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MONETARY POLICY SPILLOVERS AND THE TRILEMMA IN THE NEW NORMAL:
PERIPHERY COUNTRY SENSITIVITY TO CORE COUNTRY CONDITIONS

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ABSTRACT

We investigate why and how the financial conditions of developing and emerging market countries (peripheral countries) can be affected by the movements in the center economies - the U.S., Japan, the Eurozone, and China. We apply a two-step approach. First, we estimate the sensitivity of countries' financial variables to the center economies, controlling for global and domestic factors. Next, we examine the association of the estimated sensitivity coefficients with the macroeconomic conditions, policies, real and financial linkages with the center economies, and the level of institutional development. In the last two decades, for most financial variables, the strength of the links with the center economies have been the dominant factor. While certain macroeconomic and institutional variables are important, the arrangement of open macro policies such as the exchange rate regime and financial openness are also found to have direct influence on the sensitivity to the center economies. We also find, among other results, that an economy that pursues greater exchange rate stability and financial openness faces a stronger link with the center economies. Nonetheless, exchange rate regimes have mostly indirect effects on the strength of financial linkages. We conclude the trilemma remains relevant.

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1. Introduction

The integrated nature of the financial system was amply demonstrated by the turmoil in emerging market currency and bond markets in the wake of Fed Chairman Bernanke's statements regarding the normalization of U.S. monetary policy, commonly termed the "taper tantrum". Following close on the heels of complaints about unconventional monetary policy implementation in the preceding years, it is clear that – at a minimum – policymakers in emerging market economies perceive an increasing vulnerability to the whims of the global financial system.

The idea that the monetary policies of financial center countries have large spillover effects on the smaller economies is not new. During the mid-1990's, when advanced economy central bankers raised policy rates, after several years of negative real interest rates, similar complaints were lodged, and some may partly trace the financial crises in Latin America and subsequently in East Asia to the cycle in core country policy interest rates.

One key difference is that in the earlier episode's aftermath, the semi-fixed exchange rate regimes were tagged as a contributing factor. In contrast, countries adhering to a variety of exchange rate regimes all experienced challenges in insulating their economies in the most recent episode. This has led to a grand debate about the continued relevance of the "impossible trinity" or "monetary trilemma".

Since Mundell (1963) outlined the hypothesis of the monetary trilemma, fundamental policy management in the open economy has been viewed as policy trade-offs among the choices of monetary autonomy, exchange rate stability, and financial openness.[4] The hypothesis and its extensions in recent years suggest a continuous trade off between the three trilemma dimensions, with the possibility that a fourth policy goal, financial stability, may augment it and turn it into a quadrilemma, where international reserves may play a role as buffers.

In contrast, in the aftermath of the global financial crisis (GFC), Rey (2013) concluded that the economic center's (CE) monetary policy influences other countries' national monetary policy mostly through capital-flows, credit growth, and bank leverages, making the types of exchange rate regime of the non-CEs irrelevant. In other words, the countries in the periphery (PH) are all sensitive to a "global financial cycle" irrespective of exchange rate regimes. In this

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[4] See Aizenman, et al. (2010, 2011, 2013), Obstfeld (2014), Obstfeld, et al. (2005), and Shambaugh (2004) for further discussion and references dealing with the trilemma.

view, the "trilemma" reduces to an "irreconcilable duo" of monetary independence and capital mobility. Consequently, restricting capital-mobility maybe the only way for non-EC countries to retain monetary autonomy. The recent experience of Brazil, India, Indonesia, South Africa, and Turkey – the "Fragile Five" – during the so called taper tantrum may make many observers the "irreconcilable duo" view convincing.

In this paper we investigate whether Rey's prematurely predicted the end of the trilemma. Inferences based data drawn from times of heightened volatility emanating from the center might be modified once we examine how the propagation of large shocks from the EC can be affected by economic structures and measures of the trilemma variables. In a world of more than hundred countries, one ignores heterogeneity at one's own risk. For instance, the trade-offs facing the OECD countries may differ from those facing manufacturing based or commodity based emerging markets economies and developing countries.[5] Furthermore, large shocks arising from the EC during the global financial crisis and the Euro debt crisis may have altered the transmission dynamics, especially in comparison to the preceding decade of illusory tranquility.

We first review key global developments in the past decades and preview our methodology and the main empirical results. We begin with Figure 1 which illustrates the 36-month rolling correlations of domestic money market rates with the U.S. money market rate for developed countries (IDC), developing countries (LDC), and emerging market economies (EMG), and China, from 1990 to 2013. For developed economies, the correlation between domestic and the U.S. policy interest rates is high and hovers at relatively high levels in the last decade. In contrast, developing countries tend to retain high monetary independence from the U.S., while emerging market monetary policy independence occupies a middle ground. All the correlations fluctuate, but experience two pronounced dips in recent years, one in 2005 and the other at the time of the global financial crisis. These two dips correspond to rapid changes in the U.S. Federal funds rate.[6]

Figure 2 depicts correlations of long-term interest rates. Again, the long-term interest rates of industrialized countries register high correlations with that of the U.S., particularly in the

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[5] For example, maintaining exchange rate stability could be more important for developing countries whose growth strategy is reliant on the exports of a narrower variety of manufactured goods or commodities than advanced economies with more diversified economic structures.

[6] The Federal Reserve started raising the federal fund rate target from 1.00% in June 2004 to 5.25% in June 2006. It started lowering the target from 5.25% in September 2007 all the way essentially to the 0.00-0.25 by December 2008.

first half of the sample period, though the correlation has been on a rising trend again in recent years. Developing countries experience relatively high correlations in the early 2000s but since the late 2000s, the correlations appear to be trendless for these countries. Long-term interest rates across countries, including both developed and developing countries, were highly correlated during the Great Moderation period.

Figure 3 is an interesting picture. It illustrates the comparable correlations of stock market price indexes (expressed in local currency) with the U.S. index. Since the mid-2000s, all the country groups have maintained high levels of correlations of stock market price indexes with the U.S. stock market, with some tail-off since the global financial crisis.

What do these figures tell us? Broadly speaking, the extent of correlations is the highest for stock market price movements, followed by the long-term and short-term interest rates. Given short-term interest rates bear lowest levels of risks, we may conjecture that the prices of assets with higher risk tend to be more highly correlated with that of the United States. Of course, these graphical depictions do not provide conclusive evidence, particularly since we have not controlled for any number of important factors, e.g., the policy regimes, macroeconomic conditions, the extent of trade linkage, the level of institutional development and size of financial markets, and global market conditions.

Many studies such as Ahmed and Zlate (2013), Forbes and Warnock (2010), Fratzscher (2011), and Ghosh, et al. (2012) have documented the importance of global factors such as advanced economy interest rates and global risk appetite in affecting capital flows to small open economies. Nonetheless, these studies have also highlighted that domestic, country-specific factors also retain importance. In particular, the institutional and macroeconomic policy frameworks of the emerging market economies also determine the variations in flows.

Given this context, we focus on the questions of why movements in the major advanced economies often have large effects on other financial markets, how these cross-market linkages have changed over time, and what kind of factors contribute to explaining the sensitivity to the movements in the major economies. More specifically, we will conduct an empirical analysis on what determines the sensitivity of economies to factors pertaining to the core economies in the world, namely, the U.S., the Euro area, Japan, and China.

For the last two decades, the Chinese economy has been growing at impressive rates and quickly moving upward on the development ladder. However, its financial markets may not be

developed or sophisticated to the extent of becoming the center of global financial cycles. Despite data limitations as well as China's relatively short tenure as one of the G3 countries, we will also examine whether our results are sensitive to the inclusion of China as one of the center economies.

For our empirical exploration, we employ an estimation process similar to that employed by Forbes and Chinn (2004), which is composed of two steps of estimations. First, we investigate the degree to which the sensitivity of several important financial variables to global, cross-country, and domestic factors. Second, treating the estimated sensitivity as a dependent variable, we will examine their determinants among a number of country-specific variables. In so doing, we will disentangle roles of countries' macroeconomic conditions or policies, real or financial linkage with the center economy, or the level of institutional development of the countries.

