Economics Bulletin

Volume 33, Issue 4

Exchange Market Pressure, Output Drops, and Domestic Credit: Do Emerging Markets Behave Differently?

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Abstract

Currency crises, credit growth, and output growth have been extensively examined in the literature, but so far, less has been done to explicitly examine the linkages among these variables. Previous studies have also frequently omitted non-crisis periods in their analyses. This study creates continuous monthly indices of Exchange Market Pressure (EMP) for eight emerging markets and three developed economies, from 2001 to 2012. We then use Vector Autoregressive methods to examine the impact of credit growth and output growth on EMP before reversing causation to isolate EMP's effects on the other two variables. We find that the interactions among these variables are far more prevalent for the emerging markets. In particular, output growth increases EMP in Brazil and South Africa, while credit growth increases EMP in Hungary and reduces it in Mexico. Higher EMP reduces credit growth in Brazil, Hungary, and Turkey, and lowers growth in Russia.

Citation: Scott W Hegerty, (2013) "Exchange Market Pressure, Output Drops, and Domestic Credit: Do Emerging Markets Behave Differently?", *Economics Bulletin*, Vol. 33 No. 4 pp. 2583-2595.
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Submitted: September 18, 2013.   **Published:** October 08, 2013.

1. Introduction

Following the Global Financial Crisis that began in 2008, the world is no stranger to sharp drops in output and collapses in domestic credit. At the same time, events in Europe and elsewhere have drawn attention to the enormous strains put on currencies as macroeconomic balance is restored. Numerous studies have focused on aspects of the relationship among currency markets, credit growth, and output growth. In particular, currency crises can have detrimental effects on an economy, yet causation can be reversed as recessions increase pressure on the currency. Likewise, excessive credit growth might precipitate a crisis, but a crisis might lead to reduced lending. It is these interlinkages that we seek to investigate in this study.

This study creates a continuous, monthly measure of Exchange Market Pressure (EMP) for eight emerging markets and three developed economies, from 2001 to 2012. It has three goals. First, we study each EMP series in a model that includes their macroeconomic determinants. We thus evaluate the effects of credit growth and output growth on EMP, with these variables possibly reducing or increasing it. We the look at the other direction of causality to determine how EMP increases impact credit or output growth. Finally, we examine whether the emerging markets and developed economies exhibit any differences in behavior.

Our analysis ties together a number of separate threads found elsewhere in this vast literature. Previous studies often focus on certain aspects of the EMP-credit growth-output growth nexus, but not others, often analyzing only one direction in which contagion can occur. At times, they might limit their analysis to include crisis periods only, rather than tranquil periods or episodes of excessive appreciation. Other studies define “crises” as simply “devaluations,” not successful attempts to fight them, which fails to take into account all events in the exchange market. Even when market pressure is calculated, it is often used to create a binary variable that equals one when EMP exceeds a certain threshold, and one otherwise. Seminal works along these lines include Edwards (1986), as well as Gupta *et al.* (2003), Hutchinson and Noy (2005), Cerra and Saxena (2005), and Rahan and Shen (2006).

Further works achieve part of our goals, but not all. These include Beng and Ying (2001), who examine the credit crunch that accompanied Malaysia’s 1997-1998 currency crisis, but do not calculate EMP or examine any causal relationship among a crisis indicator and a measure of credit growth. Hong and Tornell (2003) analyze a dataset that includes 100 countries, finding that output remains at a permanently lower level following a currency crisis (although its growth rate returns relatively quickly), but that the “credit crunch” that follows a crisis is especially long-lasting. This analysis does not use EMP as its crisis measure, however. Lahiri and Vegh (2007) theoretically model the contractionary effects of interest rate hikes that are implemented to defend a currency’s value. They find that these increases can be detrimental on output growth if used excessively, but do not test their model empirically. Hegerty (2009) examines the effects of capital flows on credit growth and output on four transition economies’ EMP, as well as the effects of EMP on credit growth, but do not focus on output’s response.

Other studies focus on Latin America or other specific regions, rather than conduct a comprehensive study such as this one. Tanner (2000) focuses on the bilateral EMP-credit growth relationship in Latin America and Asia, using Vector Autoregressive (VAR) methods to generate impulse responses. Garcia and Malet (2007) study Argentina from 1993 to 2004, finding that EMP and domestic credit increase each other. Output had a larger effect on EMP than does domestic credit growth (reducing pressure as output grows). In addition, pressure on the peso had appears to have reduced growth.

Our study explicitly examines the bilateral relationships between exchange market pressure and credit and output growth for a wider set of countries. Using VAR methods, we find that these variables exhibit more interconnections for the eight emerging markets that we study than for the three developed economies.. This paper proceeds as follows. Section 2 outlines the econometric methodology. Section 3 explains the empirical results. Section 4 concludes, and data are explained in the Appendix.

2. Methodology

Using monthly data from the International Financial Statistics of the International Monetary Fund, over the period from 2002 to 2012, we examine macroeconomic time series for 11 countries. These include three more advanced economies (Canada, Japan, and the U.K.), as well as eight emerging markets (Brazil, Hungary, Indonesia, Mexico, Philippines, Russia, South Africa, and Turkey). These countries are chosen because they have complete data series for all variables (EMP components as well as macroeconomic determinants), and still allow for a comprehensive analysis.

First, we create our monthly series of EMP for all countries. Following Eichengreen *et al.* (1996), or Hegerty (2010), we construct continuous indices that are composed of three parts as in Equation (1).

$$EMP_t = \frac{1}{\sigma_{\Delta e}}\left(\frac{e_t - e_{t-1}}{e_{t-1}}\right) - \frac{1}{\sigma_{\Delta RES}}\frac{\Delta RES_t}{MB_{t-1}} + \frac{1}{\sigma_{\Delta r}}\Delta\left(r_t - r_t^{US}\right) \quad (1)$$

Percentage increases in the number of domestic currency units per U.S. dollar capture exchange-rate depreciations. Intervention is captured by reserve losses (scaled by the lagged, deseasonalized monetary base) and changes in the interest-rate differential between the domestic and U.S. money market rates. To avoid having the most volatile component dominate the series, we deflate each component by its own standard deviation. It is important to note that while certain studies, including Pentecost *et al.* (2001), Pontines and Siregar (2008), and Bertoli *et al.* (2010), criticize this method, they do not come up with a superior alternative. In fact, Hegerty (2013) compares this measure with a principal-components-based weighting scheme, and finds that not all countries generate a usable alternative EMP measure.

