

The Effects of US Unconventional Monetary Policies in Latin America

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Abstract

This paper offers an empirical analysis of the way in which 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 and 2009, and the tapering talk in 2013 generated sizable sovereign yield and exchange rate fluctuations. We further find some excess response of Latin American asset prices that disappear once we take into account their country characteristics. 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 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 American relative to other emerging economies.

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

JEL classification: E52, F32, G11.

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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—was instrumental in calming 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 solidified. 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 the 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 (Gagnon et al., 2011, Meaning and Zhu, 2011, Neely, 2010, 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., 2012, for the US LSAP; and Kapetanios et al., 2012, or Joyce et al., 2011, for the 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 into the US, in particular into US bonds lowering their yields. In contrast, LSAP2 policies triggered a rebalancing from US funds into 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 emerging market economies to US unconventional monetary policy shocks differs across different episodes. More precisely, country characteristics were more decisive in explaining differences in the reaction to QE announcements than they were in response to 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 or not 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 two-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. This is a simple alternative to VAR analysis that considers the asset price changes in volatility (Wright, 2012) or in future interest rates (Gertler and Karadi, 2015) to identify the monetary shocks within the period of unconventional monetary policy. Thus, we refrain from differentiating in the announcements between the impact effect and the signal

about future policy intentions (Chen et al., 2014), and we simply consider them as unanticipated events.

Our analysis covers three types of financial assets: 10-year sovereign bonds in local currency, bilateral exchange rates relative to the US dollar, and headline stock market indices. Annex I describes the data sources and defines the variables, and Annex II presents a summary of statistics. The sample includes the following 20 emerging economies: Brazil, Chile, China, Colombia, 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 establishment of unconventional policies in November 2008. The set of events includes announcements relating to the first two large-scale asset purchases (LSAP-1 and LSAP-2) in 2008-2009 and in 2010, the maturity extension program in 2011 (MEP), the third LSAP (LSAP-3) 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 forward guidance policy and some speeches by chairman Bernanke that could prompt potential market reactions.

Figure 1 shows the time series for the aggregate index for EMEs, Latin American and US sovereign yields (panel A) and stock market prices (panel B), along with the aggregate index for EMEs and Latin American exchange rates with respect to the US dollar (panel C). This figure provides some insight into the relationship between US unconventional monetary policy phases and EME financial asset prices. First, a co-movement between US sovereign yields and EME (and Latin American) yields is observed, and it is clearer in the case of the LSAP-1 and tapering periods. Second, the relationship 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.

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
March 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 chairman 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

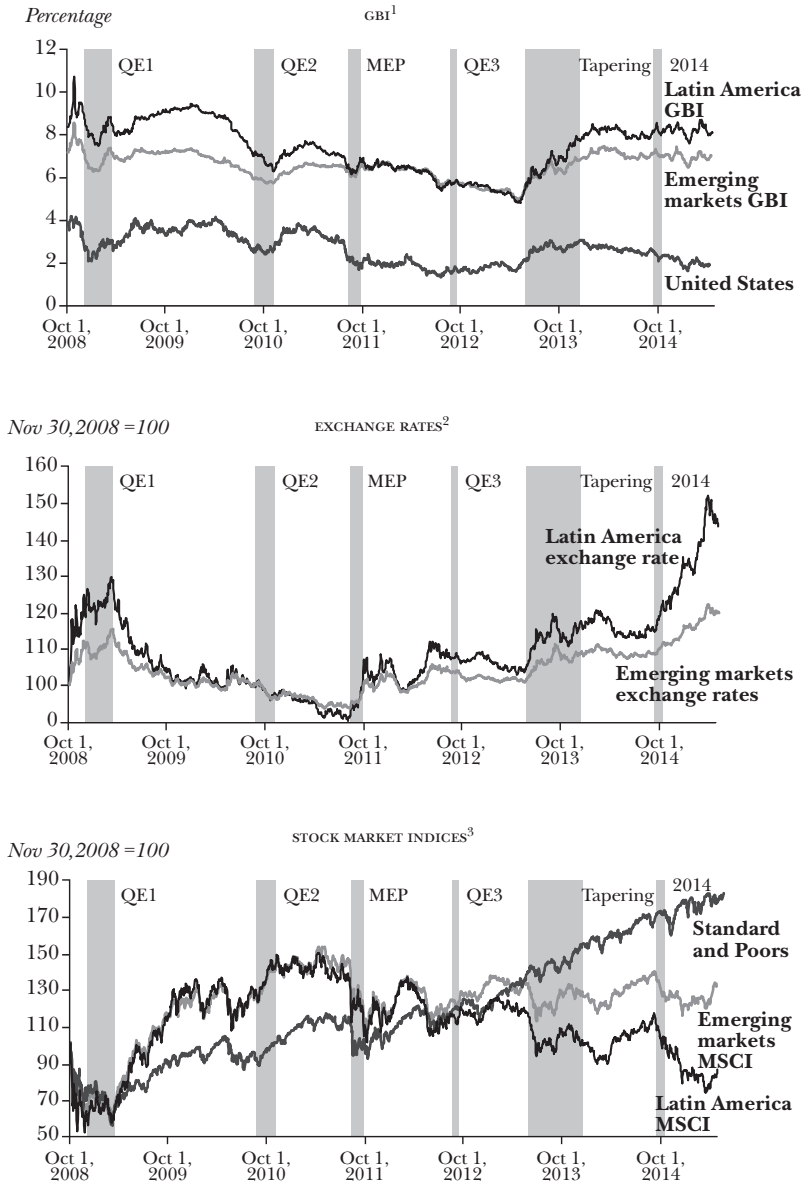
Maturity Extension Program (MEP)