In Section 2, we will detail the framework of the two stage estimation exercise. We will report and discuss the estimation results in section 3. In Section 4, we will make concluding remarks.

To anticipate the results, we find that for most of the financial variables we examine, the strength of the links with the center economies have been the dominant factor over the last two decades. The influence of global financial factors, for which we use VIX and Ted spread, has been increasing since around the time of the global financial crisis. The results we obtain suggest that, across different financial linkages, higher levels of direct trade linkage, financial development, and gross national debt all tend to lead to stronger financial linkages between the sample countries and the three center economies. Open macro policy arrangements such as the exchange rate regime and financial openness also affect the extent of financial linkage both directly and indirectly, i.e., interactively with other macroeconomic or institutional variables. Specifically, we do find that the types of exchange rate regimes do affect the extent of sensitivity to changes in financial conditions or policies in the center economies. Hence, the open macro policy choice is "*still*" dictated by the hypothesis of the trilemma, so that we yet need to reduce the trilemma to a dilemma between monetary autonomy and financial integration.

2. The Empirical Methodology
2.1 The First-Step: Estimating Sensitivity Coefficients

The main objective of this first step estimation is to estimate the correlation of a specific financial variable between country i and each of the center economies while controlling for global and domestic factors. The estimated coefficient of our focus is $\hat{\gamma}_{Fi}^{C}$. A significantly positive $\hat{\gamma}_{Fi}^{C}$ indicates a closer linkage between country i and economic center country C, as shown in (1):

$$R_{it}^{F} = \alpha_{Fit} + \sum_{g=1}^{G} \beta_{Fit}^{G} Z_{it}^{G} + \sum_{c=1}^{C} \gamma_{Fit}^{C} X_{it}^{C} + \phi_{Fit} Y_{it} + \varepsilon_{it}. \tag{1}$$

Where the Z_{i}^{G} is a vector of global factors, the X_{i}^{c} is a vector of cross-country factors, and Y_{it} is a control variable for domestic factors. C represents the center economies: the U.S., the Euro area, Japan, and China. $\hat{\gamma}_{ii}^{C}$ is the estimate of our focus and represents the extent of sensitivity of a financial variable (R_{it}^{F}) to cross-country factors, or more specifically, linkages to the four major economies.

As for the financial variable as the dependent variable, we are interested in 1) the short-term policy interest rate; 2) stock market price changes; 3) the sovereign bond spread; and 4) the rate of change in the real effective exchange rate (REER).

We use money market rates to represent policy short-term interest rate. In recent years, all of the advanced major economies, the U.S., the Euro area, and Japan have implemented extremely loose monetary policy in the aftermath of the global financial crisis (GFC). Given that both the U.S. and Japan have lowered their policy interest rates down to zero or near zero, using official policy interest rates may not capture the actual state of monetary policy. In recent years, many researchers have estimated "shadow interest rates" to represent the actual state of liquidity availability by allowing the estimated shadow rates to drop below the zero bound. We use these shadow rates for the three advanced economies to estimate more realistic correlations between the policy interest rates of the center economies and sample countries. For the U.S. and the Euro area, we use the shadow interest rates estimated by Wu and Xia (2014). For Japan, we use the shadow rates estimated by Christensen and Rudebusch (2014).[7]

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[7] For the U.S. policy interest rates, we use the shadow rates for the entire sample period – the shadow rates deviate from the actual Federal Fund Rate more substantially only after the policy rates hit the zero bound. For the Euro area,

For stock market prices, we use stock market price indices reported in the IMF's *International Financial Statistics (IFS)*. The (sovereign) term spread is the difference between the long-term interest rate (usually 10 year government bond) and the policy short-term interest rate – i.e., the slope of the yield curve. We use the REER indices from the *IFS*.

For a vector of global factors (Z_i^G), we have two subsets of global factors. The first subset of global factors include "real" variables -- global interest rates (for which we will use the first principal component of U.S. Federal Reserve, ECB, and Bank of Japan's policy interest rates); oil prices; and commodity prices. To avoid multicollinearity or redundancy, we also calculate the first principal component of oil and commodity prices and use the resultant variable as a control variable for input or commodity prices.[8]

The second subset is "financial." In this group, we include the VIX index from the Chicago Board Options Exchange (CBOE), as a proxy for the extent of investors' risk aversion,[9] and the "Ted spread," which is the difference between the 3-month Eurodollar Deposit Rate in London (LIBOR) and the 3-month U.S. Treasury Bill yield. This latter measure gauges the general level of stress in the money market for financial institutions. The same set of global factors, except for the principal components of the global interest rates, is used for all the estimations regardless of the dependent variable.

The vector of cross-country linkage factors (X^C) corresponds to the dependent variable. For example, if the short-term interest rate for country i is the dependent variable, X_i^c includes the short-term interest rates of the four center economies.[10] We implement the estimation for each of the sample countries for the four different dependent variables and for a sample period of either three or five-year panels (*p*). To control for domestic economic conditions, we include the year-on-year growth rate of industrial production index.

All the data used for this estimation exercise are monthly frequency. The same set of explanatory variables (except for the world interest rate) is regressed against the four financial

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we use the estimated shadow rates only after the introduction of the Euro. For Japan, we use the shadow rates after 1996, before which we assume the shadow rates do not deviate substantially from the actual policy rates.

[8] When we estimate for the policy interest rate correlation, we do not include the first component of U.S. FRB, ECB, and Bank of Japan's interest rates as part of the global factor vector because it would overlap with X^C.

[9] The VIX index series starts in 1990, but we use the VXO index, an older version of the VIX index, to extrapolate the VIX index to 1986. The correlation between the two indices is about 99%. A higher VIX index indicates a higher level of risk appetite.

[10] For the Euro Area's variables, before the introduction of the euro in 1999, the GDP-weighted average of the variable of concern for the original 12 Euro countries is calculated and included in the estimation.

variables: policy interest rate, the rate of change in stock market price indices and the rate of change in the REER index, and sovereignty bond spread.

Because we deal with a relatively long sample period, coefficient instability is a concern. Hence, we estimate period specific regressions in each of the three and five year panels, starting in 1986 in the case of three-year panels.[11] That means that $\hat{\gamma}_{Fit}^{C}$ is time-varying across the panels. For the rest of the paper, we focus on the results from the estimations on the three-year panels since the results from five-year panels are qualitatively similar.

We also estimate two specifications. One specification excludes China as one of the "center economies." In this model setup, we are testing the sensitivity of our sample economies to the traditionally-defined major economies of the U.S., the Euro area, and Japan. Excluding China mitigates data limitations as well, especially for the second-step of the estimation procedure. The other model does include China as one of the center economies.[12]

We estimate equation (1) to a group of about 100 countries including both advanced economies (IDC) and less developed countries (LDC), though the number of countries included in the four models differs depending on data availability. In our sample, the U.S. and Japan are not included in any of estimates. Moreover, China is excluded for the specificaiotn in which China is included as one of the major economies. As for the Euro member countries, they are removed from the sample after the introduction of the euro in January 1999 or when they become member countries, whichever comes first. We also have a subsample of emerging market countries (EMG) within the LDC subsample.[13]

2.2 The Second Step: Explaining the Sensitivity Coefficients

Once we estimate γ_{Fit}^{C} for each of the four dependent variables for all the samples, we regress $\hat{\gamma}_{Fit}^{C}$ on a number of country-specific variables.

$$\hat{\gamma}_{Fit}^{C} = \theta_0 + \theta_1 OMP_{Fit} + \theta_2 MC_{Fit} + \theta_3 LINK_{Fit} + \theta_4 INST_{Fit} + \theta_5 CRISIS_{Fit} + u_{Fit} \quad\quad (2)$$

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[11] In the case of five year intervals, the first panel starts in 1985 and is composed of three years: 1985-1987, and after that, five-year periods are constituted: 1988-1992, 1993-1997, 1998-2002, 2003-2007, and 2008-2012.