Figure 1 shows these EMP series. We see that while events such as the 2008 Global Financial Crisis are common to all, others are country-specific. In particular, there are many instances of negative EMP, during which a currency is appreciating or the central bank is accumulating reserves. As a result, we must examine each country separately.

We do so by creating vectors that include EMP as well as its macroeconomic determinants. Following studies such as Hegerty (2010), we include credit growth, output growth, the inflation rate, and the growth rate of government debt, as in Equation (2a):

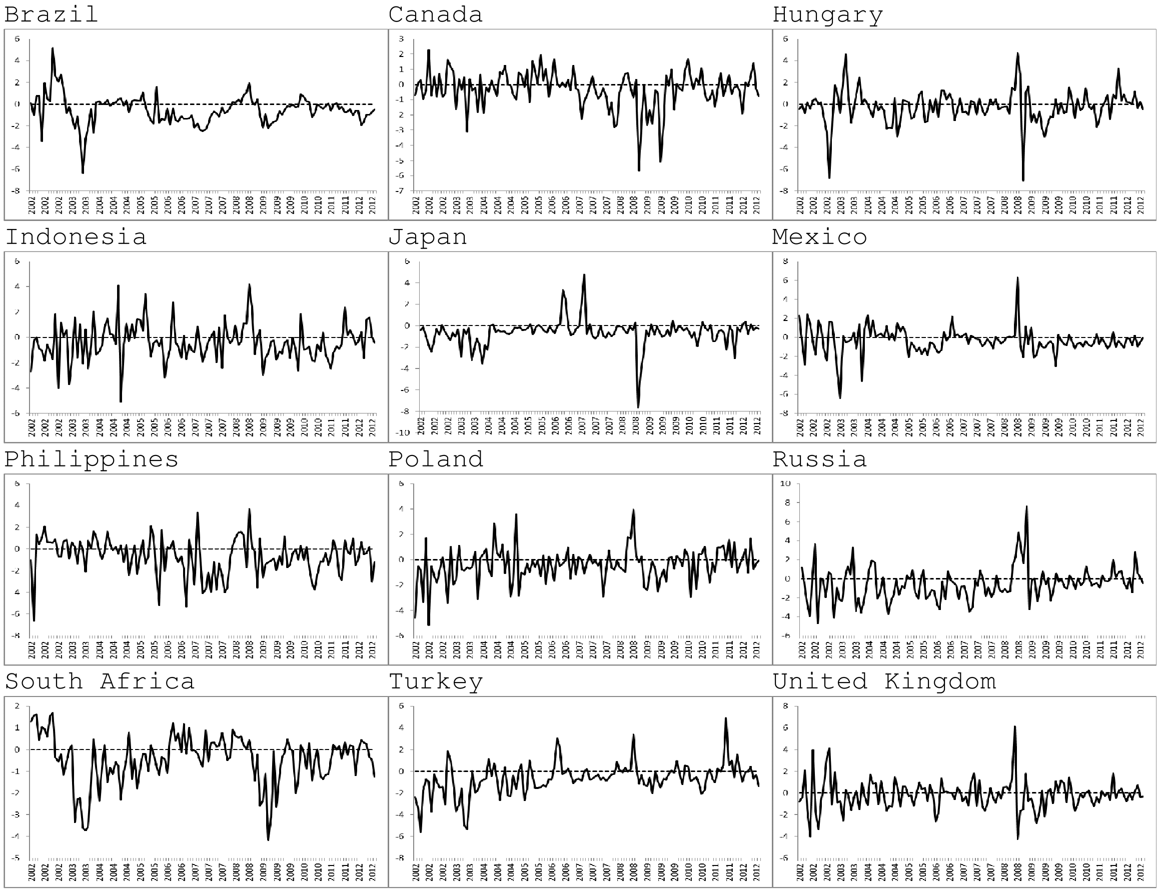
$$\left[EMP_t, CRG_t GOVG_t GROWTH_t INF_t\right] \quad (2a)$$

All variables are in real terms and explained in the Appendix. We also test for stationarity and first-difference where necessary.

We expect that credit growth or higher debt might lead to an expectation of a depreciation that might put pressure on a currency. Alternatively, these variables, as well as slow growth or high inflation, might represent weakening fundamentals that can cause a currency decline. As a result, we expect them all to have an impact on EMP. In addition, we test for the inclusion of each country's trade balance in each specification via our Granger causality tests; if the variable is significant, we include it in equation (2b).

$$\left[EMP_t, CRG_t GOVG_t GROWTH_t INF_t, TB_t\right] \quad (2b)$$

Figure 1. EMP Series, 2002-2012.



We conduct Granger causality/Block exogeneity tests for specifications (2a) and (2b) for each country, noting which EMP determinants are significant and whether the trade balance should be included in the next phase of the study. We also reverse the direction of causality to examine which variables Granger-cause credit growth and output growth.

In our main phase of this study, we generate impulse-response functions (IRFs) for each country, choosing Equation (2a) in most cases. We apply the generalized IRF methodology of Pesaran and Shin (1998), which is invariant to the ordering of the variables. (This differs from the orthogonalized approach of Sims, 1980, which requires ordering for the Cholesky decomposition.) If the standard error bands of a function fall outside of the zero line, we can say that the response is significant. We will also be able to tell if the effect is positive or negative. We look at responses to all four (or five) determinants by EMP itself. When we change the direction of causality, we report only the effects of EMP on credit growth and on output. Our findings are presented below.

3. Results

Before proceeding, we must test all variables for stationarity and take first differences of any I(1) variables. The results of our Phillips-Perron (1988) tests are provided in Table I. As is typical for this variable (as well as readily deduced visually), all EMP series are stationary. The others are either I(0) or I(1) on a country-by-country basis and are first-differenced as necessary. U.S. stock prices are already measured in log differences, so this variable is stationary.

Table I. Phillips-Perron Stationarity Test Results.