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)	Chairman Bernanke suggests new QE
Sep 13, 2012	FOMC statement	The Federal Reserve announces new quantitative easing
Events in 2013		
March 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 <i>tapering</i> 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	<i>Tapering</i> 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 <i>indefinite</i> forward guidance

Figure 1

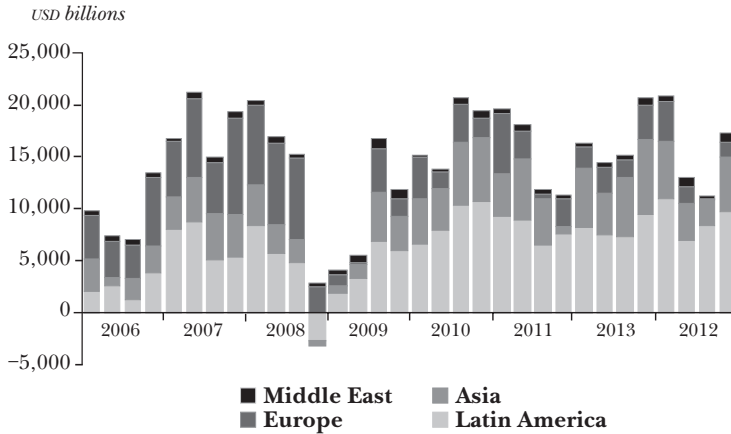
EMERGING MARKET ASSET PRICES AND US FINANCIAL VARIABLES



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

Figure 2

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



Source: IFS, International Monetary Fund.

2.1 Emerging (and Latin American) Market Reactions

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

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

where Δy_{it-1} is the change in the financial variable of interest, $E_{it-1} [\Delta y_{it-1}]$ 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 announcement (D_j). However, in our analysis we focus on the impact of these announcements at high frequency (daily data), which limits the possibility to control for real variables that are not available at that frequency. Moreover, in practice, the inclusion of different sets of controls influence very modestly the magnitude of the β_j coefficient (see Fratzscher et al., 2013). For these reasons, we estimate a simplified version of Equation 1, removing the expected change.

Table 2

EVENT STUDY FOR CHANGES IN SOVEREIGN YIELDS: DAILY DATA

(November 30, 2008 to April 24, 2015)

Dates	US yields	EME GBI index	LATAM GBI index	$\Delta y_{it} = \alpha_i + \sum_{j=1}^{25} \beta_j * D_j + \sum_{j=1}^{25} \gamma_j * Lat * D_j + \varepsilon_{it}$	
				Event effect (β)	LATAM effect (γ)
First LSAP					
Nov 25, 2008	-33.84 ^c	21.46 ^c	-22.24 ^b	-15.56 ^c	2.26
Dec 1, 2008	-26.46 ^c	-2.86	-25.04 ^b	-2.25	-50.51 ^c
Dec 16, 2008	-33.23 ^c	-16.86 ^b	12.74	-29.36 ^c	1.95
Jan 28, 2009	29.88 ^c	9.24	10.46	4.11	-6.94
Mar 18, 2009	-40.31 ^c	-5.86	9.84	-7.63 ^b	-10.34
Second LSAP					
Aug 10, 2010	-14.59 ^a	-2.96	-6.84	-2.64	-4.16
Aug 27, 2010	5.28	4.14	7.36	2.44	4.62
Sep 21, 2010	-14.25 ^a	-3.26	-2.84	-1.09	-3.42
Oct 15, 2010	0.64	1.34	3.66	4.36	-6.61
Nov 3, 2010	-12.58	-2.06	0.00	0.93	0.12
MEP					
Aug 9, 2011	-19.87 ^b	-8.06	-13.14	-6.74 ^a	3.33
Aug 26, 2011	5.33	-5.56	-10.44	1.48	-11.45 ^a
Sep 21, 2011	-22.57 ^c	17.24 ^b	21.36 ^b	4.65	20.57 ^c

Dates	US yields	EME GBI index	LATAM GBI index	$\Delta y_{it} = \alpha_i + \sum_{j=1}^{25} \beta_j * D_j + \sum_{j=1}^{25} \gamma_j * Lat * D_j + \varepsilon_{it}$	
				Event effect (β)	LATAM effect (γ)
Third LSAP					
Aug 22, 2012	-13.87 ^a	-7.36	-11.94	-2.94	-1.00
Aug 31, 2012	-6.47	-3.87	-1.94	-3.09	2.87
Sep 13, 2012	10.63	4.04	4.36	2.15	6.14
Events in 2013					
Mar 20, 2013	2.19	2.01	3.06	0.94	3.19
May 1, 2013	-4.49	-3.89	-1.84	-4.02	1.41
May 22, 2013	8.03	9.84	12.86	6.27 ^a	11.12
Jun 19, 2013	23.84 ^c	36.64 ^c	46.76 ^c	23.80 ^c	14.35 ^b
Jul 11, 2013	-7.56	-5.26	-9.54	-2.56	-3.83
Oct 30, 2013	3.76	18.04 ^b	35.06 ^c	5.34	3.79
Dec 18, 2013	8.37	1.84	-0.24	3.58	2.91
Events in 2014					
Sep 17, 2014	4.15	1.54	0.02	0.11	1.56
Oct 29, 2014	2.44	5.24	0.12	0.84	-1.18

Note: Column 2 reports the changes in US 10-year sovereign yields. Columns 3 and 4 report the changes in two aggregate indexes. 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.