[12] Including China changes the sample periods when the dependent variable is stock market price index changes, as a consequence of data limitations.

[13] The emerging market countries (EMG) are defined as the countries classified as either emerging or frontier during the period of 1980-1997 by the International Financial Corporation plus Hong Kong and Singapore.

There are four groups of explanatory variables. The first group of explanatory variables is a set of open macroeconomic policy choices (OMP_i), for which we include the indexes for exchange rate stability (*ERS*) and financial openness (*KAOPEN*) from the trilemma indexes by Aizenman, et al. (2013).[14] A country that has a fixed exchange rate arrangement with a major country, or the base country, is more subject to financial shocks occurring to the base country if it has more open financial markets. Saxena (2008) found the extent of pass-through from foreign interest rates to domestic interest rates is higher under *floating* exchange rate regimes than pegging regimes, however.[15] Christiansen and Pigott (1997) also suggest that even under floating exchange rate regimes, foreign factors play an important role in affecting long-term interest rates. Hence, it is an empirical question how and to what extent both financial openness and exchange rate stability matter for transmitting financial shocks. As another variable potentially closely related to the trilemma framework, we suspect the level of international reserves (IR) holding may affect the extent of cross-country financial linkages and include a variable for IR holding (excluding gold) as a share of GDP. Aizenman, et al. (2010, 2011) show the macroeconomic impact of trilemma policy configurations can depend upon the level of IR holding.

The group MC_i includes macroeconomic conditions such as inflation volatility, current account balance, and public finance conditions. As the measure of public finance conditions, we include either gross national debt, or general budget balance, both expressed as shares of GDP. These variables are included as deviations from the major economies. We use the data from the IMF's *International Financial Statistics* and *World Economic Outlook* Database.

In addition to these groups of variables, we will include variables that reflect the extent of linkages with the center countries (*LINK*). One linkage variable is meant to capture real, trade linkage, which we will measure as: $TR\_LINK_{ip} = IMP_{ip}^C / GDP_{ip}$ where IMP_i^C is total imports into

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[14] As Mundell (1963) argued and Aizenman, et al. (2013) and Ito and Kawai (2012) have empirically shown it holds, a country may simultaneously choose any two, but not all, of the three goals of monetary policy independence, exchange rate stability, and financial market openness to the full extent. Given this linearity, we only include the two trilemma indexes out of the three. On the trilemma, also see Obstfeld (2014), Obstfeld, Shambaugh, and Taylor (2005) for further discussion and references dealing with the trilemma.

[15] To explain the counterintuitive results, Saxena argues that the classification of exchange rate regimes may allow some of the countries that conduct active but incomplete foreign exchange interventions to be classified as "floating" regimes so that the results for the floating regimes may include those of de facto pegging regimes. Also, she argues countries with floating exchange rates tend to have more developed financial markets which tend to follow the trend of the center country's financial markets.

center economy *C* from country *i*, that is normalized by country *i*'s GDP. Another linkage variable is financial linkage, *FIN_LINK$_{ip}$*. For one, we will measure it with the ratio of the total stock of bank lending from country *C* in country *i* as a share of country *i*'s GDP (BL_i^c) for which we use the BIS consolidated banking statistics data. As another variable of financial linkage, we also use the ratio of the total stock of foreign direct investment from country *C* in country *i* as a share of country *i*'s GDP ($FDINV_i^c$).[16]

Another variable that also reflects the linkage with the major economies is the variable for the extent of trade competition (*Trade_Comp*). *Trade_Comp* measures the importance to country *i* of export competition in the third markets between country *i* and major country *c*. Shocks to country *c*, and especially shocks to country *c* that affects country *c*'s exchange rate, could affect the relative price of country *c*'s exports and therefore affect country *i* through trade competition in third markets. See Appendix for the variable construction. A higher value of this measure indicates country *i* and major economic *c* exports products in similar sectors so that their exported products tend to be competitive to each other.

Theoretical prediction of this variable is not straightforward. For example, if a major economy lowers its policy interest rate, that would help depreciate the major economy's currency and therefore make its exports more competitive. If country *i* tends to export similar products in terms of the aggregated industrial sectors, which may also lead to a fall in the policy interest rate of country i, which makes a positive estimated coefficient on this variable. However, if a fall in the policy rate in this example foresees some underperforming productivity growth in the future, that may make competitors' exports appear more attractive. A rise in the demand for competitors' exports may lead a rise in the policy interest rate, making the expected sign of the estimate for the correlation of the policy interest rates negative.

The fourth group is composed of the variables characterize the nature of institutional development (*INST*), namely, variables for financial development and legal development. As Caballero-Farhi-Gourinchas (2008) theoretically predict and Chinn and Ito (2007) empirically show, both Financial and legal development are important factors for the volume and directions of cross-border capital flows. Alfaro, et al. (2008) argue that institutional development is also an

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[16] Among the financial link variables, the variable for bank lending provided by the center economies turned out to be persistently insignificant across different estimation models. Therefore, we decided to drop the variable from the models.

important factor. If these factors affect cross-border capital flows, they should also affect the extent of sensitivity to financial shocks occurring to the center economies.

There is no agreement about what would be the best way to measure the extent of financial development, because the development of financial markets can be gauged in terms of size, depth, activeness, unit or transaction costs, and profitability to name a few. Here, to measure the level of financial development, we calculate a composite index, or the first principal component, of financial development (*FD*) using the data on private credit creation, stock market capitalization, stock market total value, and private bond market capitalization all as shares of GDP. Additionally, we also include a measure of legal development, for which we use *LEGAL* which is the first principal component of law and order (*LAO*), bureaucratic quality (*BQ*), and anti-corruption measures (*CORRUPT*), all from the ICRG database.[17]

The precision of $\hat{\gamma}_{Fit}^{C}$ could be reduced by economic or financial disruptions. To control for that, we include a vector of currency and banking crises (*CRISIS*). We use the crisis dummies from Aizenman and Ito (2013) to identify the two types of the crises. For currency crisis, Aizenman and Ito use the exchange market pressure (EMP) index using the exchange rate against the currency of the base country. The banking crisis dummy is based on the papers by Laeven and Valencia (2008, 2010, 2012).

For each of the four financial variables we estimated in the first-step regression, we have $(i \times C \times t)$ $\hat{\gamma}$'s where *t* refers to either three- or five-year panels and *C* is four when we include China as a major economy and three if not. The variables in *MC* and *INST* are included in the estimations as differences from the U.S., Japanese, Chinese, and Euro Area's counterparts. The variables in vectors *OMP*, *MC*, and *INST* are sampled from the first year of each three (or five) year panels to minimize the effect of potential endogeneity. Also, to capture global common shocks, we also include time fixed effects.

As we previously mentioned, our discussions focus on the results from three-year panel estimations. For each of the three- or five-year panels, we average all the explanatory variables.[18] By so doing, we will essentially form non-overlapping three- or five-year panels.

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[17] Higher values of these variables indicate better conditions.
[18] As for the crisis dummies, if a crisis occurs in any year within the three- or five-year period, we assign the value of one.

3. Empirical Results

3.1 First-Step Estimations

The Contributions of Different Factor Vectors

For the first-step estimation, we have four variables to estimate: policy interest rate, stock market price changes, REER changes, and sovereignty debt spread. We regress each of these dependent variables on four groups of explanatory variables: real global, financial global, cross-country link, and domestic factors for three-year, non-overlapping panels in the 1986-2012 period.[19]

To grasp the general trend of the groups of factors that influence the four financial variables, we focus on the joint significance of the variables included in the real global, financial global, cross-country, and domestic groups. Figure 4 illustrates the proportion of countries for which the joint significance tests are found to be statistically significant (with the *p*-value less than 10%) for each of the four financial variables. These figures are based upon the specification that includes China as a major economy while the figures based on the specification without China as a center economy yields similar observations. The figure illustrates the proportion for the groups of advanced economies (IDC) and less developed economies (LDC) after 1992.[20]

These graphical depictions lead to the following four conclusions. First, the movements of the financial variables of the center economies not only matter for all of the four financial variables, but contribute the most among the groups of explanatory variables to jointly explaining the variation of the variables for both the IDC and LDC groups. Among the LDC economies, the influence of the major economies appears to be the greatest for the policy interest rates, though it tends to be high also for term spreads and real effective exchange rates and less so for stock market price changes.[21] While the policy interest rate specification indicates for the LDC economies that the levels of joint significance remain constantly high throughout the sample period, the influence of the major economies increased markedly in the last two three-year periods in the specifications for the other three financial variables. In the model of stock market price changes, the major economies' influence appears to be relatively smaller than in the

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[19] For the model that includes China as a center economy, the sample for the stock market price estimation starts in 1992 due to data availability.