	Brazil Levels	First Difference	*Canada* Levels	First Difference	*Japan* Levels	First Difference
EMP	-5.955 (0.000)	-15.690 (0.000)	-8.509 (0.000)	-23.050 (0.000)	-7.067 (0.000)	-17.665 (0.000)
INF	-2.542 (0.106)	-5.166 (0.000)	-3.593 (0.006)	-9.454 (0.000)	-2.521 (0.110)	-8.380 (0.000)
CRG	-2.098 (0.245)	-10.608 (0.000)	-1.687 (0.438)	-8.767 (0.000)	-1.593 (0.487)	-8.350 (0.000)
GROWTH	-2.779 (0.061)	-9.889 (0.000)	-2.300 (0.172)	-11.384 (0.000)	-2.807 (0.057)	-9.096 (0.000)
GOVG	-3.260 (0.017)	-13.372 (0.000)	-2.484 (0.119)	-6.897 (0.000)	-2.380 (0.147)	-11.691 (0.000)
TB	-2.051 (0.265)	-22.599 (0.000)	-2.246 (0.191)	-15.251 (0.000)	-1.811 (0.374)	-18.974 (0.000)
	Russia Levels	First Difference	*S. Africa* Levels	First Difference	*Hungary* Levels	First Difference
EMP	-8.132 (0.000)	-20.623 (0.000)	-6.250 (0.000)	-17.900 (0.000)	-9.615 (0.000)	-19.233 (0.000)
INF	-1.548 (0.510)	-5.517 (0.000)	-2.258 (0.186)	-6.482 (0.000)	-2.361 (0.153)	-8.701 (0.000)
CRG	-1.845 (0.359)	-11.586 (0.000)	-2.317 (0.167)	-13.104 (0.000)	-1.692 (0.435)	-11.788 (0.000)
GROWTH	-2.400 (0.142)	-12.643 (0.000)	-2.825 (0.055)	-14.125 (0.000)	-2.673 (0.079)	-16.412 (0.000)
GOVG	-8.009 (0.000)	-26.505 (0.000)	-9.568 (0.000)	-24.674 (0.000)	-11.530 (0.000)	-30.729 (0.000)
TB	-2.609 (0.094)	-14.854 (0.000)	-6.534 (0.000)	-38.862 (0.000)	-1.446 (0.557)	-30.900 (0.000)
	Phillipines Levels	First Difference	*Indonesia* Levels	First Difference	*Mexico* Levels	First Difference
EMP	-9.267 (0.000)	-22.919 (0.000)	-10.607 (0.000)	-27.522 (0.000)	-9.389 (0.000)	-22.025 (0.000)
INF	-2.405 (0.140)	-5.601 (0.000)	-2.282 (0.178)	-8.750 (0.000)	-2.444 (0.130)	-6.736 (0.000)
CRG	-2.660 (0.081)	-11.695 (0.000)	-1.252 (0.651)	-10.851 (0.000)	-3.112 (0.026)	-10.984 (0.000)
GROWTH	-3.505 (0.008)	-13.217 (0.000)	-8.826 (0.000)	-24.368 (0.000)	-2.167 (0.218)	-11.607 (0.000)
GOVG	-10.900 (0.000)	-27.594 (0.000)	-2.819 (0.056)	-11.734 (0.000)	-3.122 (0.025)	-13.348 (0.000)
TB	-6.106 (0.000)	-21.918 (0.000)	-3.782 (0.004)	-24.884 (0.000)	-5.670 (0.000)	-16.793 (0.000)
	Turkey Levels	First Difference	*U.K.* Levels	First Difference		
EMP	-7.126 (0.000)	-16.397 (0.000)	-12.191 (0.000)	-27.956 (0.000)		
INF	-2.827 (0.055)	-7.583 (0.000)	-2.206 (0.204)	-8.188 (0.000)		
CRG	-2.412 (0.138)	-10.613 (0.000)	-0.653 (0.859)	-12.085 (0.000)		
GROWTH	-4.171 (0.001)	-18.514 (0.000)	-6.875 (0.000)	-26.102 (0.000)		
GOVG	-11.170 (0.000)	-28.414 (0.000)	-3.805 (0.003)	-10.971 (0.000)		
TB	-4.978 (0.000)	-20.846 (0.000)	-6.359 (0.000)	-20.772 (0.000)		
DLNUSSTK	-8.316 (0.000)	-19.380 (0.000)				

P-values in parentheses.

These stationary variables are then entered into two vectors for each country. The first includes EMP, credit growth, income growth, the growth rate of government debt, and inflation; the second includes the trade balance as well. Granger causality tests are performed on each vector, with the first three variables mentioned above serving as the dependent variable in three separate tests. All vectors are estimated at one lag based on minimizing the Schwarz criterion.

Table II presents the Granger Causality tests for each country. The trade balance is significant in the tests on EMP in only two cases (Indonesia and South Africa). We therefore focus on vector (2b) for these countries and vector (2a) for the other nine. The significance of the remaining variables is robust between specifications, however.

Beginning with the developed economies' specifications, we see large differences among the countries. This suggests that there may be little pattern by which we can classify countries into groups. For example, the growth rate in government debt and the inflation rate Granger-cause EMP in Canada, while U.S. stock prices are significant in Japan. No explanatory variable has a significant effect on the United Kingdom.

The other variables are also affected differently across countries when the direction of causation is changed. Inflation Granger-causes British credit growth, but other variables have limited effects. Government debt influences growth in the U.K. and Japan, and U.S. stock-price changes Granger-cause Canadian and Japanese output growth.

Table II. Granger Causality (Block Exogeneity) Results.

