug 27, 2010	0.08	0.59	0.66	0.18	−0.07
Sep 21, 2010	−0.82	0.31	−0.22	−0.54	−0.02
Oct 15, 2010	0.84	−1.37	−0.18	−0.52	0.00
Nov 3, 2010	2.22	2.34	3.07	1.03[b]	−0.24
			MEP		
Aug 9, 2011	0.03	−1.01	3.79	0.18	5.15[c]
Aug 26, 2011	4.30[b]	3.19	4.12	1.34[c]	1.57[a]
Sep 21, 2011	−6.12[c]	−7.47[c]	−9.57[c]	−3.55[c]	−0.32

			Third LSAP		
Aug 22, 2012	−0.87	−0.20	−0.80	−0.10	−0.23
Aug 31, 2012	0.42	0.84	0.92	0.96[b]	−0.78
Sep 13, 2012	1.95	3.58[a]	3.58	1.10	−0.09
			Events in 2013		
Mar 20, 2013	−0.25	−0.30	−0.22	−0.03	0.34
May 1, 2013	−0.09	−0.26	−1.07	0.07	−0.01
May 22, 2013	−1.20	−2.17	−1.43	−1.11[c]	1.19
Jun 19, 2013	−3.94[b]	−4.78[b]	−6.57[b]	−3.03[c]	−0.23
Jul 11, 2013	1.58	3.19	1.84	1.34[c]	−0.73
Oct 30, 2013	−0.96	−0.28	−1.05	−0.56	0.22
Dec 18, 2013	1.52	−0.04	0.72	−0.54	0.54
			Events in 2014		
Sep 17, 2014	0.53	0.16	−1.16	0.44	−0.94
Oct 29, 2014	0.40	1.46	2.27	0.18	−0.32

Note: Column 2 reports the changes in the S&P500 returns. Columns 2 and 3 report the changes in two aggregate return indices. Columns 4 and 5 report the average country change and their significance level. [a], [b] and [c] represent significance at the standard 10, 5 and 1 percent confidence levels. $E_{it-1}[\Delta y_{it}]$ represents the expected change in the dependent variable in the absence of shocks. This expected component is captured by including the following controls (all dated in *t−1):* the lagged dependent variable, the change in the VIX, the change in US 10 years sovereign bond yield, a liquidity spread (US 3-months OIS minus US T-bill 3 months), the change in the S&P500 index, and country fixed effects.

aggregate yield index (column 3 in Table 2) are similar and, in a number of cases, of a larger size. The different response of assets has already been reported by, among others, Bowman et al. (2015). More generally, the decreasing effect of the different QE programs has been documented in the US economy (for example, Krishnamurthy and Vissing-Jorgensen, 2011) and internationally (for example, Fratzscher et al., 2013).

The last two columns in Table 2 allow us to see whether the movements in sovereign yields around the relevant events are significant once we control for the proxies of the expected component of the yield and allow for country variability and whether these responses differ in the Latin American countries with respect to other emerging market economies. EME yields decreased on average two basis points within the LSAP1 period and the fall was more significant after the December 16, 2008, announcement when the Federal Reserve cut the federal funds rate to zero. We do not find that the Latin American countries have a systematic differential response.

The decreasing effect of subsequent QE programs in EME economies is clear since the movements in yields are not significant between 2010 and 2012. Nevertheless, when Operation Twist was launched in September 2011, there was a significant interest rate increase for Latin America. Finally, during the tapering period, yield increases were found around June 2013. The size of the yield change was larger than the one during the LSAP1 period and the reaction for Latin American countries was not significantly different.

A monetary shock that lowers US yields also generates an appreciation of the EME currencies (Table 3) and an increase in the stock market indices of the EME economies (Table 4). Contrary to Fratzscher et al. (2013) results, we do not find evidence of a significant US dollar appreciation during the LSAP1 period and that would support a portfolio rebalancing out of EME assets into US assets.

Interestingly, the EME movements in exchange rates and stock markets are more significant when we control for the expected component in the changes of these variables and the

cross-country dimension of the data is taken into account than when looking to aggregate indices. And we found more significant events for the EME coefficient with these two assets than with the yields. The LSAP1 caused a dollar depreciation of 1% on December 16, 2008, and an increase of stock market of 2% just for Latin American indices.[5] Nevertheless, other events did not have the expected sign coefficient. In the case of exchange rate fluctuations, the depreciation after the June 2013 FOMC announcement of tapering was significantly greater in Latin America. This same pattern was also observed around the March 2009 LSAP1 announcement, but in this case Latin America and aggregate EME moved in opposite directions. The MEP announcement in September 2011 had a significant negative impact on equity markets internationally and induced a cross-country rebalancing on bonds, especially out of Latin American yields and into US bonds that appreciated the dollar significantly, particularly against Latin American currencies. After the October 2014 FOMC meeting, when the tapering process concluded and an indefinite forward guidance policy was announced, the aggregate Latin American exchange rate against the US dollar appreciated. Thus, it seems that Latin American exchange rates were more sensitive in a few cases to some of the US monetary shocks. Similarly, there is evidence of a significantly higher stock market response for the Latin American countries in three events: the announcement on December 16, 2008; August 9, 2011, when the FOMC assured that interest rates would remain exceptionally low over the period to mid-2013; and Bernanke's speech at Jackason Hole on August 26, 2011.

In sum, a simple time series analysis of US unconventional monetary policies shows that they have had a more significant effect across EME asset prices after the LSAP1 (2008-2009) and the tapering (2013) periods with some excess response

[5] When the regression analysis was repeated eliminating the five countries with higher per capita income the significant events and their coefficients remain very much the same.

by Latin American assets. Comparing the three asset prices, the exchange rate is the variable which has more significant events, consistently with the relevance of the exchange rate channel in the transmission of monetary shocks to EME economies (Taylor, 2013).