[20] The figures for the EMG group are qualitatively similar to those of the LDC group. Hence, we omit discussing them here.

[21] When we restrict our sample to emerging market economies (not reported), the contribution of the major economies becomes bigger, which is expected considering that this group of economies have more developed and open financial markets.

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models for the other three financial variables, reflecting that many of LDC's stock markets are less developed, though the proportion of joint significance is now in a moderately rising trend in the last decade or so.[22]

Second, as far as policy interest rate is concerned, the proportion of joint significance is also relatively high for the group of "financial global" variables, especially for the EMG countries. Unsurprisingly, the last two three-year panels indicate high proportions of joint significance for both country groups, suggesting global financial factors have been playing an important role in affecting the policy interest of countries, both developed and developing. This result is consistent with the Rey's (2013) thesis of "global financial cycles". In the panels for 1998-2000 and 2001-2003, the proportions of financial global factors also appear high for both country groups.[23] Given the emerging market crises in the 1998-2000 period, and dot com bust of the 2001-2003 period, these results suggest that economies are more exposed to global financial shocks during periods of financial turbulence while also following center monetary policies.

Third, stock market movements in almost all the developed economies are influenced by those in the center economies. The fact that many of the countries in this group have highly sophisticated stock markets explain the high proportion of joint significance.[24] Among developing countries, the proportion of these economies subject to movements in the center economies is generally lower, though the proportion has been moderately rising over the last decade.

Fourth, the center economies play a crucially important role for developed economies' term spreads, although "real global" factors are also influential in the 1990s through the early 2000s, as well as the last three-year post-GFC period. For developing economies, the center economies' spreads matter less, though they appear quite influential in the last post-crisis period. The fact that "real global" factors do not affect the policy interest rates that much while more influencing the term spreads indicates that "real global" factors must affect longer-term interest rates.

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[22] The rising trend is more discernable for the EMG group.
[23] Again, this is more distinct for the EMG group.
[24] This subsample includes most of the European Monetary Union members. That also contributes to the high proportion of joint significance.

Last, for the changes in the REER, the movements of the center economies are critically important for both country groups. Interestingly, the highest proportion of developing countries appear sensitive to the REER movements of the center economies in 2010-2012. These results are consistent with the reactions expressed by emerging market policy makers to the taper in Fed quantitative easing.[25]

Overall, in accord with Rey (2013), these figures suggest that economies, both advanced and developing, are subject to the financial conditions of the center economies. We investigate the determinants of the degree of sensitivity to the financial conditions of the center economies in the next subsection.

Figure 5 provides a closer look at the influences of the center economies. It presents the proportion of the countries for which the estimated coefficients of the center economies' variables are found to be significantly positive (with the *p*-value less than 20%) for each of the four financial variables ($\hat{\gamma}_C$ >0) and for each of the center economies. We display only the results for the group of developing countries. The positive estimate indicates that the financial conditions of the center economies are influential on other non-CE countries. By comparing the $\hat{\gamma}_C$'s for different center economies, we can see to which center economy's financial conditions the sample countries are more sensitive to.

Policy interest rates in many developing countries appear to be positively correlated with the Euro area's policy interest rate in the last three-year period. The high proportion of the countries with $\hat{\gamma}_{EURO} > 0$ likely reflects the Euro debt crisis. We also find relatively high proportions of countries with positive correlations with Euro area stock market price changes, although unsurprisingly it is the U.S. that affects other countries' stock market price movements.

The U.S. is also a relatively dominant influence in terms of the real effective exchange rate movements. The influence of the center economies for term spread is hard to pin down, except for that, again, the Euro area is a dominant economy in the 2007-09 period.

Contributions of China as a Major Economy

So far, the empirical results illustrated in Figures 4 and 5 are based on the assumption that China is one of the center economies. However, one can still question whether China's

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[25] Another observation is that the contribution of industrial production growth as the domestic factor is generally low, though it tends to be slightly higher for the policy rate and term spread estimation models.

financial influence matches its impact on real activity. Many studies have shown that there is still much room for China to further develop and open its financial markets.[26]

Hence, we repeat the previous exercise of testing the joint significance of each vector of explanatory variables, but excluding China from the group of the center economies (i.e., removing the Chinese variable from the cross-country linkage vector). The general characteristics we observed in Figure 4 remain qualitatively intact, suggesting that the financial influence of China remains minimal.

To test this assertion more formally, we compare the adjusted R-squared values of the two specifications for each country and each three-year panel, and for each of the four financial variables. Figure 6 illustrates the cross-country average differences in the adjusted-R squared values between the estimation with China as one of the center economies and the one without for the four financial variables. The averages of the gap are calculated for the groups of developed countries, developing countries, emerging market countries, and East Asian emerging market economies as a comparison.[27]

Overall, the extent of contribution to the adjusted R-squared of including China as one of the center economies depends on the financial variable examined. Regarding the policy interest rate and term spread models, including China as a major country increases the adjusted R-squared, especially in the last three years of the 1990s that correspond to the East Asian crisis. For East Asian emerging market economies, including the Chinese policy interest rate in the estimation model increases the adjusted R-squared as much as over 15% on average. Despite the recent impressive rise as an economic power, however, China's contribution seems negligible in the last two three-year panels for both the policy rate and term spread models.

In the REER figure, we see a high increase in the adjusted R-squared in the crisis years of 2007-2009 for emerging market countries, especially those in East Asia (with the additional contribution of about 18% to the adjusted R-squared). This may reflect the situation where international trade shrank significantly immediately after the outbreak of the global financial crisis in 2008. In the tight international trade market, trade competitiveness of the world's largest exporter may have had a large influence on other trading partners.

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[26] See Huang, et al. (2013) and Hung (2009) among others.
[27] The group of East Asian emerging market economies includes: Hong Kong, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, Thailand, and Vietnam.

China's stock markets do not appear influential in most of the sample period, except for the 2004-2006 period. Given that China's stock markets only became open recently, the lack of influence of China's stock markets is unsurprising.

3.2 Results of the Second-Step Estimation

Now that we have $\hat{\gamma}_{Fit}^{C}$ for the four financial variables, we investigate the determinants of the extent of linkages using the estimation model based on equation (2). We estimate two specifications with two different dependent variables for each of the four financial variables. The first type of estimation has the dependent variable of $\hat{\gamma}_{Fi}^{C}$ from the first-step estimation that does not include China as one of the center economies. Hence, for country i in one three-year panel t, there are three (i.e., $\hat{\gamma}_{Fit}^{US}$, $\hat{\gamma}_{Fit}^{JP}$, and $\hat{\gamma}_{Fit}^{EURO}$), making ($i \times 3 \times t$) observations. The second type is the one for which the first-step estimation is conducted with China included as one center economy. Hence, for the second-step estimation, country i in one three-year panel t has four $\hat{\gamma}_{Fit}^{C}$ (($i \times 4 \times t$) observations in total). In what follows, however, we only report the results from the specifications without China as a center economy, since we determined the financial influence of China is minimal. The regressions with China as a center economy yield results qualitatively similar to those without China.[28]

Tables 1-1 through 1-3 report the estimation results for the extent of sensitivity of policy interest rates, stock market price changes, and the REER for the FULL, IDC, LDC, and EMG samples. We do not report the estimation results for the term spread sensitivity because of the consistent lack of robust results across different models, especially for the groups of developing and emerging market countries. The bottom rows of the tables also report the joint significance tests for each vector of explanatory variables. We will focus our observations on the results for the subgroups of LDC and EMG.