Table 3

EVENT STUDY FOR CHANGES IN EXCHANGE RATES¹: DAILY DATA

September 30, 2008 to April 24, 2015

Dates	EME index	LATAM index	$\Delta y_{it} = \alpha_i + \sum_{j=1}^{25} \beta_j * D_j + \sum_{j=1}^{25} \gamma_j * Lat * D_j + \varepsilon_{it}$	
			Event effect (β)	LATAM effect (γ)
First LSAP				
Nov 25, 2008	-0.76 ^a	-1.46	-1.22 ^c	0.11
Dec 1, 2008	0.89 ^b	0.81	1.07 ^c	-0.31
Dec 16, 2008	-0.96 ^b	-1.11	-1.68 ^c	0.03
Jan 28, 2009	0.05	-0.69	0.38	-0.27
Mar 18, 2009	-0.74 ^a	-0.39	-1.48 ^c	1.69 ^c
Second LSAP				
Aug 10, 2010	0.55	0.56	0.94 ^c	-0.75
Aug 27, 2010	0.01	0.07	-0.06	-0.18
Sep 21, 2010	-0.36	-0.44	-0.78 ^c	0.66
Oct 15, 2010	0.19	0.07	0.64 ^b	-0.38
Nov 3, 2010	-0.62	-0.99	-0.91 ^c	0.41
MEP				
Aug 9, 2011	0.19	0.42	0.22	0.53
Aug 26, 2011	-0.35	-0.55	-0.44	0.17
Sep 21, 2011	1.67 ^c	5.12 ^c	1.74 ^c	1.80 ^c

<i>Dates</i>	<i>EME index</i>	<i>LATAM index</i>	$\Delta y_{it} = \alpha_i + \sum_{j=1}^{25} \beta_j * D_j + \sum_{j=1}^{25} \gamma_j * Lat * D_j + \varepsilon_{it}$	
			<i>Event effect (β)</i>	<i>LATAM effect (γ)</i>
Third LSAP				
Aug 22, 2012	-0.19	0.17	-0.32	0.19
Aug 31, 2012	-0.33	-0.95	-0.29	-0.28
Sep 13, 2012	-0.62	-1.00	-0.79 ^c	0.16
Events in 2013				
Mar 20, 2013	0.08	0.11	0.14	-0.13
May 1, 2013	-0.21	0.27	-0.18	0.28
May 22, 2013	0.51	0.66	0.36	0.31
Jun 19, 2013	1.46 ^c	3.43 ^c	1.44 ^c	1.01 ^a
Jul 11, 2013	-0.34	-0.42	-0.69 ^b	0.27
Oct 30, 2013	0.32	0.83	0.41	0.15
Dec 18, 2013	0.51	0.82	0.57 ^b	-0.05
Events in 2014				
Sep 17, 2014	0.27	0.65	0.35	-0.25
Oct 29, 2014	-0.02	-1.80 ^a	0.23	-1.37 ^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.

¹A positive (negative) value in the Table indicates depreciation (appreciation) of the domestic currency against the US dollar.

Table 4

EVENT STUDY FOR CHANGES IN STOCK MARKET INDEX: DAILY DATA

November 30, 2008 to April 24, 2015

Dates	US S&P 500	MSCI EME index	MSCI LATAM index	$\Delta y_{it} = \alpha_1 + \sum_{j=1}^{25} \beta_j * D_j + \sum_{j=1}^{25} \gamma_j * Lat * D_j + \varepsilon_{it}$	
				Event effect (β)	LATAM effect (γ)
First LSAP					
Nov 25, 2008	4.12 ^b	5.66 ^c	6.23 ^b	3.33 ^c	-0.87
Dec 1, 2008	-5.38 ^c	-4.94 ^b	-7.99 ^c	-3.48 ^c	0.32
Dec 16, 2008	4.04 ^b	4.12 ^a	6.25 ^b	1.36 ^b	1.32
Jan 28, 2009	0.15	2.50	2.49	1.28 ^b	-0.41
Mar 18, 2009	0.67	2.81	3.10	2.10 ^c	0.27
Second LSAP					
Aug 10, 2010	-3.49 ^a	-3.38	-3.80	-2.00 ^c	-0.10
Aug 27, 2010	0.08	0.59	0.66	0.59	0.24
Sep 21, 2010	-0.82	0.31	-0.22	0.14	0.14
Oct 15, 2010	0.84	-1.37	-0.18	-0.58	-0.27
Nov 3, 2010	2.22	2.34	3.07	1.49 ^c	-0.04
MEP					
Aug 9, 2011	0.03	-1.01	3.79	-2.45 ^c	6.09 ^c
Aug 26, 2011	4.30 ^b	3.19	4.12	1.26 ^b	1.44
Sep 21, 2011	-6.12 ^c	-7.47 ^c	-9.57 ^c	-4.12 ^c	-1.38

$$\Delta y_{it} = \alpha_i + \sum_{j=1}^{25} \beta_j * D_j + \sum_{j=1}^{25} \gamma_j * Lat * D_j + \varepsilon_{it}$$