3. TRANSMISSION OF US MONETARY POLICY

This section examines the role played by country characteristics in financial market reactions to the Federal Reserve's policy actions. We first make use of the previous event study framework and analyze differences in transmission between the previously identified positive and negative events. In the second part, we study country heterogeneity in a monthly panel data set-up modeling a specific transmission channel. In both cases, we test whether or not Latin American countries follow different patterns in response to the exogenous policy announcements relative to the sample of emerging market economies (EMEs).

The country characteristics are detailed in Appendix I. They can be classified in four categories: *1)* macro fundamentals: GDP growth, inflation, and public debt/GDP; *2)* financial market conditions: CDS spread and the policy interest rate; *3)* external conditions: reserves/GDP, current account/GDP, external debt/GDP, short-term external debt/GDP, net banking position/GDP, portfolio flows/GDP, nominal exchange rate deviation, and the accumulated change in the real exchange rate; and *4)* structural characteristics: an index of financial openness; exports to the United States/GDP and stock market capitalization (relative to GDP). Note that among the external conditions, we have included two exchange rate indicators that measure the competitiveness gains in the most recent period, and that among the structural variables we have included stock market capitalization as a proxy of financial market size.

Some of these characteristics may represent country vulnerabilities in the sense that the market reaction of those country assets could be stronger in response to an exogenous shock. Others represent country strengths and the market reaction to the US monetary policy announcement might be negatively

correlated with them. However, for variables that measure the level of financial and real integration as well as the change in competitiveness, the effect may be more uncertain.

3.1 Market Reaction and Country Characteristics: Sample of UMP Events

We initially estimate a set of regressions by pooling the identified 25 policy events across the 20 EMEs. The dependent variable Δy_{ij} is the 2-day change for one of three financial asset prices considered in country i and event date j. The explanatory variables, besides the country fixed effect, include each of the country characteristics (CC_{it-1}), a dummy variable (D_j^s) for the selected events that were significant (positively or negatively) in the previous time-series regression, and the interaction between the significant event dummies and the country characteristics. The specification is:

$$\Delta y_{ij} = E_{it-1}\left[\Delta y_{ijt}\right] + \beta D_j^s + \gamma CC_{it-1} + \delta D_j^s CC_{it-1} + \varepsilon_{it}. \quad (3)$$

The regression with a positive event considers the December 12, 2008 LSAP1 date that became significant across EME or Latin American economies in regression 2. And the regression with the negative event considers the June 19, 2013, significant date during the tapering talk by the Federal Reserve. We use the same set of controls than in the event study and all the characteristics are lagged one month to avoid correlation with the error term.

Table 5 presents the regression results for changes in sovereign bond yields. For each of the country characteristics, the left-hand side of the table reports the estimated coefficients for the regression with the dummy variable under the significant LSAP1 event and the interaction of the dummy with the characteristics. The right-hand side of the table reports the regression results under the significant tapering event.[6]

[6] We do not report the general vulnerability coefficients since we are only interested in the effects around the significant policy events.

Table 5

EFFECT OF THE LSAP1 AND THE TAPERING TALK PERIODS ON EMERGING MARKET YIELDS AND THEIR RELATION TO COUNTRY CHARACTERISTICS

$$\Delta y_{ij} = E_{it-1}\left[\Delta y_{it}\right] + \beta D_j^s + \gamma CC_{it-1} + \delta D_j^s CC_{it-1} + \varepsilon_{it}$$

	LSAP1 period		*Tapering talk period*	
	Dummy (β)	Dummy*CC (δ)	Dummy (β)	Dummy*CC (δ)
	Macroeconomic variables			
GDP	−0.096	−0.007	0.155[c]	−0.000
Inflation	0.245[c]	−0.059[c]	0.109[a]	0.013
Debt	−0.060	−0.001	0.230[c]	−0.002
	Market conditions			
Policy rate	0.068	−0.027[c]	0.222[b]	−0.012
CDS	0.578[c]	−0.002[c]	0.164	0.000
	External variables			
Current account to GDP	−0.139[c]	0.010[a]	0.151[c]	−0.012[a]
Reserves to GDP	−0.272[c]	0.005[c]	0.189[c]	−0.001
External debt to GDP	−0.140	0.000	0.166[b]	−0.000
Portfolio flows to GDP	−0.136[b]	0.004	0.108	0.020
Net banking position to GDP	−0.138[b]	0.002	0.149[c]	−0.003
Exchange rate deviation	−0.120[a]	−0.001	0.178[c]	−0.002
Real exchange rate	−0.121[b]	0.002	0.153[c]	−0.000
	Structural variables			
Market size (capitalization to GDP)	−0.145[c]	0.000	0.152[c]	−0.000
Real integration (exports to US to GDP)	−0.141[b]	0.006	0.140[c]	0.001
Financial integration (Chinn Ito index)	−0.145[b]	0.016	0.153[c]	0.019

Notes: this table reports the set of regressions pooling the 25 policy events across the 20 EMEs. Each line contains the regression results for one of the country characteristics (CC) and the corresponding event period. In the LSAP1 period, the date considered is December 16, 2008. In the tapering talk period, the date is June 19, 2013. The general country characteristics coefficients are not reported. [a], [b] and [c] represent significance at the standard 10, 5 and 1 percent confidence levels. $E_{it-1}\left[\Delta y_{it}\right]$ represents the expected change in the dependent variable in the absence of shocks. This expected component is captured by including the following controls (all dated in *t−1):* the lagged dependent variable, the change in the VIX, the change in the US 10 years sovereign bond yield, a liquidity spread (US 3-months OIS minus US T-bill 3-months), the change in the S&P500 index, and country fixed effects.

First, the dummy variable for most of the country characteristics is significant and has a negative effect for the LSAP1 events (reducing yields) and a positive effect for the tapering events (increasing yields). By contrast the inflation rate and the CDS correlate positively with the first UMP event. In general, the significance around these events, their sign, and magnitude is consistent with the average event estimates in Table 2.