As for the linkage of policy interest rates, reported in Table 1-1, the variables that characterize countries' open macro policies affect the sensitivity to the monetary policies of the center economies. In contrast with Rey's argument, we find that the type of exchange rate regimes does matter; countries with greater exchange rate stability tend to be more sensitive to changes in the center economies' monetary policy, though except for model (5), the estimate is

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[28] The estimation results with China as a center economy are available from the authors upon request.

only marginally significant. Financial openness also contribute to higher degrees of sensitivity to the center economies' policy interest rates. Interestingly, holding higher levels of foreign reserves tend to help peripheral economies to shield the impact of changes in the center economies' policy interest rates, i.e., to retain its monetary autonomy. Exchange rate stability, financial openness, and IR holding are jointly significant for the group of developing or emerging market countries.

Among the variables for macroeconomic conditions, only current account balance seems to matter. However, the positive estimate on current account balance appears somewhat puzzling considering that a country running current account *deficit* -- not surplus -- is more susceptible to monetary policy changes of the center economies. The result indicates that a net capital exporter rather than importer is more sensitive to the monetary policies of the center economies.

Among the factors of external links, financial linkage through foreign direct investment is the most important variable in determining how shocks to the center economies' monetary policies could affect those of other non-center economies for both developing and emerging market countries. A country that receives more FDI from the center economies tends to be more sensitive to changes in the monetary policies of the center economies.[29]

Financial development also matters significantly for the IDC and LDC samples. Countries with more developed financial markets tend to be more sensitive to the changes in the monetary policies of the center economies. That suggests that countries with deep financial markets can be good investment destinations for foreign investors, so that their arbitrage actions may lead those countries to follow the monetary conditions of the center economies more closely.

Table 1-2 shows that the estimation results for stock market price changes are less robust and share few characteristics with the model for the policy interest rates. A developing or emerging market country with larger government debt tends to be more vulnerable to stock market movements of the center economies, while financial development, if any, seems to help its market shun shocks arising in the center economies' markets unlike in the case of policy interest rates.

The degree of exchange rate stability does matter for stock market price changes, but in a manner that is a sharp contrast to the policy interest rate model. A country with greater exchange

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[29] We dropped cross-bank lending and FDI stock since both variables are found to be persistently insignificant contributors to the extent of sensitivity.

rate stability tends to experience a smaller degree of co-movement of stock market prices with the center economies. This result is somewhat counterintuitive considering that greater exchange rate stability may leave an economy more susceptible to external financial shocks. However, if a shock occurs in the center economies, international investors may try to reorganize their portfolios in the markets where the exchange rate is flexible because the exchange rate risk is greater than in a fixed exchange rate regime. Financial openness appears to be a negative contributor, though significantly only in model (5).

Among the external link variables, the degree of trade competition positively affects the stock market price change link between peripheral and center economies among the group of developing countries. If a developing country exports products in similar sectors to the center economies, that country tends to be more vulnerable to changes in stock market prices in the center economies, possibly reflecting that similar industrial structures should pass around shocks to stock markets. However, receiving more FDI from the center economies could shun the effects of the shocks occurring in the center economies' stock markets.

Generally, the models for REER present results with best goodness-of-fit as Table 1-3 reports. Given certain degrees of price stickiness, pursuing greater exchange rate stability would lead both nominal and real effective exchange rate to be more sensitive to that of the center economies. Our results show the positive impact of greater exchange rate stability on the REER connectivity for all the subsample country groups. Greater financial openness also contributes to greater sensitivity for developing countries, though not significantly so for the EMG group. Interestingly, irrespective of group, a country with a higher level of IR holding tends to be more sensitive to REER changes of the center economies. One interpretation is that a country could respond to changes in the center economies' real currency appreciation through foreign exchange market interventions, inducing a positive correlation; the interpretation of this coefficient is then not causal.

Emerging market countries with larger government debt or budget deficits tend to be less sensitive to the REER of the center economies. These results may reflect the fact that such countries, which likely face higher inflationary expectations, often face some difficulty in maintaining real exchange rate stabilities against the currencies of the major economies despite their general desire to pursue greater (nominal) exchange rate stability (Aizenman, et al. 2013, Calvo, et al. 2000).

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Not surprisingly, countries with greater bilateral trade links with the center economies tend to be more sensitive to the REER movements of the center economies. The negative impact of trade competitiveness means that peripheral countries with more competitive trade structure to that of the center economies tend to become alternative investment destination if a shock occurs to the center economies. For example, if a shock happens in a way that causes real depreciation of the center economies' currencies such as predicted output growth, an institutional change that would increase the level of labor rigidities, and a decrease in the appetite for the center economies' financial assets, the demand for financial assets in peripheral economies can rise and push the real values of their currencies. Interestingly, financial linkage through FDI does not matter for the level of REER connectivity.

In contrast, countries with more developed financial markets tend to be less sensitive to the REER movements of the center economies. These results are consistent with the observation that greater financial development allows a country to have more flexible exchange rate movements; countries could afford to detach their currency values' movements from those of the center economies.

3.3 Robustness Checks

In order to check the robustness of our results, we implement robust regression techniques that account for outliers in both the dependent variable and explanatory variables by recursively down-weighting them to obtain converged estimates. In addition, we undertake other sensitivity analyses.

As a first attempt, we remove both the fifth and the 95th percentiles of the $\hat{\gamma}_c$ sample, and then re-estimate by reapplying the robust regression technique to the truncated sample. The results (not reported) remain qualitatively intact. While the magnitude of the estimates change, their statistical significance remain unchanged. When we repeat by removing the observations below the 10th percentile and above the 90th percentile of the $\hat{\gamma}_c$'s, still we obtain qualitatively similar results. These findings indicate that the results we report in Tables 1-1 through 1-3 are not driven by outliers.

Some of the countries in our sample have experienced financial crises. During periods of financial turbulence, economic variables could exhibit anomalous behavior, leading to extreme observations. Hence, as a second way to check the robustness of the estimation results, we

interact all the independent variables with a dummy for currency crises to account for potential effects of currency crisis. For all the $\hat{\gamma}_c$'s of the three financial variables, we again obtain qualitatively similar results. Therefore, we conclude that our estimation results are not driven by extreme values of the explanatory and dependent variables during financial turbulences.

4. Further Analyses

4.1 Open Macro Policy in Conjunction with Other Factors

In the baseline results in the previous subsection, open macro policy variables are found to affect the extent of connectivity through financial variables in some cases or not to affect in some other cases. While these variables may or may not directly affect the extent of sensitivity to the center economies' financial variables, it is also possible that they affect the financial linkages indirectly through other variables.

To investigate such a possibility, we re-estimate the specifications while including interactive terms between the variables for exchange rate stability and financial openness and some selected variables. More specifically, we are interested in whether exchange rate stability and financial openness affect the impact of current account balances, government gross debt (both as a share of GDP), trade demand from the center economies, and the level of financial development, and report the results in Tables 2-1 to 2-3 for policy interest rates, stock market price changes, and the REER.[30]

We obtain several interesting results. First, while financial development alone would make developing countries more susceptible to center economies' monetary policy changes, the degree of susceptibility would be even higher if the country has more open financial markets or adopts more *flexible* exchange rate regime, although theoretically, more flexible exchange rate movements should make the country less subject to the monetary policies of the center economies, i.e., allow for greater monetary autonomy.

Table 3 illustrates the net effects of certain changes in the level of macroeconomic or institutional variables (X) depending on the levels of both exchange rate stability (ERS) and

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[30] For all the financial variables, we continue to use the models that do not include China as one of the center economies. The estimates for inflation volatility, trade competition, legal development, and currency and banking crisis are omitted from presentation in the tables due to space limitation.

financial openness (KAOPEN) – i.e., $(\beta_0 + \beta_1 ERS + \beta_2 KAOPEN)\Delta X$. In the table, for a certain magnitude of change in X, *ERS* and *KAOPEN* take the values of zero, 0.50, or 1.00.