Dates	US S&P 500	MSCI EME index	MSCI LATAM index	Event effect (β)	LATAM effect (γ)
Third LSAP					
Aug 22, 2012	-0.87	-0.20	-0.80	-0.17	-0.36
Aug 31, 2012	0.42	0.84	0.92	0.87 ^a	-0.88
Sep 13, 2012	1.95	3.58 ^a	3.58	1.76 ^c	0.55
Events in 2013					
Mar 20, 2013	-0.25	-0.30	-0.22	-0.09	0.20
May 1, 2013	-0.09	-0.26	-1.07	0.14	-0.27
May 22, 2013	-1.20	-2.17	-1.43	-1.18 ^b	1.08
Jun 19, 2013	-3.94 ^b	-4.78 ^b	-6.57 ^b	-3.34 ^c	-0.43
Jul 11, 2013	1.58	3.19	1.84	2.57 ^c	-1.29
Oct 30, 2013	-0.96	-0.28	-1.05	-0.28	-0.13
Dec 18, 2013	1.52	-0.04	0.72	-0.08	0.49
Events in 2014					
Sep 17, 2014	0.53	0.16	-1.16	0.70	-0.70
Oct 29, 2014	0.40	1.46	2.27	0.88 ^a	-0.47

Note: Column 2 reports the changes in the S&P 500 returns. Columns 2 and 3 report the changes in two aggregate return indexes. 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.

Tables 2, 3 and 4 report the two-day changes in sovereign yields, exchange rates and stock prices, respectively, around the 25 selected dates of the announcements.¹ As a reference, in each Table we include a first column that reports the estimated changes in the US variable, 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 country variation:

$$2 \quad \Delta y_{it} = \alpha_i + \sum_{j=1}^{25} \beta_j * D_j + \sum_{j=1}^{25} \gamma_j * Lat * D_j + \varepsilon_{it},$$

where α_i is a country fixed effect, 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 LATAM 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 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.²

United States yields (first column in Table 2) dropped significantly around the first LSAP announcements, except for the January 28, 2009 event, at which time yields 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-EME in column 2, Table 2) are less uniform and of

¹ The results for one-day and seven-day windows around events do not differ much from those reported in the tables, and similarly when we consider for Asian asset prices opening times in $t+1$.

² 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.

a lower magnitude. As in the case of the United States, the most significant events are those around the LSAP-1 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 aggregate yield index (column 3 in Table 2) are similar and, in general, 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 (e. g., Krishnamurthy and Vissing-Jorgensen, 2011) and internationally (e. g., Fratzscher et al., 2013).

The last two columns in Table 2 allow us to see the significance of country variability and to test whether the movements in sovereign yields around the relevant events differ in the Latin American countries with respect to other emerging market economies. EME yields decreased on average 20 basis points within the LSAP-1 period. We also find that after the first LSAP announcements the yields of the Latin American countries fell more than did the whole sample of emerging economies, and that these differences were highly significant for the December 2008 announcements.³

The decreasing effect of subsequent QE programs in EME economies is clear since the movements in yields are not significant between 2010 and 2012. The only exception is the August 2011 FOMC meeting, prior to the launching of the maturity extension program (MEP) with a higher LATAM effect after Bernanke's 2011 Jackson Hole speech. By contrast, when Operation Twist was launched in September 2011, the effect was the opposite, with a significant differential effect for Latin America. Finally, during the tapering period, yield increases were found around the relevant dates of May and June 2013. The size of the yield change was similar to the one during the LSAP-1 period and the reaction for Latin American countries was significantly higher in June.⁴

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

³ The *p*-value for the coefficient capturing the differential effect for Latin American economies to the FOMC statement in March 2009 extending the first LSAP was 0.14.

⁴ The *p*-value for the coefficient capturing the differential effect for Latin American economies to Bernanke's testimony in May 2013 was 0.11.

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 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. But again the LSAP-1 and the Tapering periods are the most significant. For example, the LSAP-1 caused, on average, a dollar depreciation of 1%-2% and a stock market increase of 2%.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 LSAP-1 announcement, but in this case LATAM 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 LATAM yields and into US bonds that appreciated the dollar significantly, particularly against LATAM currencies. After the October 2014 FOMC meeting, when the tapering process concluded and an indefinite forward guidance policy was announced, the aggregate LATAM exchange rate against the US dollar appreciated. Thus, it seems that LATAM exchange rates were more sensitive to some of the US monetary shocks. On the contrary, there is no evidence of a significant higher stock market response for the Latin American countries, with the exception of the announcement on August 9, 2011, when the FOMC assured that interest rates would remain exceptionally low over the period to mid-2013.

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 by LATAM 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).

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.

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 Annex 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, while 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 previously identified 25 policy events across the 20 EMEs. The dependent variable Δy_{ij} is the two-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 as follows:

$$\Delta y_{ij} = \alpha_i + \beta D_j^s + \gamma CC_{it-1} + \delta D_j^s CC_{it-1} + \varepsilon_{it}.$$

The regression with positive events includes three LSAP-1 dates that became significant across EME or LATAM economies in regression 2: November 25, 2008; December 16, 2008; and March 18, 2009. And the regression with the negative events considers the two significant events during the tapering talk by the Federal Reserve: May 22, 2013; and June 19, 2013. All the characteristics are lagged one month to avoid correlation with the error term.