A second result is that a number of the interaction coefficients (five) are significant under the LSAP1 whereas they are not so under the tapering events. Thus, we can say that on impact, the tapering had a more indiscriminate effect across EMEs whereas the LSAP1 had a differential effect across countries depending on the country characteristics. During the LSAP1 period countries with a higher inflation rate, higher CDS spread, and higher policy rate yields responded more to the US monetary shock whereas countries with higher current account surpluses or higher reserves yields responded less. The size of these effects is nonnegligible: A one standard deviation increase in CDS (92.4 bp), the inflation rate (2.9%) and the policy rate (2.8%) implies an additional reduction in sovereign yields after LSAP1 announcement of 20 bp, 17 bp and 8 pb, respectively, while a one standard deviation increase in the reserves to GDP ratio (28%) and the current account to GDP ratio (6.28) implies an increase in sovereign yields after LSAP1 announcement of 14 bp, and 6 pb, respectively.

The results are less relevant when the dependent variable is the change in exchange rates during the LSAP1 event (see Table 6). Only in some regressions, the dummy for that event is significant and there is only one country characteristic that interact significantly with the first set of unconventional Federal Reserve policies, which was also significant in the yields regression–the domestic policy rate. By contrast, some of the country characteristics become significant when interacting with the tapering period: Countries with higher output growth and higher reserves experimented lower depreciations of their currencies.

Table 6

EFFECT OF THE LSAP1 AND THE TAPERING TALK PERIODS ON EMERGING MARKET EXCHANGE RATES AND THEIR RELATION TO COUNTRY CHARACTERISTICS

$$\Delta y_{ij} = E_{it-1}\left[\Delta y_{it}\right] + \beta D_j^s + \gamma CC_{it-1} + \delta D_j^s CC_{it-1} + \varepsilon_{it}$$

	LASP1 period		*Tapering talk period*	
	Dummy (β)	Dummy*CC (δ)	Dummy (β)	Dummy*CC (δ)
	Macroeconomic variables			
GDP	−1.124[b]	0.097	1.828[c]	−0.295[c]
Inflation	−0.446	−0.062	0.897[b]	0.012
Debt	−0.590	−0.006	−0.026	0.021[b]
	Market conditions			
Policy rate	0.157	−0.125[a]	0.679	0.104
CDS	0.567	−0.003	−0.075	0.007
	External variables			
Current account to GDP	−0.917[c]	0.054	0.949[c]	−0.058
Reserves to GDP	−1.186[c]	0.013	1.500[c]	−0.016[b]
External debt to GDP	0.124	−0.033[b]	0.284	0.023[b]
Portfolio flows to GDP	−0.999[b]	0.031	1.160[b]	0.012
Net banking position to GDP	−1.018[b]	0.011	1.175[c]	−0.004
Exchange rate deviation	−0.424	−0.024	1.316[c]	0.007
Real exchange rate	−0.669[a]	−0.019	1.086[c]	0.016
	Structural variables			
Market size (capitalization to GDP)	−0.879[b]	0.001	1.145[c]	−0.002[a]
Real integration (exports to US to GDP)	−0.772[a]	0.012	0.759[b]	0.026
Financial integration (Chinn-Ito index)	−0.547	−0.302	0.866[c]	0.269

Notes: this table reports the set of regressions pooling the 25 policy events across the 20 EMEs. Each line contains the regression results for one of the country characteristics (CC) and the corresponding event period. In the LSAP1 period, the date considered is December 16, 2008. In the tapering talk period, the date is June 19, 2013. The general country characteristics coefficients are not reported. [a], [b] and [c] represent significance at the standard 10, 5 and 1 percent confidence levels. $E_{it-1}\left[\Delta y_{it}\right]$ represents the expected change in the dependent variable in the absence of shocks. This expected component is captured by including the following controls (all dated in *t−1):* the lagged dependent variable, the change in the VIX, the change in the US 10 years sovereign bond yield, the change in the S&P500 index, and country fixed effects.

Therefore, there are differential effects of the sovereign interest rates during the LSAP1 period depending on variables proxying vulnerabilities and strengths of these economies. However, the bond yield responses around the first two months of the tapering process are consistent with the indiscriminate impact of the earlier events in this process, although market differentiation was gradually becoming more relevant later on (Sahay et al., 2014). Moreover, when the analysis is carried out with the exchange rates we found that the impact of the taper talk was significantly related to some macroeconomic fundamentals. Thus, the results with this asset are more in line with the ones found by Mishra et al. (2014).

Next, we examine whether there are additional specific Latin American effects besides those captured by the country characteristics. To that end, we repeat the estimation of Equation 3, adding an interaction effect with a Latin American dummy (*Lat*) for each of the previous variables considered. The specification is as follows:

$$\Delta y_{ij} = E_{it-1}\left[\Delta y_{it}\right] + \beta D_j^s + \gamma CC_{it-1} + \delta D_j^s CC_{it-1} + \eta Lat D_j^s + \\ + \lambda Lat\, CC_{it-1} + \rho Lat D_j^s CC_{it-1} + \varepsilon_{it}. \quad (4)$$

The estimation results for Equation 4 with sovereign yields as the dependent variable and under the relevant LSAP1 events are presented in Table 7.[7] As in the previous regression, we find a negative and significant dummy interactions with the country characteristics that remain significant and with the expected sign for the same variables: inflation, CDS spreads, policy rates, reserves and the current account. But the interaction of the LSAP1 event and the *Lat* dummy is weakly significant for a few cases. And a similar result holds for the regression with the dummy for the tapering talk events and the interaction with the *Lat* dummy.

[7] The magnitude of the effects is similar to that of the results reported in Table 5.