Table 3 (a) shows the net impact of a 10 percentage points (ppt) increase in the level of financial development (as a deviation from the center economies'). From the table, we can see that, except for the cases of having a rigidly fixed exchange rate regime with intermediately open or closed financial markets, the net impact of a 10 ppt increase in the level of financial development is usually positive. The net impact on the connectivity through policy interest rates is larger for more financially open economies or those with more *flexible* exchange rate regimes. This counterintuitive result could possibly be rationalized by the high correlation between financial development and exchange rate flexibility; higher levels of financial development would lead a country to become more prepared to adopt greater exchange rate flexibility. Hence, a country with more developed financial markets and greater exchange rate flexibility could become a destination for investors' arbitrage-seeking behavior once the center economies changes their monetary policy stance, thus leading to more synchronization of policy interest rates. This reasoning is consistent with the finding that the interactive effect between financial development and financial openness is positive.

In Table 2-1, we also see a significant estimate for the interaction between ERS and import demand from the center economies. Table 3 (b) that reports the net impact of a 5 percentage points (ppt) increase in the level of import demand shows that the net impact is larger, or less negative, for economies with more open financial markets or more stable exchange rate regimes. Greater trade linkage could lead to faster transmission of monetary policy from the center economies to peripheral economies in this globalized world especially when peripheral economies attempt to pursue exchange rate stability.

Such a positive interactive effect between import demand from the center economies and greater exchange rate stability is also observed in the estimation for the stock market price connectivity model (Table 3 (c)). Peripheral economies that face strong trade demand from the center economies could be more sensitive to the stock market movements of the center economies if the countries pursue more stable exchange rate movements. The interaction between import demand and financial openness is negative, but insignificant and negligible.

The types of trilemma regimes could also affect the connectivity with the center economies through REER. According to Table 3 (e), the net impact of a 2 ppt *deterioration* of

current account balance would be larger for economies with more flexible exchange rate movements, while its interactive effect with financial openness is negligible and insignificant. That is, if a shock occurs to the center economies' REER, it would be transmitted to peripheral economies more through nominal exchange rate movements, especially for a country with worsening current account balances. Hence, given price rigidity, the shock to the center economies would not be passed on to peripheral economies when they try to maintain exchange rate stability.

Pursuit of greater exchange rate stability and financial openness would also make the net impact of gross debt larger for the REER connectivity (Table 3 (f)). Holding a larger amount of debt would make a developing country more susceptible to the REER movement of the center economies' currencies if it pursues greater exchange rate stability and more financial integration, which is consistent with the economic characteristics of emerging market economies that had gone through financial crisis in the past. In those crises, it was often the case that a policy interest rate increase in the center economy, usually the U.S., led first to real appreciation of the center economy's currency, then transmitted to peripheral economies especially when an indebted country pegged their currencies to the center economy's currency and had more open capital account. That may also mean that an indebted country is tempted to monetize its debt, so that the REER transmission would take place more in the form of higher inflation rather than nominal exchange rate flexibility.

Even when it adopts stable exchange rate movements, a developing country with more developed financial markets could make the extent of REER synchronization be smaller (Table 3 (g)), though the interactive impact of financial openness is negligible or insignificant. Again, if a shock occurs to the center economies, the shock would be transmitted to peripheral economies with more developed financial markets rather through nominal exchange rate movements.

Overall, across all three sets of results shown in Tables 2-1 through 2-3, we show that the degree of exchange rate stability does matter, and more so compared to the level of financial openness, and especially when a peripheral economy faces strong import demand from the center economies or holds larger gross debt. Hence, it is safe to conclude that the types of exchange rate regimes do matter for the degree of linkage of financial variables between the center and peripheral economies, both directly and indirectly through other macroeconomic variables such as current account balances, gross government debt, trade linkages, and financial development.

In this sense, our findings are different from Rey's "irreconcilable duo," in which policy makers face only the dilemma between financial openness and monetary autonomy, not the types of exchange rate regimes.

4.2 Center Economy Conditions and Exchange Market Pressure

As we saw in the "taper tantrum" episode in the summer of 2013, a policy change, or a mere mention of its possibility, by the center economy may pressure non-center financial markets. Using the same framework, we now investigate how the financial variables of the center economies could affect the stress level of financial markets in the peripheral economies by focusing on the correlation between the financial variables of the center economies and the exchange market pressure (EMP) index in LDC economies. The financial variables of the center economies of our focus are policy interest rates, REER, and EMP.

We follow the oft-used methodology introduced by Eichengreen et al. (1995, 1996) to calculate the EMP index as a weighted average of monthly changes in the nominal exchange rate (i.e., the rate of depreciation), the international reserve loss in percentage, and the change in the nominal interest rate with all in respect to the base country in the sense Aizenman, et al. (2013) do to construct the trilemma indexes.[31] The weights are inversely related to each country's variances of each of the changes in the three components.

The financial variables of the center economies (CE) we focus on can be correlated with the EMP of the peripheral economies. If the policy interest rates rise in the CE, for example, that might draw more cross-border capital flows into these economies, including those which used to flow to peripheral economies. That might increase the level of financial stress on the peripheral economies, as evidenced by some emerging market economies that experienced financial difficulties after the United States tightened its monetary policy. Hence, we should expect a positive correlation between the CE's policy interest rates and the non-center EMP.

When the center economies experience real appreciation of their currencies (i.e., a rise in the REER), given some price stickiness, that would create (expected) nominal depreciation pressure on a peripheral economy, which we depict in Figure 7 as an outward shift of the curve for the rate of return from holding CE's assets in terms of PH's currency. If the non-center economy does not pursue exchange rate fixity, its currency would depreciate (from E_0 to E_1). If it

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[31] See Data Appendix for more details.

does pursue exchange rate fixity, then the non-center's monetary authorities would have to intervene the foreign exchange market, decrease its holding of foreign reserves, and end up having a higher policy interest rate (from $R_{PH,0}$ to $R_{PH,1}$). Given that the EMP index is defined as a weighted average of monthly changes in the rate of depreciation, the percentage loss in international reserves, and the change in the nominal interest rate, whether non-center's monetary authorities pursue exchange rate fixity (i.e., no currency depreciation but a rise in the interest rate and a reduction in IR holding) or not (i.e., currency depreciation with no or less change in the interest rate or IR holding), its EMP should rise. Hence, the CE's REER should be positively correlated with the non-center's EMP.

Lastly, the link between the CE's EMP and the PH's EMP is essentially about whether and to what extent stress in the CE's financial markets can be contagious and affect the EMP of non-center economies. We could expect that if a non-center economy is more financially open and pursues greater exchange stability, then it might be more susceptible to an increase in the stress level of the CE's financial markets. However, at the same time, when one or more center economies experience a rise in the EMP, that would also lead to nominal (and real) *appreciation* of non-center's currencies. In such a case, whether or not the non-center economy intervenes the foreign exchange market, it could experience a *fall* in the level of EMP, suggesting a negative correlation between the CE's EMP and the non-center's EMP. After all, this poses a good empirical question. We will examine whether CE's EMP and the non-center's EMP are positively or negatively correlated.

With these theoretical predictions at hand, we first repeat the exercise based on equation (1), but this time having the EMP indexes of the sample countries as the dependent variable for all the financial variables tested as explanatory variables. Since we are interested in examining the extent of sample countries' external policy vulnerability to the center economies' policies, we test the correlation between the sample countries' EMP and the center economies' policy interest rates, the REER, and the EMP, while controlling the estimation model in the same way as in the previous analysis.

Figure 8 is comparable to Figure 4 in that it illustrates the proportion of countries for which the joint significance tests are found to be statistically significant (with the *p*-value less

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than 10%) for the three financial variables.[32] The figure illustrates the proportion for the groups of advanced economies (IDC) and less developed economies (LDC) after 1992 for the four vectors of variables and for each of the three financial variables.