Table 5 presents the regression results for changes in sovereign 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 LSAP-1 events and the interaction of the dummy with the characteristics. The right-hand side of the Table reports the regression results under the significant tapering events.⁶

First, the dummy variable for most of the country characteristics is significant and has a negative effect for the LSAP-1 events (reducing yields) and a positive effect for the tapering events (increasing yields). The exceptions are the dummy coefficients when including the inflation rate, the policy rate, and the CDS, since those characteristics are very much correlated with the countries' bond yields. In general, the significance around these events, their sign, and magnitude is consistent with the average event estimates in Table 2.

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 LSAP-1 AND THE TAPERING TALK PERIODS
ON EMERGING MARKET YIELDS AND THEIR RELATION
TO COUNTRY CHARACTERISTICS**

$$\Delta y_{ij} = \alpha_i + \beta D_j^s + \gamma CC_{it-1} + \delta D_j^s CC_{it-1} + \varepsilon_{it}$$

	<i>LSAP-1 Period</i>		<i>Tapering Talk Period</i>	
	<i>Dummy</i> (β)	<i>Dummy*CC</i> (δ)	<i>Dummy</i> (β)	<i>Dummy*CC</i> (δ)
Macroeconomic variables				
GDP	-0.181 ^c	-0.006	0.234 ^c	-0.007
Inflation	0.063	-0.042 ^c	0.120 ^b	0.019
Debt	-0.236 ^c	0.001	0.262 ^c	-0.001
Market conditions				
Policy rate	-0.030	-0.018 ^b	0.199 ^c	-0.001
CDS	0.112	-0.001 ^c	0.104	0.000
External variables				
Current account to GDP	-0.209 ^c	0.012 ^c	0.203 ^c	-0.012 ^b
Reserves to GDP	-0.314 ^c	0.004 ^c	0.266 ^c	-0.002
External debt to GDP	-0.303 ^c	0.003 ^a	0.234 ^c	-0.000
Portfolio flows to GDP	-0.217 ^c	-0.001	0.222 ^c	0.004
Net banking position to GDP	-0.208 ^c	0.002	0.210 ^c	-0.005 ^b
Exchange rate deviation	-0.196 ^c	0.000	0.202 ^c	0.001
Real exchange rate	-0.188 ^c	-0.001	0.196 ^c	0.003
Structural variables				
Market size (capitalization to GDP)	-0.215 ^c	0.032	0.220 ^c	0.000
Real integration (exports to US to GDP)	-0.223 ^c	0.004	0.189 ^c	0.003
Financial integration (Chinn Ito index)	-0.187 ^c	0.025		

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 dates considered are November 25, 2008; December 16, 2008; and March 18, 2009. In the tapering talk period the dates are May 22, 2013; and 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.

A second result is that a number of the interaction coefficients are significant under the LSAP-1, 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 LSAP-1 had a differential effect across countries depending on the country characteristics. During the LSAP-1 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 non-negligible: 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 LSAP-1 announcements of 12 bp, 9 bp and 5 bp, 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 LSAP-1 announcements of 11 bp, and 8 bp, respectively. There is also a significant variable, the external debt that does not affect yields with the expected sign when interacting with the LSAP-1 events. Stock market capitalization has a positive sign, indicating, in this case, that large markets reacted less to the external shock, but it is not significant.

The results are even stronger when the dependent variable is the change in exchange rates (see Table 6). In all the cases the dummy for the LSAP-1 event is significant, indicating the relevance of this variable in the transmission of monetary policy shocks. There are three country characteristics that interact significantly with the first set of unconventional Fed policies, which were also significant in the yields regression: the domestic policy rate, the current account, and the reserves. Now the interaction with the public debt instead of the inflation rate becomes significant and the external debt has the expected sign. Moreover, two of the structural variables are significant: the market capitalization and the share of exports. Again, most of the country characteristics are not significant when interacting with the tapering period.

Therefore, we have found significant coefficients for some country characteristics that are consistent with differential effects of the LSAP-1 measures depending on variables proxying vulnerabilities and strengths of these economies. However, the asset price responses around the first two months of the tapering process are consistent with the indiscriminate impact of the earlier events in this process,

Table 6

EFFECT OF THE LSAP-1 AND THE TAPERING TALK PERIODS
ON EMERGING MARKET EXCHANGE RATES AND THEIR
RELATION TO COUNTRY CHARACTERISTICS

$$\Delta y_{ij} = \alpha_i + \beta D_j^s + \gamma CC_{it-1} + \delta D_j^s CC_{it-1} + \varepsilon_{it}$$

	<i>LSAP-1 period</i>		<i>Tapering talk period</i>	
	<i>Dummy</i> (β)	<i>Dummy*CC</i> (δ)	<i>Dummy</i> (β)	<i>Dummy*CC</i> (δ)
Macroeconomic variables				
GDP	-1.686 ^c	0.043	1.716 ^c	-1.172 ^b
Inflation	-1.366 ^c	-0.032	0.854 ^b	0.064
Debt	-0.851 ^b	-0.0153 ^a	0.557	0.011
Market conditions				
Policy rate	-0.920 ^b	-0.121 ^b	0.814	0.092
CDS	-1.481 ^c	-0.001 ^c	0.358	0.005
External variables				
Current account to GDP	-1.633 ^c	0.076 ^c	1.158 ^c	-0.043
Reserves to GDP	-2.042 ^c	0.017 ^b	1.575 ^c	-0.013 ^a
External debt to GDP	-0.705 ^b	-0.036 ^c	0.745	0.013
Portfolio flows to GDP	-1.849 ^c	0.038	1.179 ^c	0.055
Net banking position to GDP	-1.704 ^c	-0.014	1.284 ^c	-0.003
Exchange rate deviation	-1.433 ^c	0.015	1.042 ^c	0.025
Real exchange rate	-1.871 ^c	0.007	1.326 ^c	0.006
Structural variables				
Market size (capitalization to GDP)	-1.723 ^c	0.243 ^a	1.305 ^c	-0.136 ^a
Real integration (exports to US to GDP)	-2.058 ^c	0.076 ^b	0.992 ^c	0.024
Financial integration (Chinn-Ito index)	-1.426 ^c	-0.154		