Table 7

EFFECT OF THE LSAP1 ON EMERGING AND LATIN AMERICAN ECONOMIES YIELDS DEPENDING ON THEIR COUNTRY CHARACTERISTICS

$$\Delta y_{ij} = E_{it-1}\left[\Delta y_{it}\right] + \beta D_j^s + \gamma CC_{it-1} + \delta D_j^s CC_{it-1} + \eta LatD_j^s + \lambda LatCC_{it-1} + \rho LatD_j^s CC_{it-1} + \varepsilon_{it}$$

	Dummy (β)	*Dummy*CC* (δ)	*Dummy*Lat* (η)	*Dummy*Lat*CC* (ρ)
	Macroeconomic variables			
GDP	−0.092	−0.015	−0.034	0.026
Inflation	0.253[c]	−0.066[c]	−0.458	0.086[a]
Debt	−0.207[b]	0.001	0.419[b]	−0.009[b]
	Market conditions			
Policy rate	−0.007	−0.025[b]	0.378[a]	−0.023
CDS	0.546[c]	−0.002[c]	−0.494	0.002
	External variables			
Current account to GDP	−0.186[c]	0.014[b]	−0.360	−0.271[b]
Reserves to GDP	−0.355[c]	0.006[c]	−0.052	0.014
External debt to GDP	−0.171	−0.000	−0.226	0.014[b]
Portfolio flows to GDP	−0.190[b]	0.005	0.114	0.009
Net banking position to GDP	−0.192[b]	0.002	0.149	0.000
Exchange rate deviation	−0.179[b]	0.003	0.147[a]	−0.008
Real exchange rate	−0.147[b]	0.002	0.099	0.002
	Structural variables			
Market size (capitalization to GDP)	−0.177[c]	0.000	−0.090	0.005
Real integration (exports to US to GDP)	−0.217[c]	0.017	0.209[a]	−0.022
Financial integration (Chinn-Ito index)	−0.154[b]	−0.011	−0.069	0.137

Notes: this table reports the set of regressions pooling the 25 policy events across the 20 EMEs. Each line contains the regression results for one of the country characteristics (CC) and the corresponding event period. In the LSAP1 period, the date considered is December 16, 2008. The general country characteristics coefficients are not reported. [a], [b] and [c] represent significance at the standard 10, 5 and 1 percent confidence levels. $E_{it-1}\left[\Delta y_{it}\right]$ represents the expected change in the dependent variable in the absence of shocks. This expected component is captured by including the following controls (all dated in *t−1):* the lagged dependent variable, the change in the VIX, the change in US 10 years sovereign bond yield, the change in the S&P500 index, and country fixed effects.

We consider the above regression results as weak evidence of an independent effect coming out of the Latin American economies, once the country characteristics are taken into account to explain the EME country heterogeneity when facing US monetary policy shocks. That spillover result is in line with the weak evidence found for the excess response on Latin American asset prices in the event study section.

3.2 Channels of Transmission

This section estimates a simple model for the transmission of unconventional US monetary policy. The objective is to analyze whether the observed asset price responses for EME economies found in the event study (Section 2) correspond to the implied model response.

We adopt the specification of Bowman et al. (2015), which distinguishes the monetary policy effect through US 10-year sovereign yields $\left(\Delta Y_{sovt}^{US}\right)$ and high-yield corporate bond spreads $\left(\Delta Y_{hyt}^{US}\right)$:

$$\Delta y_{it} = \alpha_i + \delta \Delta y_{it-1} \left(\beta_1 + \beta_2 CC_{it-1}\right) * \Delta Y_{sovt}^{US} + \left(\gamma_1 + \gamma_2 CC_{it-1}\right) * \Delta Y_{hyt}^{US} + \delta Z_t + \varepsilon_{it}. \quad (5)$$

Thus, we characterize for the transmission of US monetary shocks through the interest rate channel $\left(\Delta Y_{sovt}^{US}\right)$ and the risk channel $\left(\Delta Y_{hyt}^{US}\right)$ that has been found for the US economy at the zero lower bound.[8] The specification considers how international spillover differences may depend on the country characteristics (CC_{it-1}), consistent with the evidence presented in the previous section around policy events. The specification 5 also includes a set of control variables (Z_t) to explain the changes in EME asset prices: the VIX index, the change in commodity price index, and the change in the return on the S&P500 index. We include them contemporaneously because we think they are not affected by changes in the countries' financial variables. Moreover, the lagged dependent variable is included to

[8] More precisely, following Bowman et al. (2015) relies on the findings in Wright (2012), Rogers et al. (2014) and Bowman et al. (2015) that US monetary policy shocks have a significant effect on the yields US sovereign and corporate bonds.

control for the serial correlation component. The model is estimated with monthly data for the period from October 2008 to December 2014.

The estimation results, including one country characteristic at a time, for yields, exchange rates, and the stock market index are reported in Tables 8, 9 and 10, respectively. The standard deviations of the estimated coefficients are computed using the SUR method in order to correct for the potential cross-section and time correlation of the residuals. We report the coefficients of the interactions of the country characteristics with the changes in both US sovereign yields and high-yield corporate bonds (β_2 and γ_2) and their significant value. Later on (Table 11), we report the joint estimation results for the sovereign yields including a set of country characteristics with the highest explanatory power.

In the panel regression of EME sovereign yields (Table 8), inflation is the only macroeconomic variable with significant interactions. Countries with higher inflation are experiencing a higher response to fluctuations in US sovereign yields and in high-yield bond spreads. But we do not find a similar result for the public debt ratio or GDP growth. Agents seem to be more concerned with the real return of their investments what may explain the significance of inflation. The market conditions measured by a high CDS spread or a high policy rate also positively affect the response to US fluctuations since they may be proxies for financial risk. Most of the eight external variables considered are significant. The current account, reserves, portfolio flows, and the net lending banking position, all measure the strengthening of the external position of the country and consequently reduce the variability of yields to US shocks. The external debt to GDP does not prove to be significant[9] and the outstanding international debt appears with the sign opposed to the expected one. Similarly, the last year's cumulative real appreciation reflect vulnerability but it causes a reduction of interest rates instead of an increase when facing an external shock.

[9] Non-financial corporations' external debt has raised after the global financial crisis in many EMEs. The interaction of that variable in regression 4 was significant but with the sign opposed to the expected one.