Interestingly but not surprisingly, Figure 8 shows that for all of the three financial variables, the proportion of countries that received significant influence from the global financial factors is high for the advanced economies in the 2007-2009 period. The proportion for developing countries whose EMP is more vulnerable to the global financial factors is the highest, but in the 2010-2012 period immediately after the outbreak of the GFC unlike the case of advanced economies. Generally, however, the linkages between developing countries' EMP and CE's policy interest rates appear weak. The proportion for the significant linkage rises in the 2010-2012 period, but only to less than 20%.

The EMP of developing countries is a little more vulnerable to the REER movements of the center economies. The proportion of developing countries for which the center economies' REER are jointly significant for the EMP estimation is the highest among the vectors of explanatory variables in the 2010-2012 period and other time periods.

In general, the EMP of developing countries is more exposed to the influence of the center economies' EMP. Especially, in the GFC years and their aftermath, developing countries' EMP is found more sensitive to the movements of the EMP of the center economies. In other words, financial stress that arises in the center economies must have been transmitted to developing countries during and after the GFC.

In parallel to Figure 5, Figure 9 illustrates the proportion of the countries for which the estimated coefficients of the CE's financial variables are found to have a significantly positive or negative $\hat{\gamma}_C$ with the *p*-value less than 20%. We predict $\hat{\gamma}_C > 0$ for policy interest rates and REER, and $\hat{\gamma}_C > 0$ or $\hat{\gamma}_C < 0$ for the EMP, whose results we illustrate in panels (a) through (d), respectively.

Roughly speaking, when we focus on the test of $\hat{\gamma}_C > 0$, the three center economies' financial variables are relatively equally influential on the EMP of developing countries, except for the 2007-2009 and 2010-2012 periods in which either the U.S. along or both the U.S. and the Euro area are influential, reflecting the GFC and the Euro debt crisis. It is interesting to note,

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[32] These figures are made using the model that does not include China as a center economy. The figures made using the model with China as one of the center economies yields similar patterns.

however, that the highest portion of developing countries have their EMP significantly positively affected by the policy interest rate of the Euro area in most of the time periods. Also, the REER of Japan and the U.S. appear influential on developing countries' EMP in the last three-year panel. Overall, the EMP of the center economies was jointly significant as an influencer on developing countries' EMP in Figure 8, but the result seems to be more driven by the negative effects of the center economies' EMP as panel (d) shows, indicating that the negative effects of the CE's EMP is more of a case. Considering that the US dollar and the Japanese yen had been the currencies most heavily used in carry trade and also providing safe haven for international investors during the GFC and in its immediate aftermath, the crisis in the 2007-2009 period let these currencies to appreciate significantly.[33] The appreciation of the CE's currencies led to a fall in the EMP of these economies, which at the same time also meant depreciation of the currencies of the non-center countries. That explains the finding that more non-center countries' EMP appears to be negatively correlated with the CE's EMP during the GFC and the following period.

Now, we repeat the second-step estimation, but the dependent variable this time will be the estimated coefficient for the impact ($\hat{\gamma}_c$) on the sample countries' EMP of the center economies' financial variables: policy interest rates, the REER, and the EMP. We continue to use the robust regression estimation technique to accommodate potential extreme values of the EMP index, and report the results in Tables 4-1 to 4-3.

Table 4-1 shows that we do not obtain robust results when we estimate the determinants of the estimated impact ($\hat{\gamma}_c$) of the CE's policy interest rates on the sample countries' EMP. The estimate for the variables of financial development is persistently significant and negative, suggesting that a country equipped with more developed financial markets tends to be able to shield itself from the center economies' policy interest rate changes affecting its EMP. Interestingly, in Table 1-1, we found that a country with more developed financial markets tends to have its own policy interest rates more sensitive to those of the center economies. However, while developing countries have their economies more exposed to those of the center economies, more developed financial markets may also be able to help absorb and internalize shocks from changes in the center economies' policy interest rates. That may explain the motivation for developing countries to develop their financial markets.

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[33] That is also applicable to the Euro before the breakout of the Euro debt crisis.

Such an insulating effect of financial development is also observed in the results for the factors affecting the link between the center economies' REER and the sample countries' EMP as shown in Table 4-2. The negative coefficient on financial openness appears somewhat counterintuitive, considering that more open financial markets would allow for more rapid capital flight if center economies experience real appreciation of their currencies. However, more open financial markets often lead to more financial development (Chinn and Ito, 2006), so that it may also complement the shock-absorbing effect of general financial development. Or, it could be also possible that an economy with greater financial openness – especially toward outward capital flows – may be able to benefit from more risk sharing. While developing countries with greater inflation volatility tend to have their EMP more vulnerable to real appreciation of the CE's currencies, we also see some evidence that those with worse current account balances or *deficit*, also tend to be more vulnerable to the CE's currency values. In contrast to financial openness being a significant factor, the types of exchange rate regimes do not appear to affect the link between the CE's REER and the peripheral economies' EMP.

The estimated effect of greater import demand from the CEs is found negative. If the CE's currencies experience real appreciation, a peripheral economy that has stronger trade ties with the center economies could experience real *depreciation* especially when it has stronger trade ties with the center economies.

Table 4-3 reports the results of the estimates regarding the factors affecting the impact of the CE's EMP on the non-center countries' EMP. While higher levels of financial openness, inflation volatility, and financial development might lead developing countries to face higher, or more positive, degrees of connectivity between the CEs and non-center economies through their EMP, higher levels of government debt, budget deficit, current account deficit, trade demand, and legal development would lead to lower degrees of the CE-PH EMP connectivity. The latter group of significant estimates may appear puzzling. However, Panel (d) of Figure 9 helps us interpret these results. First of all, there are more developing countries which turn out to have negative connectivity between their EMP and that of the center economies. Also, appreciation of the CE's currencies, especially the dollar and the Japanese yen during the GFC and its aftermath contributed to lowering the EMP of the CE's. However, negative sensitivity indicates that a fall in the CE's EMP led to a rise in the PH's EMP, and our results indicate that such a movement is

more applicable to economies with higher government debt or budget deficit, current account deficit, and more developed legal systems.

As we did with the original model, we now interact some of the explanatory variables with the open macro variables of exchange rate stability and financial openness to examine if there is any interactive or indirect effects of open macro policy arrangements. We report the results in Table 5. Columns (1) through (3) report the estimation results on the estimated linkage between the CE's policy interest rates and the PH's EMP, columns (4) through (6) those on the estimated linkage between the CE's REER and the PH's EMP, and columns (7) through (9) those on the estimated linkage between the CE's EMP and the PH's EMP.

Since we have many interaction terms, we again examine how the net impact of a variable changes depending on the levels of both exchange rate stability and financial openness. Table 6 is comparable to Table 3, illustrating the marginal effects of a certain change in a macroeconomic or institutional variable for the levels of exchange rate stability and financial openness being either zero, 0.50, or 1.00. This table allows us to make several observations.

Tables 6 (b) and (c) are based on the regressions of the REER-EMP linkages. According to Table 6 (b), for a developing country with the greater exchange rate stability or relatively closed financial openness, greater financial development could make its economy's EMP levels more sensitive to changes in the center economies' REER. If an economy of concern runs a current account *deficit,* Table 6 (c) indicates that a peripheral economy's EMP would be more sensitive to REER changes in the center economies when it pursues greater exchange rate stability or more financial openness, though the impact of financial openness is insignificant and rather small. When a PH economy strengthens its trade ties with the center economies (by 5 ppt), it makes the PH economy's EMP more sensitive to the CE's REER if the PH economy has more flexible exchange rate regime and more open financial markets.

When we examine the indirect effects of exchange rate stability and financial openness for the EMP-EMP connectivity between the center and peripheral economies, Table 6 (e) shows that if a country worsens its current account balance, its impact would be larger, or less negative, on the EMP-EMP connectivity for a country that pursues greater financial openness and greater exchange rate *flexibility*. During the 2007-2009 and 2010-2012 periods particularly, a country with worsening current account balance would face more negative EMP-EMP link with the center economies if has more rigid exchange rate regime and more closed financial markets

while the effect of an exchange rate regime type is stronger than that of financial openness regime.