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 dates considered are November 25, 2008; December 16, 2008; and March 18, 2009. In the tapering talk period the dates are May 22, 2013; and 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.

although market differentiation was gradually becoming more relevant later on (Sahay et al., 2014). Nevertheless, these results differ from Mishra et al. (2014) since they find that the impact of the taper talk was significantly related to macroeconomic fundamentals.⁷

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:

$$\Delta y_{ij} = \alpha_i + \beta D_j^s + \gamma CC_{i-1} + \delta D_j^s CC_{i-1} + \eta Lat D_j^s + \lambda Lat CC_{i-1} + \rho Lat D_j^s CC_{i-1} + \varepsilon_{it}.$$

The estimation results for Equation 4 with sovereign yields as the dependent variable and under the relevant LSAP-1 events are presented in Table 7.⁸ As in the previous regression, we find a negative and significant dummy effect around those policy events, and their interactions with the country characteristics remain significant and with the expected sign for the same variables: inflation, CDS spreads, policy rates, reserves, the current account and the market capitalization. But the interaction of the LSAP-1 event and the *Lat* dummy is not significant in most cases, and a similar result holds for the regression with the dummy for the tapering talk events and the interaction with the *Lat* dummy.

We consider the above regression results as evidence of the rejection 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 qualifies the excess response on LATAM asset prices found in the event study section.

⁷ This difference with the results in Mishra et al. (2015) might be explained by the higher number of significant events identified in their case over the tapering process.

⁸ The magnitude of the effects is similar to that of the results reported in Table 5.

Table 7

EFFECT OF THE LSAP-1 ON EMERGING AND LATIN AMERICAN ECONOMIES YIELDS DEPENDING ON THEIR COUNTRY CHARACTERISTICS

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

	Dummy (β)	Dummy*CC (δ)	Dummy*Lat (η)	Dummy*Lat*CC (ρ)
Macroeconomic variables				
GDP	-0.167 ^c	-0.010	-0.079	0.024
Inflation	0.076	-0.048 ^c	-0.329	0.067 ^b
Debt	-0.300 ^c	0.001	0.246 ^b	-0.005 ^a
Market conditions				
Policy rate	-0.016	-0.029 ^c	-0.027	0.025
CDS	0.139	-0.001 ^c	-0.313	0.002 ^b
External variables				
Current account to GDP	-0.230 ^c	0.013 ^c	0.029	-0.011
Reserves to GDP	-0.360 ^c	0.004 ^c	0.026	0.005
External debt to GDP	-0.338 ^c	0.002	0.041	0.003
Portfolio flows to GDP	-0.233 ^c	-0.003	0.017	0.021
Net banking position to GDP	-0.235 ^c	0.002	-0.001	-0.009
Exchange rate deviation	-0.249 ^c	0.001	0.184 ^c	-0.002
Real exchange rate	-0.190 ^c	0.001	0.010	-0.003
Structural variables				
Market size (capitalization to GDP)	-0.222 ^c	0.026	-0.114	0.518 ^a
Real integration (exports to US to GDP)	-0.281 ^c	0.021 ^b	0.109	-0.024 ^b
Financial integration (Chinn-Ito index)	-0.201 ^c	0.0186	-0.002	0.05

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 dates considered are November 25, 2008; December 16, 2008; and March 18, 2009. The general country characteristics coefficients are not reported. ^a, ^b and ^c represent significance at the standard 10, 5 and 1 percent confidence levels.

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 ten-year sovereign yields (ΔY_{sout}^{US}) and high-yield corporate bond (ΔY_{hyt}^{US}) spreads:

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

Thus we characterize for the transmission of US monetary shocks through the interest rate channel (ΔY_{sout}^{US}) and the risk channel (ΔY_{hyt}^{US}) that has been found for the US economy at the zero lower bound (e. g., Rogers et al., 2013). 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. 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. 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, which may explain the significance of inflation. The market conditions measured by a high CDS

Table 8

REACTION OF EMERGING MARKET YIELDS TO US FINANCIAL VARIABLES

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

	<i>US sovereign yield (β_2)</i>	<i>US high yield spread (γ_2)</i>	<i>R² gains</i>
Macroeconomic variables			
GDP	0.000	-0.010	0.01
Inflation	0.137 ^c	-0.048 ^c	6.16
Debt	0.002	0.001	0.26
Market conditions			
Policy rate	-0.176 ^c	-0.029 ^c	10.96
CDS	0.005 ^c	-0.001 ^c	10.40
External variables			
Current account to GDP	-0.043 ^c	-0.014 ^c	3.63
Reserves to GDP	-0.011 ^c	-0.004 ^c	4.42
External debt to GDP	-0.001	0.001	0.39
Portfolio flows to GDP	-0.057 ^b	-0.016 ^c	1.56
Net banking position to GDP	-0.010 ^b	-0.004 ^c	2.33
Exchange rate deviation	0.010	0.003	0.99
Real exchange rate	-0.000	0.004	0.49
Outstanding international debt	-0.029	-0.017 ^c	
Structural variables			
Market size (capitalization to GDP)	-0.222 ^c	-0.031 ^c	1.59
Real integration (exports to US to GDP)	-0.281 ^c	-0.009	0.88
Financial integration (Chinn Ito index)	-0.201 ^c	0.001	0.00

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 were corrected by panel data Newey West.

spread or a high policy rate also positively affect the response to US fluctuations since they may be proxies for financial risk. Four out of the seven 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 Similarly, a positive nominal exchange rate deviation from its long-run baseline or the last year's cumulative real appreciation reflect vulnerability and cause larger changes in yields, but they are not significant.