Table 8

REACTION OF EMERGING MARKET YIELDS TO US FINANCIAL VARIABLES

$$\Delta y_{it} = \alpha_i + \delta \Delta y_{it-1} + \left(\beta_1 + \beta_2 CC_{it-1}\right) * \Delta Y^{US}_{sovt} + \left(\gamma_1 + \gamma_2 CC_{it-1}\right) * \Delta Y^{US}_{hyt} + Z_t + \varepsilon_{it}$$

	US sovereign yield (β_2)	*US high yield spread* (γ_2)	R^2 *gains*
Macroeconomic variables			
GDP	−0.011	−0.003	0.07
Inflation	0.126[c]	0.020[c]	4.65
Debt to GDP	0.001	0.001[b]	0.12
Market conditions			
Policy rate	0.151[c]	0.028[c]	6.27
CDS	0.004[c]	0.001[c]	6.32
External variables			
Current account to GDP	−0.034[c]	−0.010[c]	1.64
Reserves to GDP	−0.008[c]	−0.003[c]	1.67
External debt to GDP	−0.001	0.001	0.53
Portfolio flows to GDP	−0.038[b]	−0.009[b]	0.44
Net banking position to GDP	−0.006[c]	−0.002[c]	0.23
Exchange rate deviation	0.001	−0.001	0.15
Real exchange rate increase	−0.021[c]	−0.005[c]	0.83
Outstanding international debt	−0.016[a]	−0.011[c]	0.73
Structural variables			
Market size (capitalization to GDP)	−0.033[c]	−0.022[c]	0.68
Real integration (exports to US to GDP)	−0.015[a]	−0.001	0.16
Financial integration (Chinn-Ito index)	−0.039	−0.013	0.10

Note: Δy_{it} is the one-month change in each EME sovereign bond yield. [a], [b] and [c] represent significance at the standard 10, 5 and 1 percent confidence levels, where standard deviations are computed using the SUR (PCSE) method in order to control for the potential cross-section and time correlation of the residuals.

As for the three structural variables considered, we find that market size is significant: a bigger market size and thus a more liquid financial system reduces the response of yields to a financial shock. We also find that the real integration variable is marginally significant.

Table 9 presents the estimation results for the panel data model with the EME exchange rates. An increase in the bilateral rate against the dollar represents a depreciation of the EME currency. Interestingly, a similar group of country characteristics to the yields equation affect the exchange rate fluctuations in a significant way. Higher inflation, higher policy rates, higher CDS spreads, lower reserves, a lower current account, lower portfolio flows, lower net lending banking position and a lower market capitalization depreciate the exchange rate more after an increase in US sovereign yields or in high-yield spreads. Table 10 shows the estimation results for the EME stock market returns. The number of significant country characteristics is smaller and the risk channel plays a more important role in this case.

We conducted some robustness exercises controlling for domestic variables besides global ones in regression 5. For example, when the Z_{it} vector includes the countries' policy rate, inflation rate, and output growth, the same country characteristics became significant with the exception of the market size.

Moreover, once each of these characteristics is introduced into the panel regression, there is not a significant common Latin American dummy to explain any of the three asset price movements.[10] That reinforces the previous specific event analysis (QE1 and tapering) where there was no a strong evidence of excess sensitivity for Latin American economies to US monetary disturbances once country-specific fundamentals are taken into account.

[10] These results are not reported to save space.

Table 9

REACTION OF EMERGING MARKET EXCHANGE RATES TO US FINANCIAL VARIABLES

$$\Delta y_{it} = \alpha_i + \delta \Delta y_{it-1} + \left(\beta_1 + \beta_2 CC_{it-1}\right) * \Delta Y^{US}_{sovt} + \left(\gamma_1 + \gamma_2 CC_{it-1}\right) * \Delta Y^{US}_{hyt} + Z_t + \varepsilon_{it}$$

Country variables	*US sovereign yield* (β_2)	*US high yield spread* (γ_2)	R^2 *gains*
	Macroeconomic variables		
GDP	−0.051	−0.036[a]	0.17
Inflation	0.278[c]	0.134[c]	1.74
Debt to GDP	−0.007	0.008[c]	0.38
	Market conditions		
Policy rate	0.218[a]	0.140[c]	1.80
CDS	0.006[a]	0.005[c]	2.19
	External variables		
Current account to GDP	−0.148[c]	−0.103[c]	3.70
Reserves to GDP	−0.043[c]	−0.031[c]	4.53
External debt to GDP	0.027	0.016[c]	1.50
Portfolio flows to GDP	−0.185[b]	−0.055[c]	0.59
Net banking position to GDP	−0.025[b]	−0.013[c]	0.50
Exchange rate deviation	−0.005	0.001	−0.08
Real exchange rate increase	−0.022	−0.022[b]	0.31
Outstanding international debt	−0.163[c]	−0.105[c]	1.87
	Structural variables		
Market size (capitalization to GDP)	−0.341[c]	−0.251[c]	2.13
Real integration (exports to US to GDP)	−0.126[c]	−0.054[c]	0.54
Financial integration (Chinn-Ito index)	0.252	−0.032	0.13

Note: Δy_{it} is the one-month depreciation rate of each EME currency with respect to the US dollar. [a], [b] and [c] represent significance at the standard 10, 5 and 1 percent confidence levels, where standard deviations are computed using the SUR(PCSE) method in order to control for the potential cross-section and time correlation of the residuals.