Developed Economies: Specification (2a)

Canada	*EMP*	*D(CRG)*	*D(GROWTH)*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		0.297 (0.586)	0.013 (0.908)
D(CRG)	0.004 (0.949)		**4.697 (0.030)**
D(GOVG)	**5.766 (0.016)**	1.095 (0.295)	0.930 (0.335)
D(GRWTH)	1.034 (0.309)	0.604 (0.437)	
INF	**3.229 (0.072)**	1.027 (0.311)	1.981 (0.159)
DLNUSSTK	0.415 (0.519)	0.662 (0.416)	**3.172 (0.075)**
All	**11.16 (0.048)**	6.161 (0.291)	8.407 (0.135)

Japan	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		0.145 (0.703)	1.898 (0.168)
D(CRG)	1.273 (0.259)		0.128 (0.720)
D(GOVG)	0.539 (0.463)	2.469 (0.116)	**3.026 (0.082)**
D(INF)	0.093 (0.760)	0.558 (0.455)	**3.536 (0.060)**
GROWTH	0.279 (0.598)	0.431 (0.511)	
DLNUSSTK	**4.488 (0.034)**	0.003 (0.958)	**4.499 (0.034)**
All	6.482 (0.262)	3.241 (0.663)	**17.33 (0.004)**

UK	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		1.181 (0.277)	0.054 (0.816)
D(CRG)	1.223 (0.269)		0.079 (0.779)
GOVG	1.495 (0.221)	0.615 (0.433)	**7.147 (0.008)**
GROWTH	0.334 (0.563)	0.064 (0.801)	
D(INF)	1.498 (0.221)	**3.037 (0.081)**	2.408 (0.121)
DLNUSSTK	0.000 (0.996)	0.009 (0.926)	1.472 (0.225)
All	6.105 (0.296)	4.086 (0.537)	**11.56 (0.041)**

Developed Economies: Specification (2b)

Canada	*EMP*	*D(CRG)*	*D(GROWTH)*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		0.206 (0.650)	0.021 (0.884)
D(CRG)	0.003 (0.955)		**4.089 (0.043)**
D(GOVG)	**5.504 (0.019)**	0.572 (0.449)	1.079 (0.299)
D(GRWTH)	0.929 (0.335)	0.077 (0.782)	
INF	**3.179 (0.075)**	0.933 (0.334)	2.016 (0.156)
D(TB)	0.002 (0.969)	**3.547 (0.060)**	0.334 (0.563)
DLNUSSTK	0.404 (0.525)	0.900 (0.343)	**3.258 (0.071)**
All	**10.989 (0.089)**	9.957 (0.127)	8.653 (0.194)

Japan	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		0.151 (0.698)	0.939 (0.333)
D(CRG)	1.338 (0.247)		0.263 (0.608)
D(GOVG)	0.496 (0.481)	2.429 (0.119)	**2.790 (0.095)**
D(INF)	0.173 (0.678)	0.558 (0.455)	
GROWTH	0.226 (0.635)	0.415 (0.519)	**5.790 (0.016)**
D(TB)	0.393 (0.531)	0.008 (0.928)	**7.404 (0.007)**
DLNUSSTK	**4.578 (0.032)**	0.002 (0.961)	**4.218 (0.040)**
All	6.839 (0.336)	3.219 (0.781)	**25.774 (0.000)**

UK	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		1.192 (0.275)	0.054 (0.816)
D(CRG)	1.260 (0.262)		0.077 (0.782)
GOVG	1.614 (0.204)	0.573 (0.449)	**7.041 (0.008)**
GROWTH	0.351 (0.554)	0.066 (0.797)	
D(INF)	1.492 (0.222)	**3.011 (0.083)**	2.386 (0.122)
TB	0.364 (0.547)	0.048 (0.827)	0.002 (0.964)
DLNUSSTK	0.002 (0.967)	0.006 (0.940)	1.458 (0.227)
All	6.432 (0.377)	4.097 (0.664)	**11.455 (0.075)**

Emerging Markets: Specification (1)

Brazil	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		0.472 (0.492)	0.188 (0.664)
D(CRG)	**3.356 (0.067)**		0.229 (0.632)
GOVG	1.162 (0.281)	1.839 (0.175)	**3.780 (0.052)**
GROWTH	**8.798 (0.003)**	**5.704 (0.017)**	
D(INF)	0.603 (0.438)	**9.918 (0.002)**	0.007 (0.934)
DLNUSSTK	0.309 (0.579)	0.492 (0.483)	**7.415 (0.007)**
All	**11.28 (0.046)**	**18.98 (0.002)**	**15.81 (0.007)**

Hungary	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		2.328 (0.127)	2.138 (0.144)
D(CRG)	**22.21 (0.000)**		**5.485 (0.019)**
GOVG	0.543 (0.461)	**4.027 (0.045)**	0.031 (0.861)
D(GRWTH)	0.168 (0.682)	0.014 (0.904)	
D(INF)	**6.846 (0.009)**	**4.111 (0.043)**	**6.285 (0.012)**
DLNUSSTK	1.026 (0.311)	0.067 (0.795)	0.653 (0.419)
All	**25.06 (0.000)**	**11.26 (0.046)**	**11.65 (0.040)**

Indonesia	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		0.509 (0.476)	**2.814 (0.093)**
D(CRG)	2.103 (0.147)		0.363 (0.547)
GOVG	0.767 (0.381)	0.604 (0.437)	0.078 (0.779)
GROWTH	1.379 (0.240)	0.245 (0.621)	
D(INF)	1.286 (0.257)	**4.023 (0.045)**	1.510 (0.219)
DLNUSSTK	**3.565 (0.059)**	0.464 (0.496)	**3.846 (0.050)**
All	8.522 (0.130)	5.400 (0.369)	8.508 (0.130)

Mexico			
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		0.007 (0.931)	0.001 (0.981)
CRG	**5.400 (0.020)**		0.275 (0.600)

Emerging Markets: Specification (2)

Brazil	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		0.472 (0.492)	0.186 (0.666)
D(CRG)	**3.285 (0.070)**		0.243 (0.622)
GOVG	1.174 (0.279)	1.722 (0.189)	**3.825 (0.051)**
GROWTH	**8.577 (0.003)**	**5.413 (0.020)**	
D(INF)	0.561 (0.454)	**9.384 (0.002)**	0.002 (0.964)
D(TB)	0.044 (0.834)	0.412 (0.521)	0.148 (0.700)
DLNUSSTK	0.314 (0.576)	0.521 (0.471)	**7.274 (0.007)**
All	**11.221 (0.082)**	**19.292 (0.004)**	**15.829 (0.015)**