We also obtained that out of the three structural variables only market size is relevant. As in the previous event regression, a bigger market size, and thus a more liquid financial system, reduces the response of yields to a financial shock.

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, lower reserves, a lower current account, and a lower market capitalization depreciate the exchange rate more after an increase in US sovereign yields or in high-yield spreads, and 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.

⁹ Non-financial corporations' external debt has risen 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 9

REACTION OF EMERGING MARKET EXCHANGE RATES
TO US FINANCIAL VARIABLES

$$\Delta y_{it} = \alpha_i + (\beta_1 + \beta_2 CC_{it-1}) * \Delta Y_{sout}^{US} + (\gamma_1 + \gamma_2 CC_{it-1}) * \Delta Y_{hyt}^{US} + Z_t + \varepsilon_{it}$$

	<i>US sovereign yield (β_2)</i>	<i>US high yield spread (γ_2)</i>	<i>R² gains</i>
Macroeconomic variables			
GDP	-0.058	-0.028	0.09
Inflation	0.314 ^c	0.130 ^c	1.67
Debt	-0.008	0.008	0.39
Market conditions			
Policy rate	0.260	0.127 ^c	1.51
CDS	0.008 ^b	0.004 ^c	2.00
External variables			
Current account to GDP	-0.154 ^c	-0.096 ^c	3.25
Reserves to GDP	-0.044 ^c	-0.029 ^c	4.06
External debt to GDP	0.027	0.016 ^b	1.36
Portfolio flows to GDP	-0.200 ^b	-0.047	0.33
Net banking position to GDP	-0.025	-0.0125 ^c	0.30
Exchange rate deviation	-0.010	0.002	0.03
Real exchange rate	-0.037	-0.021	0.25
Outstanding international debt	-0.185 ^c	-0.106 ^c	
Structural variables			
Market size (capitalization to GDP)	-0.333 ^c	-0.240 ^c	1.39
Real integration (exports to US to GDP)	-0.123	-0.052	0.50
Financial integration (Chinn Ito index)	-0.244	-0.035	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 were corrected by panel data Newey West.

Table 10

**REACTION OF EMERGING MARKET STOCK INDICES
TO US FINANCIAL VARIABLES**

$$\Delta y_{it} = \alpha_i + (\beta_1 + \beta_2 CC_{it-1}) * \Delta Y_{sout}^{US} + (\gamma_1 + \gamma_2 CC_{it-1}) * \Delta Y_{hyt}^{US} + Z_i + \varepsilon_{it}$$

	<i>US sovereign yield (β_2)</i>	<i>US high yield spread (γ_2)</i>	<i>R² gains</i>
Macroeconomic variables			
GDP	-0.311 ^b	0.036	0.49
Inflation	-0.304 ^b	-0.049	0.16
Debt	0.005	-0.017 ^b	0.44
Market conditions			
Policy rate	-0.098	-0.021	0.02
CDS	-0.006	-0.001	0.07
External variables			
Current account to GDP	0.092	0.013	0.05
Reserves to GDP	0.025	-0.003	0.14
External debt to GDP	-0.005	-0.022 ^b	2.51
Portfolio flows to GDP	0.193	-0.007	1.9
Net banking position to GDP	0.003	-0.005	0.14
Exchange rate deviation	-0.013	-0.002	0.89
Real exchange rate	-0.055	-0.005	0.03
Outstanding international debt	0.047	-0.002	
Structural variables			
Market size (capitalization to GDP)	0.000	-0.000	0.02
Real integration (exports to US to GDP)	0.079	0.0960 ^c	0.54
Financial integration (Chinn Ito index)	-0.412	-0.319 ^b	0.01

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 were corrected by panel data Newey West.

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 LATAM 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 evidence of excess sensitivity for Latin American economies to US monetary disturbances once country-specific fundamentals are taken into account.

Table 11 presents a joint estimation of the specific country variables for the EME sovereign yields. 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.¹¹ 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 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.

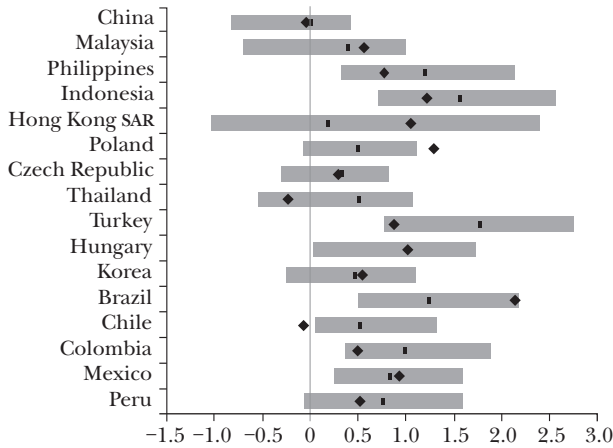
This multivariate estimation is similar to one by Bowman et al. (2015), although they consider a vulnerability index estimating a principal component of a set of macro variables and control for the currency regime. Nevertheless, our estimates present two important differences: First, both channels of transmission, sovereign yields

¹⁰ These results are not reported to save space.