Table 10

REACTION OF EMERGING MARKET STOCK INDICES TO US FINANCIAL VARIABLES

$$\Delta y_{it} = \alpha_i + \delta \Delta y_{it-1} + \left(\beta_1 + \beta_2 CC_{it-1}\right) * \Delta Y^{US}_{sovt} + \left(\gamma_1 + \gamma_2 CC_{it-1}\right) * \Delta Y^{US}_{hyt} + Z_t + \varepsilon_{it}$$

Country variables	*US sovereign yield* (β_2)	*US high yield spread* (γ_2)	R^2 *gains*
Macroeconomic variables			
GDP	−0.312	0.044	0.54
Inflation	−0.293	−0.048	0.16
Debt to GDP	0.006	−0.017[c]	0.46
Market conditions			
Policy rate	−0.088	−0.020	0.02
CDS	−0.006	−0.001	0.07
External variables			
Current account to GDP	0.091	0.013	0.05
Reserves to GDP	0.025	−0.003	0.15
External debt to GDP	−0.005	−0.022[c]	2.52
Portfolio flows to GDP	0.193	−0.006	1.82
Net banking position to GDP	0.001	−0.005	0.04
Exchange rate deviation	−0.013	−0.002	0.87
Real exchange rate increase	−0.060	−0.005	0.04
Outstanding international debt	0.046	−0.001	0.01
Structural variables			
Market size (capitalization to GDP)	0.000	−0.000	0.03
Real integration (exports to US to GDP)	0.080	0.096[c]	0.56
Financial integration (Chinn-Ito index)	−0.391	−0.337[c]	0.49

Note: Δy_{it} is the one-month return of each EME country stock market index. [a], [b] and [c] represent significance at the standard 10, 5 and 1 percent confidence levels, where standard deviations are computed using the SUR (PCSE) method in order to control for the potential cross-section and time correlation of the residuals.

Table 11 presents a joint estimation of the specific country variables for the EME sovereign yields.[11] Based on the R^2 gains of the variable by variable estimation in Table 8, the multivariate specification considers the following characteristics: CDS spread for market conditions, inflation for macroeconomic conditions, the official reserves ratio for external conditions, and market capitalization for structural conditions. The three first estimates are consistent with previous univariate estimations: An increase in CDS spread and inflation or a decrease in reserves is related to a country's higher vulnerability. By contrast, the coefficient of the stock market capitalization is estimated with a positive sign, implying that relatively large markets display larger responses to US monetary policy announcements.[12] This result is consistent with the more specific evidence around the tapering period where investors found it easier to rebalance their portfolios in larger EME economies and therefore experienced higher asset price responses (Eichengreen and Gupta, 2013). When experimenting with an alternative set of relevant country characteristics such as the current account or the policy rate, the results did not change much but the explanatory power decreased.

This multivariate estimation is similar to one by Bowman et al. (2015) although they consider a vulnerability index estimating a principal component of a set of macro variables and control for the currency regime. Nevertheless, our estimates present two important differences: First, both channels of transmission, sovereign yields, and high-yield bond spreads, are relevant for explaining the heterogeneity of EME yields; and second, the explanatory power of the country characteristics considered in our multivariate estimation is much higher than their vulnerability index.

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[11] Data availability makes the set of countries considered in the joint regression (Table 11) different from the ones considered with the individual characteristics regressions (Tables 8-10).

[12] The estimates of the joint specification for the two other asset prices (not reported) go in the same direction, although the coefficients present a lower significance level.

Table 11

MULTIVARIATE ANALYSIS OF THE REACTION OF EMERGING MARKET YIELDS TO US FINANCIAL VARIABLES

$$\Delta y_{it} = \alpha_i + \delta \Delta y_{it-1} + \left(\beta_1 + \beta_2 CC_{it-1}\right) * \Delta Y^{US}_{sovt} + \left(\gamma_1 + \gamma_2 CC_{it-1}\right) * \Delta Y^{US}_{hyt} + Z_t + \varepsilon_{it}$$

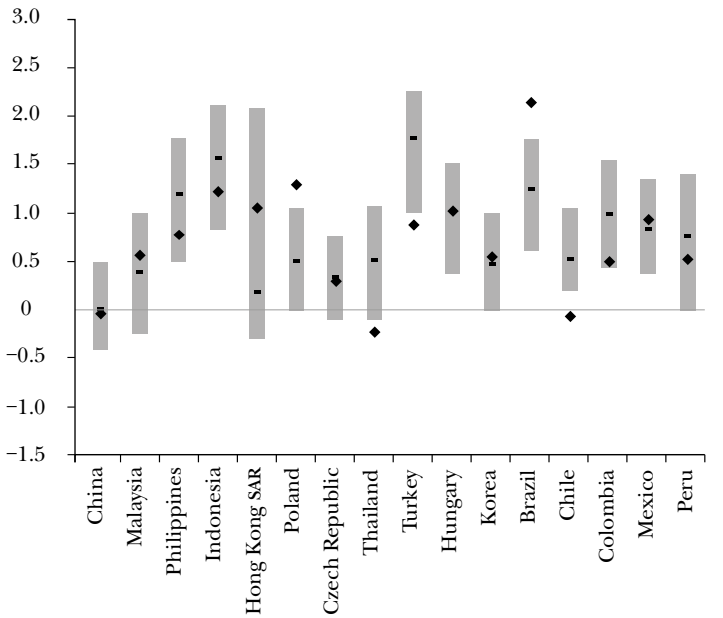
	Specifications			
	1	*2*	*3*	*4*
	Inflation			
US sovereign yield	0.182[c]	0.135[c]	0.135[c]	0.118[c]
High yield spread	0.028[c]	0.012[b]	0.011[b]	0.010[a]
R^2 gains	7.39			
	CDS			
US sovereign yield		0.002[c]	0.002[c]	0.002[c]
High yield spread		0.001[c]	0.001[c]	0.001[c]
R^2 gains		9.08		
	Reserves			
US sovereign yield			0.001	−0.007
High yield spread			−0.001	−0.001
R^2 gains			9.26	
	Capitalization to GDP			
US sovereign yield				0.073[b]
High yield spread				0.001
R^2 gains				9.52

Note: Δy_{it} is the 1-month change in each EME sovereign bond yield [a], [b] and [c] represent significance at the standard 10, 5 and 1 percent confidence levels, where standard deviations are computed using the SUR (PCSE) method in order to control for the potential cross-section and time correlation of residuals.