Hungary	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		2.318 (0.128)	2.271 (0.132)
D(CRG)	**22.199 (0.000)**		**5.745 (0.017)**
GOVG	0.439 (0.507)	**4.033 (0.045)**	0.006 (0.939)
D(GRWTH)	0.051 (0.822)	0.008 (0.931)	
D(INF)	**8.117 (0.004)**	**4.114 (0.043)**	**4.564 (0.033)**
D(TB)	1.987 (0.159)	0.060 (0.807)	**3.410 (0.065)**
DLNUSSTK	1.345 (0.246)	0.053 (0.817)	1.012 (0.314)
All	**27.274 (0.000)**	**11.225 (0.082)**	15.322 (0.018)

Indonesia	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		0.482 (0.488)	**2.880 (0.090)**
D(CRG)	2.020 (0.155)		0.349 (0.554)
GOVG	0.026 (0.871)	0.593 (0.441)	0.130 (0.719)
GROWTH	1.478 (0.224)	0.242 (0.623)	
D(INF)	0.704 (0.402)	**3.874 (0.049)**	1.575 (0.209)
TB	**6.242 (0.013)**	0.010 (0.922)	0.108 (0.742)
DLNUSSTK	2.518 (0.113)	0.469 (0.494)	**3.579 (0.059)**
All	**15.194 (0.019)**	5.358 (0.499)	8.543 (0.201)

Mexico	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		0.001 (0.976)	0.064 (0.800)
CRG	**3.929 (0.047)**		0.019 (0.891)

GOVG	**7.498 (0.006)**	0.825 (0.364)	0.347 (0.556)	GOVG	**6.871 (0.009)**	0.718 (0.397)	0.728 (0.394)
D(GRWTH)	**4.035 (0.045)**	**5.589 (0.018)**		D(GRWTH)	**3.155 (0.076)**	**4.832 (0.028)**	
D(INF)	0.013 (0.910)	0.902 (0.342)	1.330 (0.249)	D(INF)	0.068 (0.795)	0.719 (0.397)	2.440 (0.118)
				TB	0.659 (0.417)	0.199 (0.656)	**4.922 (0.027)**
DLNUSSTK	0.298 (0.585)	0.162 (0.687)	0.012 (0.913)	DLNUSSTK	0.207 (0.649)	0.200 (0.655)	0.122 (0.727)
All	**15.99 (0.007)**	6.803 (0.236)	2.217 (0.818)	All	**16.593 (0.011)**	6.951 (0.325)	7.220 (0.301)
Philippines	*EMP*	*CRG*	*GROWTH*	Philippines	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)	Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq
EMP		1.033 (0.310)	0.018 (0.893)	EMP		0.950 (0.330)	0.015 (0.903)
CRG	1.307 (0.253)		0.374 (0.541)	CRG	1.352 (0.245)		0.366 (0.545)
GOVG	0.817 (0.366)	0.186 (0.666)	0.055 (0.815)	GOVG	0.621 (0.431)	0.107 (0.743)	0.041 (0.839)
GROWTH	1.008 (0.315)	1.532 (0.216)		GROWTH	1.570 (0.210)	0.962 (0.327)	
D(INF)	0.089 (0.766)	**4.819 (0.028)**	**9.270 (0.002)**	D(INF)	0.039 (0.843)	**4.428 (0.035)**	**8.993 (0.003)**
				TB	1.852 (0.174)	1.480 (0.224)	0.113 (0.737)
DLNUSSTK	1.068 (0.302)	2.122 (0.145)	0.396 (0.529)	DLNUSSTK	0.549 (0.459)	1.401 (0.237)	0.298 (0.585)
All	6.014 (0.305)	**12.41 (0.030)**	**10.47 (0.063)**	All	7.914 (0.245)	**13.949 (0.030)**	10.501 (0.105)
Russia	*EMP*	*CRG*	*GROWTH*	Russia	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)	Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		0.000 (0.999)	**5.998 (0.014)**	EMP		0.061 (0.805)	**4.679 (0.031)**
D(CRG)	0.382 (0.537)		**5.371 (0.021)**	D(CRG)	0.192 (0.661)		**5.540 (0.019)**
GOVG	1.275 (0.259)	1.544 (0.214)	0.578 (0.447)	GOVG	0.436 (0.509)	2.003 (0.157)	0.759 (0.384)
D(GRWTH)	0.783 (0.376)	**3.816 (0.051)**		D(GRWTH)	0.872 (0.350)	**3.708 (0.054)**	
D(INF)	0.392 (0.531)	**2.814 (0.094)**	1.461 (0.227)	D(INF)	0.695 (0.405)	2.393 (0.122)	1.258 (0.262)
				TB	2.244 (0.134)	0.629 (0.428)	0.259 (0.611)
DLNUSSTK	**3.293 (0.070)**	0.052 (0.820)	**7.268 (0.007)**	DLNUSSTK	**3.326 (0.068)**	0.051 (0.821)	**7.215 (0.007)**
All	5.706 (0.336)	9.155 (0.103)	**23.49 (0.000)**	All	8.016 (0.237)	9.751 (0.136)	**23.587 (0.001)**
S. Africa	*EMP*	*CRG*	*GROWTH*	S. Africa	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)	Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		0.001 (0.978)	0.355 (0.551)	EMP		0.417 (0.518)	0.005 (0.942)
D(CRG)	0.143 (0.705)			D(CRG)	0.404 (0.525)		1.851 (0.174)
GOVG	0.853 (0.356)	0.869 (0.351)	1.560 (0.212)	GOVG	0.027 (0.870)	0.219 (0.640)	0.244 (0.621)
GROWTH	**7.116 (0.008)**	0.246 (0.620)	0.749 (0.387)	GROWTH	**6.806 (0.009)**	0.344 (0.557)	
D(INF)	1.114 (0.291)	0.238 (0.626)	**3.001 (0.083)**	D(INF)	1.001 (0.317)	0.193 (0.661)	**2.877 (0.090)**
				TB_	**8.665 (0.003)**	**2.918 (0.088)**	1.780 (0.182)
DLNUSSTK	0.056 (0.814)	1.258 (0.262)	**13.42 (0.000)**	DLNUSSTK	0.498 (0.480)	1.924 (0.166)	**11.699 (0.001)**
All	**11.73 (0.039)**	2.523 (0.773)	**21.38 (0.001)**	All	**21.235 (0.002)**	5.486 (0.483)	**23.315 (0.001)**
Turkey	*EMP*	*CRG*	*GROWTH*	Turkey	*EMP*	*CRG*	*GROWTH*
Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)	Excluded	Chi-sq (Prob)	Chi-sq (Prob)	Chi-sq (Prob)
EMP		**4.984 (0.026)**	0.057 (0.811)	EMP		**5.094 (0.024)**	0.035 (0.853)
D(CRG)	0.153 (0.696)		0.033 (0.857)	D(CRG)	0.519 (0.471)		0.016 (0.901)
GOVG	0.176 (0.675)	0.026 (0.873)	0.020 (0.887)	GOVG	0.160 (0.689)	0.029 (0.864)	0.015 (0.902)
GROWTH	0.734 (0.392)	0.109 (0.741)		GROWTH	0.051 (0.822)	0.042 (0.838)	
INF	**11.40 (0.001)**	0.735 (0.391)	0.108 (0.743)	INF	**6.317 (0.012)**	0.229 (0.633)	0.689 (0.407)
				TB	2.155 (0.142)	0.570 (0.450)	1.718 (0.190)
DLNUSSTK	0.508 (0.476)	0.209 (0.648)	1.896 (0.169)	DLNUSSTK	0.777 (0.378)	0.292 (0.589)	1.490 (0.222)
All	**13.14 (0.022)**	5.39 (0.370)	2.275 (0.810)	All	**15.439 (0.017)**	5.942 (0.430)	4.008 (0.676)