¹¹ 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.

Figure 3

AVERAGE RESPONSE OF THE EME YIELDS IN US SOVEREIGN YIELDS



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

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.

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 yields.¹² 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 two-day changes in the event study (Table 2).

¹² 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.

Table 11

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

$$\Delta y_{it} = \alpha_i + (\beta_1 + \beta_2 CC_{it-1}) * \Delta Y_{sov}^{US} + (\gamma_1 + \gamma_2 CC_{it-1}) * \Delta Y_{hyt}^{US} + Z_t + \varepsilon_{it}$$

	<i>Specifications</i>			
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Inflation				
US sovereign yield	0.201 ^c	0.151 ^c	0.144 ^c	0.115 ^b
High yield spread	0.039 ^c	0.019 ^b	0.014	0.009
R ² gains	10.38			
CDS				
US sovereign yield		0.003 ^c	0.003 ^c	0.003 ^c
High yield spread		0.001 ^c	0.001 ^c	0.001 ^c
R ² gains		13.55		
Reserves				
US sovereign yield			-0.003	-0.017 ^b
High yield spread			-0.003 ^b	-0.005 ^b
R ² gains			14.30	
Capitalization to GDP				
US sovereign yield				0.134 ^c
High yield spread				0.026
R ² gains				15.04

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 were corrected by panel data Newey West.

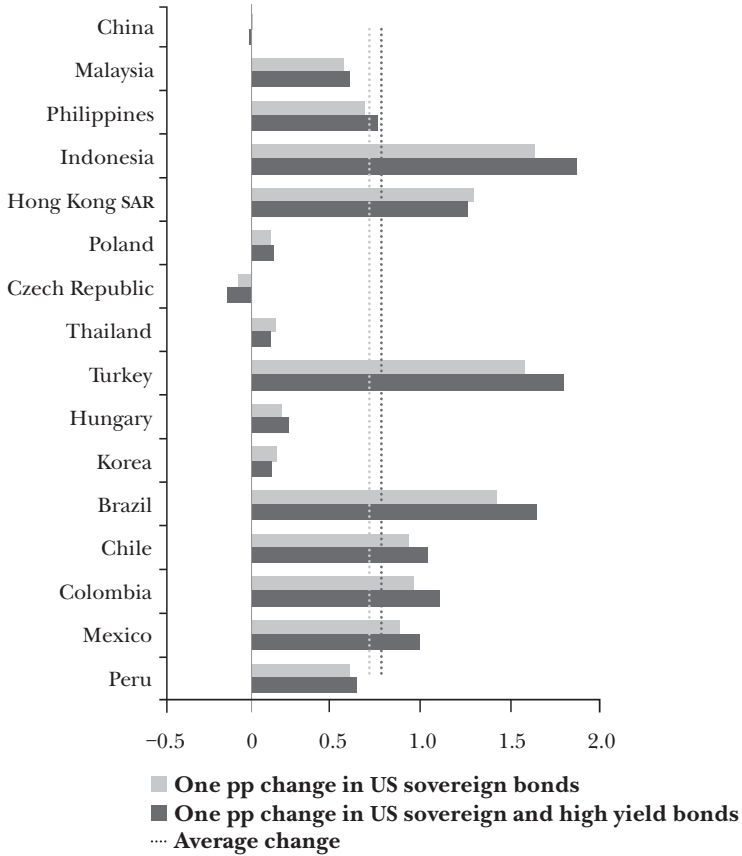
We find a large variability across countries. Nevertheless, for most of the countries in the sample the responses to the US policy have not outsized the expected price response of the model once the parameter uncertainty has been considered. The only country with an observed response above the upper limit of the confidence band is Poland. Interestingly, the model for Brazil is within the limit. 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 LATAM 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 future 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 in 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 62 bp through the interest rate channel and 68 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 39 bp, 45 bp and 41 bp, respectively, while a one standard deviation increase in the reserves to GDP ratio (28%) implies a 61 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. Other 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 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 (slow-down 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 an excess 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 a set of country characteristics were relevant in explaining the first set of unconventional measures in 2008-2009, but that the tapering talk in 2013 initially had a more indiscriminate effect across EMEs, and in either case there is no 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 spill-over effects of US financial shocks. On average, the observed event responses to US unconventional monetary policies were within the estimated model bands, including those of the five Latin American countries in our sample.

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 excess 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 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.

ANNEXES

Annex 1: Definitions of the Variables

<i>Dependent variables</i>	<i>Description</i>	<i>Source</i>	<i>Unavailability</i>
Sovereign yields	In local currency	Bloomberg ¹	
Exchange rates	Bilateral exchange rate with US dollar	Datastream	
Stock market prices	Aggregate index	Reuters	

<i>Country characteristics</i>	<i>Description</i>	<i>Source</i>	<i>Unavailability</i>
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

<i>Country characteristics</i>	<i>Description</i>	<i>Source</i>	<i>Unavailability</i>
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 et al. (2013).

Annex 2: Summary of Statistics

<i>Variable</i>	<i>Obs.</i>	<i>Mean</i>	<i>Standard deviation</i>	<i>Min</i>	<i>Max</i>
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	1500	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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