From the estimation results in Table 11, we can now compare the observed country response to US monetary policy announcements with the implied response by the estimated model. Figure 3 shows the average and one standard deviation of the model's response to a change in US Treasury

Figure 3

AVERAGE RESPONSE OF THE EME YIELDS TO CHANGES IN US SOVEREIGN YIELDS



Note: the diamonds indicate the average observed response (2-day change). The squares and the gray area represents the average and the confidence intervals (one-standard deviation) of each country's model response for the multivariate panel-data model (Table 11, specification 3).

yields.[13] Thus, taking the multivariate version of Equation 5, we calculate the average response ($\beta_1 + \beta_2 ECC_{it-1}$) of the three country characteristics for each of the countries for which we have data and their standard deviation from the parameters' uncertainty. Similarly, Figure 3 draws the average country response (also relative to the US) using the 2-day changes in the event study (Table 2).

[13] An event study around the effect of US monetary policy announcements on the high-yield bond spread gave few significant events. That is the reason to focus on the response through the Treasury yields.

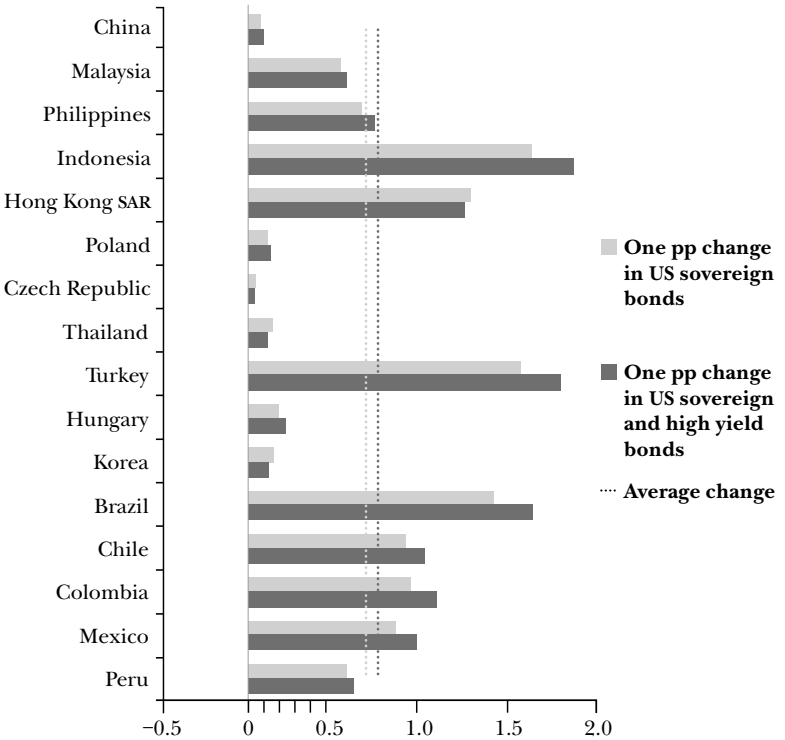
We find a large variability across countries. Nevertheless, for most of the countries in the sample, the responses to the US policy have not outsized the expected price response of the model once the parameter uncertainty has been considered. The only two countries with an observed response above the upper limit of the confidence band are Poland and Brazil. Interestingly, Brazil is an example of a large EME with a relatively open capital account and a flexible exchange rate regime where carry trade operations and thus capital flows have responded very significantly to external QE policies. Other Latin American countries' responses are within the model bands or have had a nil response, as seen in the case of Chile. Thus, the observed EME heterogeneity of sovereign yields spillovers of unconventional US monetary policy, including that of the Latin American economies, can be explained to a large extent by the model setup above.

Finally, we used the estimated model 5 to obtain some inference relative to the current normalization of US monetary policy. Figure 4 simulates a monetary shock that increases US sovereign bonds by 100 bp versus a shock that simultaneously increases sovereign bonds and high-yield spreads by 100 bp. We take the estimated model as the true one and fix the parameter values abstracting any model uncertainty. The simulation exercise considers the observed country characteristics on December 2014. There are two significant results. First, the interest rate channel, represented by changes in the Treasury bond, is more relevant than the risk channel represented by the high-yield spreads. The average EME yield response is 64 bp through the interest rate channel and 72 bp when adding the risk channel. The size of the impact of the country characteristics on these responses is non-negligible: A one standard deviation increase in CDS (92.4 bp), the inflation rate (2.9%) and the stock capitalization (258%) implies an increase in the average EME yield response of 28 bp, 37 bp and 19 pb, respectively, while a one standard deviation increase in the reserves to GDP ratio (28%) implies a 22 bp reduction in the average EME yield response. Second, the countries with weaker economic fundamentals (Indonesia, Brazil or Turkey) respond more than the average country, and thus experience a higher vulnerability to changes in US monetary conditions.

Another group of countries combines better fundamentals with lower sensitivity to US shocks like the Eastern European economies that are more linked to the euro area (Poland, Hungary or the Czech Republic). Moreover, the remaining Latin American countries are above the EMEs average showing also a higher vulnerability. That is a consequence of the relative deterioration of their financial and macroeconomic fundamentals at the end of the sample period as a result of a number of shocks (slowdown of the Chinese economy, reduction of commodities' prices, and tightening of global financial conditions) that affected Latin American economies more severely.

Figure 4

MODEL RESPONSE TO AN INCREASE IN THE US SOVEREIGN YIELD AND THE US HIGH YIELD SPREAD, DECEMBER 2014



Note: average response of countries to 100 basis points in US sovereign yields (light gray bar) and 100 basis points increase in US sovereign yields and high-yield spread (dark gray bar). It uses the multivariate panel-data model (Table 11, specification 3).

4. CONCLUSIONS

The empirical literature has shown that Latin American economies are very sensitive to US monetary policy shocks. Higher dollarization of assets and liabilities, closer financial and commercial links with the United States, and dependency on the commodities cycle could account for this historically. Moreover, after the financial crisis and the launching of unconventional monetary policies in advanced economies, Latin America was one of the regions that received massive capital flows. Now that the US monetary cycle is starting to turn, it is important to anticipate the asset price response considering country specificities, as this may be relevant for designing the proper policy response.