P-values in parentheses. Bold = significant at 10 percent.

The emerging markets studied here also exhibit highly idiosyncratic results. Credit growth Granger-causes EMP in Brazil, Hungary, and Mexico; government debt affects EMP in Mexico; and output growth influences EMP in Brazil, Mexico, and South Africa. Inflation has an effect on Hungarian and Turkish EMP, whicle U.S. stock prices affect the Russian currency market. Clearly, the exchange markets of some countries (such as Brazil and Mexico) are influenced more by these macroeconomic determinants than are others (such as the Philippines). Our major conclusion, however, is that the emerging markets differ from the advanced economies because credit or output growth have no effect on the latter group's EMP series.

For the determinants of credit and output growth, we focus on EMP's role and see that there are only three significant cases (all in emerging markets). EMP Granger-causes credit growth in Turkey, and Granger-causes output growth in Indonesia and Russia. Here, we conclude that EMP is a more prominent cause of macroeconomic variables in emerging markets as well.

To further examine these findings, we generate Generalized IRFs for vector (2a) or (2b) for each country. These are able to show sign (positive and negative responses) as well as significance (when bands of two standard errors above and below each function are included). The responses by EMP to shocks to all other variables are presented in Figure 2.

The IRFs generally support the findings of the Granger causality tests. Growth in government debt, as well as inflation, raise EMP in Canada, while U.S. stock-price increases (and possibly output growth) raise EMP in Japan. The UK also registers a small response whereby output growth appears to increase EMP. Japan's story is interesting, given that slow growth led to low interest rates and the "carry trade"—increasing demand for yen-denominated assets (and a yen appreciation). This is paired with rising stock markets in the U.S. and a significantly positive impulse response.

For the emerging markets, credit growth raises EMP in Hungary, but lowers it in Mexico. This suggests that debt places pressure on the forint, but does not do so on the peso. Most likely, consumer spending in Mexico, but not the IMF-constrained Hungary, takes this pressure off. Output growth raises EMP in Brazil and South Africa. These are two regional economic powerhouses that attracted large amounts of foreign capital during the 2000s, which led to reduced exports. Brazil, in particular, instituted capital controls to stem an appreciation of the real.

As was uncovered by the Granger causality tests, growth in Mexican government debt increases pressure on the peso. This supports the theory that, particularly in Latin America, investors might view the debt as unsustainable and as a result, withdraw capital from a country. At the same time, exports bring in foreign capital. For Indonesia and South Africa, an increase in the trade balance lowers EMP. Finally, while increases in U.S. stock prices raise EMP in Japan, they lower market pressure in Russia.

While credit growth and output growth have effects on EMP only in emerging markets, we see that EMP also has more influence on output and credit growth in these parts of the world. Figure 3 depicts GIRFs for specifications in which EMP is shocked and credit growth and output growth respond. Increased EMP leads to higher growth in Japan, most likely linking a yen depreciation with exports. At the same time, repatriating Japanese capital for investment (a reserve gain) can also lead to growth. Other effects on the developed economies are limited. For the emerging markets, we find that higher EMP reduces credit growth in Brazil, Hungary, and Turkey, and lowers growth in Russia.

In all, our analysis allows us to conclude that, while the specific effects differ from country to country, they are more prevalent for our eight emerging markets than for our three developed economies. This is true for the effects as well as the causes of higher EMP. In particular, output growth has led to increased pressure on the rand and the Brazilian real, while domestic credit growth has increased pressure on the forint and reduced it on the Mexican peso. The effects on these variables on the pound, yen, and Canadian dollar are far more limited.

4. Conclusion

Currency crises are known to lead to periods of low growth and to credit crunches. At the same time, credit growth and recessions can lead to currency crises. While individual relationships have been extensively examined in the literature, surprisingly little has been done linking them together. Even less has focused on non-crisis periods as well as crises. This study does both, examining both the causes and the effects of heightened exchange market pressure (EMP), on a set of three developed and eight developing economies. We are able to compare effects between the groups as well. In addition, our EMP index, which is monthly over the period from 2001 to 2012 can be negative when currencies are facing pressure to appreciate, as well as positive.

VAR methods, particularly Granger causality tests and Generalized IRFs, are performed on vectors containing EMP, credit growth, output growth, and other macroeconomic variables. These tests lead us to three important conclusions. First, each country behaves differently from the others; not all variables are significant in all cases. Secondly, while individual results differ, the emerging markets register far more significant effects than do the advanced economies, both when EMP is the dependent variable and when it is not. Finally, we arrive at some important styled facts. Economic growth in South Africa and Brazil has put pressure on the rand and real, while pressure on the ruble reduces Russian growth. Japan, on the other hand sees EMP fall when growth slows—which may be tied to the "carry trade" and capital inflows.

Appendix: Data Definitions.

All data are taken from the International Financial Statistics of the International Monetary Fund. They are monthly, from 2002:01 to 2012:08. Lagged series begin in 2011:12.