First, we analyzed whether there was a significant impact of US nonstandard monetary policies on financial asset prices for a set of emerging economies, including five Latin American countries. The analysis of policy events showed a more significant effect across EME asset prices after the first set of quantitative easing announcements in 2008-2009 and the tapering talk in 2013, consistent with previous results in the literature. We also found for some events an excessive response by Latin American yields and exchange rates.

Second, we explored whether the role of fundamentals in conditioning the responses in EME economies to US unconventional monetary policy shocks differed across different episodes. We found that depending on the asset price there are some country characteristics relevant in explaining the first set of unconventional measures in 2008-2009 or the tapering talk in 2013. And in both cases, we found weak evidence of an independent effect coming out of the Latin American economies.

Finally, we estimated a simple model of the international transmission of US financial conditions that incorporated the domestic country characteristics to explain the observed cross-country differences. The inflation rate, the CDS spread, the official reserves ratio, and the market capitalization are the

most significant variables for measuring the vulnerability of the EME economies, and Treasury yield changes are a relevant channel to measure the spillover effects of US financial shocks. On average, the observed event responses to US unconventional monetary policies were within the estimated model bands, including those Latin American countries in our sample with the exception of Brazil.

Overall, we showed that the intensity of the reaction of a number of financial asset prices in emerging economies to US monetary policy announcements depends on macroeconomic fundamentals. In particular, we found that a parsimonious model including CDS spreads, the ratio of official reserves to GDP, the inflation rate, and the market capitalization explains, to a large extent, the cross-country heterogeneity in the spillovers of US monetary policy. In addition, although we found some excessive response of Latin American asset prices to recent US monetary policy announcements, this differential response disappears once we take into account country-specific characteristics. In light of our results, the current deterioration of macroeconomic fundamentals in the Latin American region suggests that they are particularly vulnerable to the foreseeable normalization of the US monetary policy.

The evidence provided by the effect of US monetary policies on EME asset prices did not consider the policy responses and the exchange rate framework of the domestic economies. These are relevant aspects to be considered in future work. Moreover, this future work should also consider the response of other financial market variables (dollar-denominated sovereign bonds, corporate bonds, capital flows, to name a few) to US monetary policy measures, in order to assess the robustness of our spillover results.

Appendix 1

Definitions of the Variables

Dependent variables	*Description*	*Source*	*Unavailability*
Sovereign yields	In local currency	Bloomberg[1]	
Exchange rates	Bilateral exchange rate with US dollar	Datastream	
Stock market prices	Aggregate index	Reuters	

Country characteristics	*Description*	*Source*	*Unavailability*
GDP	Year to year GDP growth	National statistics, IFS, OECD	
Inflation	Year to year consumer price index growth	National statistics, IFS	
Debt to GDP	Public debt to GDP (%)	Oxford Economics	Chile
Policy rate	Official interest rate, set by the central bank	National central banks, IFS	China, Singapore, Taiwan
CDS	Credit default spread	Datastream	South Africa, Singapore, Taiwan, India
Current account	Current account balance respect to GDP (%) (+): surplus, (−): deficit	National statistics, IFS, OECD, Oxford Economics	
Reserves	Reserves assets to GDP (%)	National statistics, Datastream, IFS	
External debt	External debt to GDP (%)	National statistics, Oxford Economics	Singapore, Malaysia, Philippines, Hong Kong, Taiwan, Korea

Portfolio flow	Net inflows of capital to GDP (%)	National statistics, IFS, OECD, Datastream	Singapore, Malaysia, Philippines, Hong Kong, Taiwan
Net banking position	Foreign assets minus foreign liabilities to GDP (%)	National statistics, IFS	Singapore, Malaysia, Philippines, Hong Kong, Taiwan, Poland, Korea
Exchange rate deviation	Deviation from equilibrium exchange rate (proxied as a deviation from the historical average). A positive value indicates that the national currency is overpriced	JP Morgan	Singapore, Malaysia, Philippines, Hong Kong, Taiwan
Real exchange rate growth	Last year real exchange rate growth. An increase is an appreciation of the national currency	JP Morgan	-
Capitalization	Stock market capitalization to GDP	Bloomberg	-
Chinn-Ito index	Chinn and Ito index. An increase in the value implies a greater degree of openness of the financial account	Chinn and Ito web	Taiwan
Exports	US exports to GDP (%)	National statistics, FRED	

[1] For Chile, the source is the Central Bank of Chile; and for Brazil, the source is De Pooter, M., P. Robitaille, I. Walker and M. Zdinak, *Are Long-term Inflation Expectations Well-anchored in Brazil, Chile and Mexico?*, International Finance Discussion Papers, No. 1098, Board of Governors of the Federal Reserve System, 2014.

Appendix 2

Summary Statistics

Variable	*Obs.*	*Mean*	*Standard deviation*	*Min*	*Max*
Yields (one month change)	1,500	−0.04	0.50	−4.39	4.30
Exchange rates (one month change)	1,500	0.12	4.42	−14.02	26.69
Stock indices (one month change)	1,500	0.77	6.39	−37.28	38.46
GDP growth	1,500	3.61	3.86	−14.74	18.86
Inflation	1,500	3.67	2.94	−9.48	16.22
Current account to GDP	1,500	1.36	6.28	−9.55	24.18
Chinn-Ito index	969	0.53	1.39	−1.18	2.42
Exports to GDP	1,500	4.73	4.69	0.42	25.67
CDS	1,200	178.97	92.36	51.00	725.00
Policy rate	1,275	4.41	2.76	0.05	16.75
Capitalization	1,500	1.35	2.58	0.99	14.94
Debt to GDP	1,500	44.11	22.00	3.79	106.65
Net banking position	1,022	−0.33	21.25	−27.66	90.39
External debt	1,035	37.12	30.20	3.31	148.15
Portfolio flow	1,023	2.19	3.27	−6.46	16.85
Exchange rate deviation	1,080	7.78	18.86	−35.70	72.74
Reserves	1,500	33.32	27.70	8.78	122.13
Real exchange rate growth	1,500	−0.39	7.14	−30.00	30.90

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