The EMP components are defined as follows:

e: Nominal exchange rate (units of domestic currency per U.S. dollar)
RES: Total reserves excluding gold, converted into domestic currency
MB: Monetary Base, deseasoanalized using the Census X-12 procedure
r = domestic money market rate
r^{US} = U.S. money market rate

The macroeconomic variables are:

CRG: year-on-year percentage change of real Domestic Credit (deflated by the CPI)
GOVG: year-on-year percentage change of real Net Claims on Central Government (deflated by Consumer Price Index)
GROWTH: year-on-year percentage change of the index of industrial production
INF: year-on-year percentage change of Consumer Price Index
TB: the ratio of exports to import. Balanced trade would therefore equal one.

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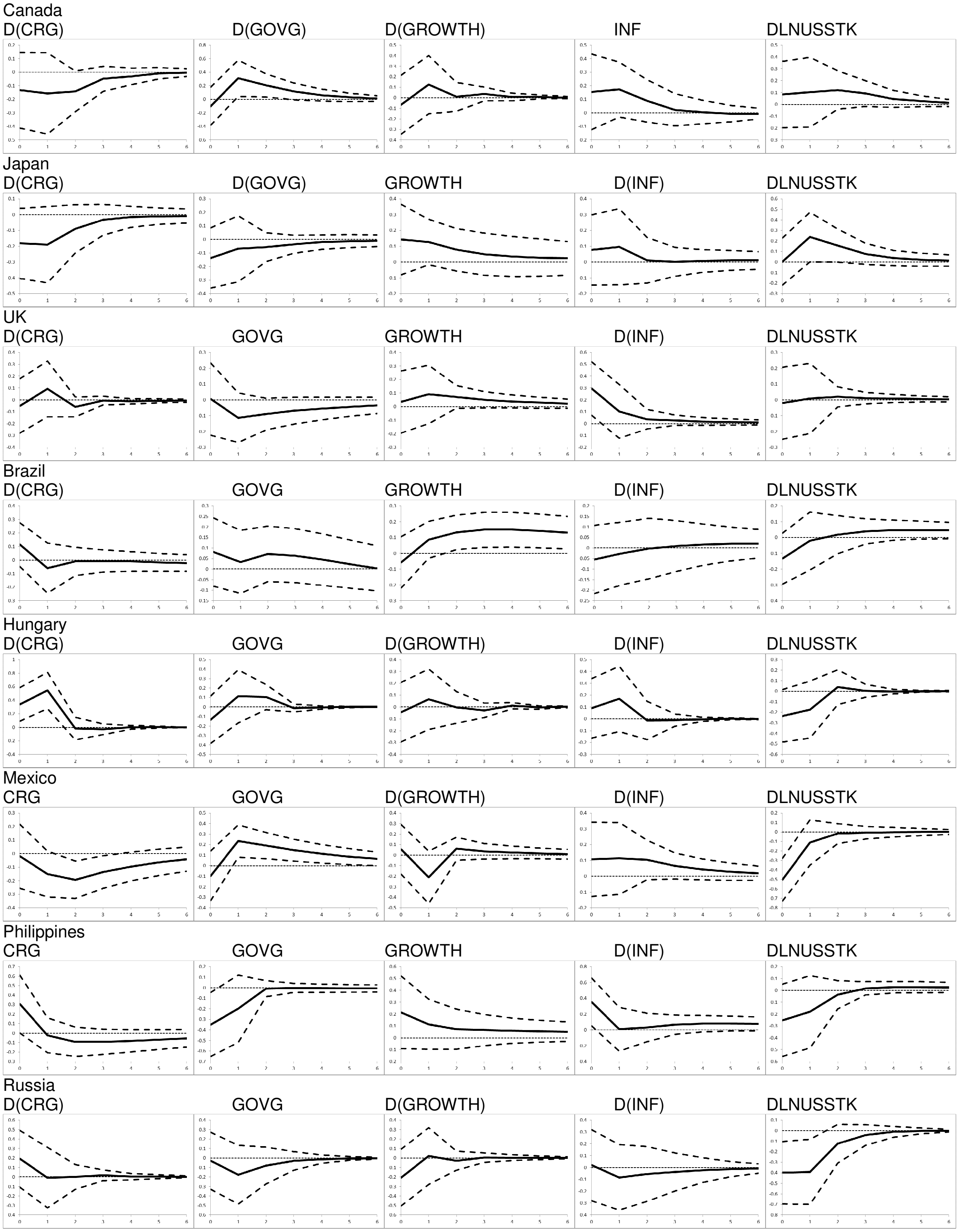
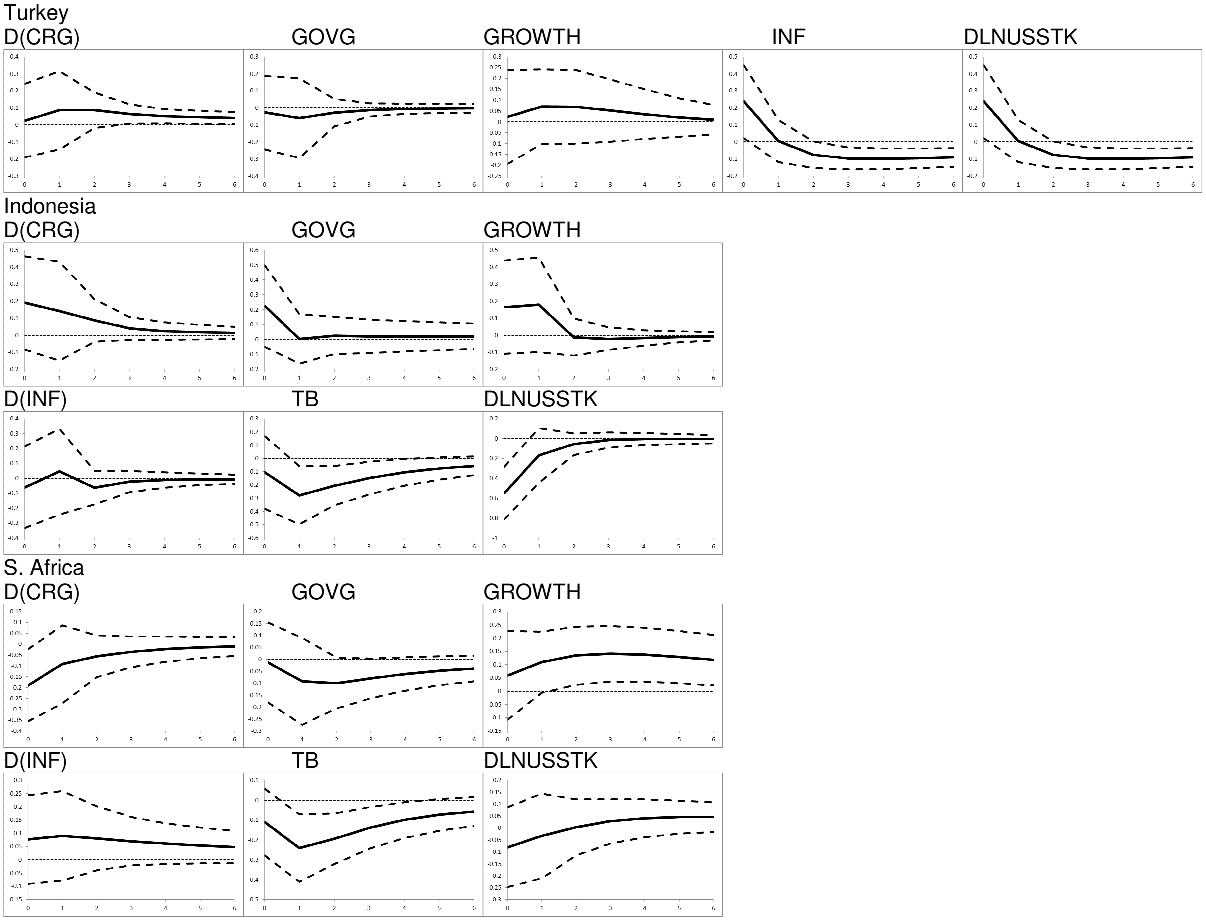
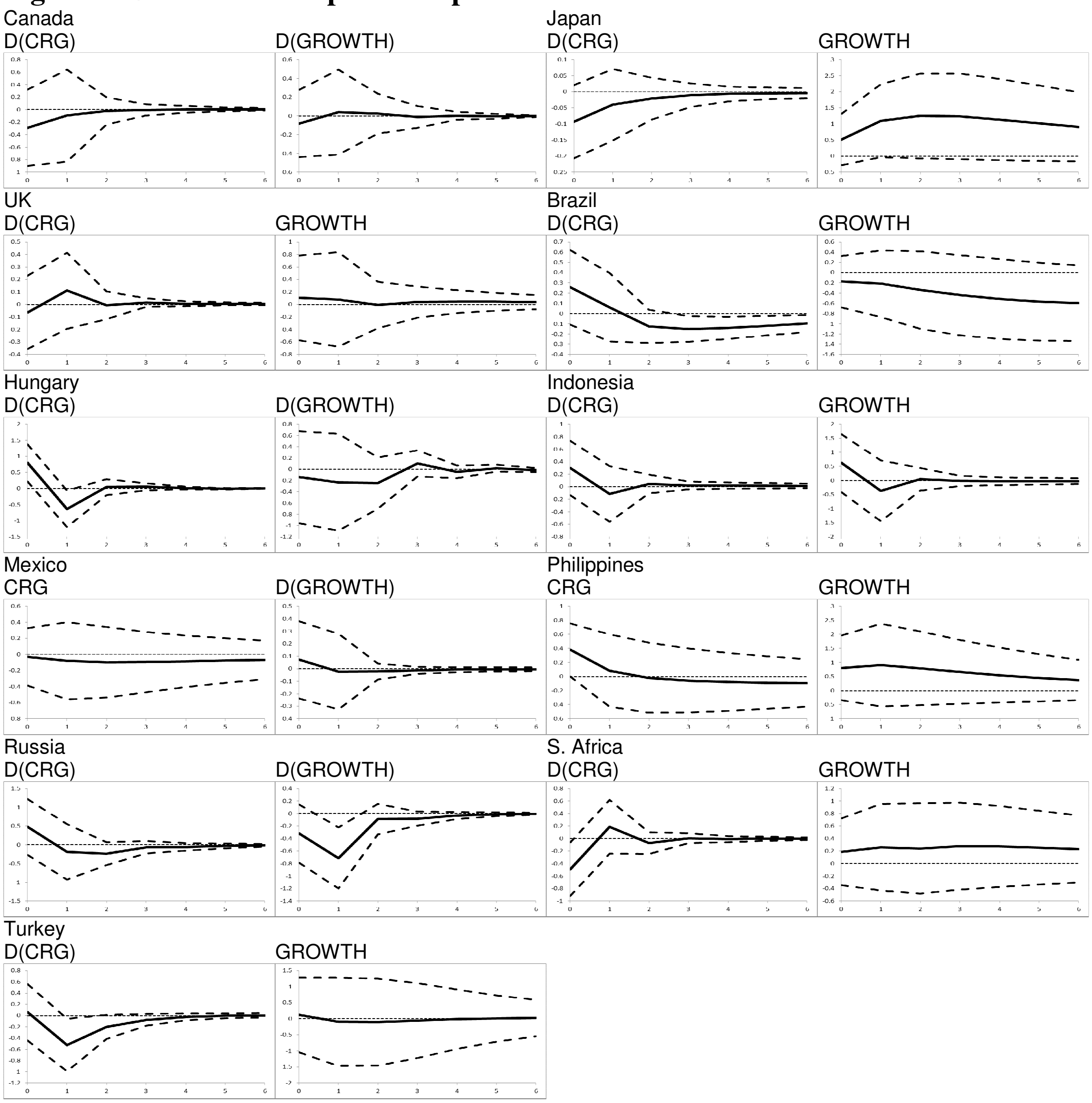
Figure 2. Generalized Impulse-Response Functions for Determinants of EMP.





Notes: Each IRF represents the effects of a determinant on EMP.
Horizon length = 6 months.
Dashed lines represent ±2 standard error bands.

Figure 3. Generalized Impulse-Response Functions for Effects of EMP.



Notes: Each IRF represents the effects of EMP on credit growth or output growth.
Horizon length = 6 months.
Dashed lines represent ±2 standard error bands.