Similar interactions with exchange rate stability and financial openness are also found for the impact of stronger trade linkages with the center economies. Having greater trade linkages with the CE would contribute to more positive EMP-EMP linkages if a country pursues greater financial openness and greater exchange rate *flexibility*. However, it also means that the extent of the negative EMP-EMP relationship is stronger for a country with more closed financial markets and a more rigid exchange rate regime though the estimate with exchange rate regimes is statistically insignificant.

Hence, as was in the previous analysis, open macro policy arrangements have not just direct but also indirect impacts on the linkage between the center economies' policy interest rates, REER, or EMP and our sample developing countries' EMP. Hence, it is safe to conclude that trilemma policy arrangements *do* affect the sensitivity of developing countries to policy changes in the center economies, although not always in accord with priors.

5. Concluding Remarks

Shocks occurring to the center economies are transmitted to other parts of the world, often buffeting smaller, open economies such emerging market economies. The increasingly integrated nature of the global financial markets may require a re-think of the role of monetary policy and the trilemma hypothesis, particularly in this post-GFC period.

This paper investigates the questions of whether and how the financial conditions of developing and emerging market countries are affected by the movements of financial variables in the center economies, namely, the U.S., Japan, the Euro area, and China. Our empirical method relies upon a two-step approach. We first investigate the extent of sensitivity of several important financial variables, such as policy interest rate, term spread, changes in stock market prices and the real effective exchange rates, to those of the center economies while controlling for global and domestic factors. Once we measure the degree of sensitivity, we examine the determinants of sensitivity by examining a number of country-specific macroeconomic conditions or policies, real or financial linkages with the center economy, and the levels of institutional development.

We find that for most of the financial variables we examine, the link with the center economies has been dominant for developing and emerging market economies in the last two decades. At the same time, the movements of policy interest rate and term spreads are also found to be more sensitive to global financial shocks around the time of the emerging markets' crises in the late 1990s and early 2000s and since the time of the Global Financial Crisis of 2008.

While China's weight in the world economic output has clearly increased dramatically, including China as one of the center economies does not necessarily increase the goodness of fit in the regressions estimating financial variable sensitivity. This finding suggests that, for now, China does not exert substantial influence in financial markets rivalling that of other center economies such as the U.S., the Euro area, and Japan.

The results from the second step estimates that investigate the determinants of sensitivity to the center economies' financial variables suggest that while the levels of direct trade linkage, financial linkage through FDI, trade competition, financial development, current account balances, and national debt are important, the arrangement of open macro policies such as the exchange rate regime and financial openness are also found to have direct influences on the sensitivity to the center economies. As theory suggests, we find that an economy that pursues greater exchange rate stability and financial openness would face a stronger link with the center economies through policy interest rates and real effective exchange rate movements.

We also find evidence that the degree of exchange rate stability and financial openness do matter for the level of sensitivity when they are interacted with other variables such as current account balances, gross national debt, trade demand, and financial development. For example, if a developing country receives higher import demand from the center economies, that would strengthen the link between the peripheral and center economies through policy interest rates or stock market price movements when the PH has a policy arrangement of pursuing both greater exchange rate stability and financial openness. Such a policy arrangement would also make the impact of having greater gross debt on the link between CE's and PH's REER. Thus, we conclude that open macro policy arrangements do have both direct and indirect impacts on the extent of sensitivity to the center economies.

Motivated by the recent "taper tantrum," we investigate whether the exchange market pressure (EMP) of the peripheral economies is sensitive to the movements of the center economies' policy interest rates, REER, and EMP. We find that the EMP of the peripheral

economies is sensitive to the movements of the center economies' REER and the EMP during the GFC and the following period.

When we reapply the second-step estimation to the estimated sensitivity of our sample countries' EMP to the center economies' financial variables, we find that a country with higher levels of financial development can mitigate the effect of changes in the center economies' policy interest rates on the level of EMP it faces. While the real appreciation of the center economies could lead to higher EMP of the peripheral economies, higher levels of financial development, greater financial openness, strong trade ties with the CEs, and more stable inflation would help reduce the EMP sensitivity to center economies' REER.

While higher levels of financial openness, inflation volatility, and financial development lead developing countries to face higher, or more positive, degrees of sensitivity between the CE's and non-center's EMP, higher levels of government debt or budget deficit, current account deficit, trade demand, and legal development lead to the opposite. These characteristics are consistent with those of many countries whose EMP negatively related with the CE's EMP during and after the GFC.

The impact of the interaction between open macro policy variables with macroeconomic and institutional conditions are also detected. For example, when a country pursues greater financial openness, exchange rate stability, or both, accumulating government debt can make the country's EMP more sensitive to policy interest rates of the center economies. We also find that the greater exchange rate stability or less of financial openness a country pursues, the more financial development makes its economy's EMP levels more sensitive to changes in the center economies' REER. If a non-center economy runs current account *deficit,* its sensitivity to the REER the center economies would rise when it pursues greater exchange rate stability. A current account deficit country finds its EMP more positively correlated with the EMP of the center economies if it pursues greater financial openness and greater exchange rate *flexibility*. Having greater trade linkages with the CE contributes to more positive EMP-EMP linkages if a country pursues greater financial openness. Thus, trilemma policy arrangements *do* affect the sensitivity of developing countries to policy changes in the center economies both directly and indirectly.

In this study, not only do we evidence that the open macro policy choice is "*still*" dictated by the hypothesis of the trilemma, but also we provide much more nuanced, indirect effects of trilemma policy arrangements. Particularly, unlike the recent "irreconcilable duo" argument, we

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do find that the types of exchange rate regimes do affect the extent of sensitivity to changes in financial conditions or policies in the center economies. Hence, the requiem for the trilemma need not yet be written.

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Appendix: Data Descriptions and Sources

Policy short-term interest rate – money market rates Extracted from the IMF's *International Financial Statistics (IFS)*.

Stock market prices – stock market price indices from the IFS

Sovereign bond spread – the difference between the long-term interest rate (usually 10 year government bond) and the policy short-term interest rate – i.e., the slope of the yield curve, *IFS*. Real effective exchange rate (*REER*) – REER index from the *IFS*. An increase indicates appreciation.

Global interest rate – the first principal component of U.S. FRB, ECB, and Bank of Japan's policy interest rates.

Commodity prices – the first principal component of oil prices and commodity prices, both from the *IFS*.

VIX index – It is available in http://www.cboe.com/micro/VIX/vixintro.aspx and measures the implied volatility of S&P 500 index options.

"Ted spread" – It is the difference between the 3-month Eurodollar Deposit Rate in London and the 3-month U.S. Treasury Bill yield.

Industrial production (IP) – It is based on the industrial production index from the IFS.

Exchange rate stability (*ERS*) and financial openness (*KAOPEN*) indexes – From the trilemma indexes by Aizenman, et al. (2013).

International reserves (IR) – international reserves minus gold divided by nominal GDP. The data are extracted from the IFS.

Gross national debt and general budget balance – both are included as shares of GDP and obtained from the World Economic Outlook (WEO) database.

Trade demand by the center economies (TR_LINK_{ip}) – $TR\_LINK_{ip} = IMP_{ip}^{C} / GDP_{ip}$ where IMP_i^{C} is total imports into center economy *C* from country *i*, that is normalized by country *i*'s GDP based on the data from the IMF *Direction of Trade* database.

Bank lending provided by the center economies (BL_{ip}^{C}) – It is the ratio of the total stock of bank lending from country *C* in country *i* as a share of country *i*'s GDP (BL_i^{C}) for which we use the BIS consolidated banking statistics data.

FDI provided by the center economies ($FDINV_i^{C}$)– It is the ratio of the total stock of foreign direct investment from country *C* in country *i* as a share of country *i*'s GDP. We use the *OECD International Direct Investment* database. Due to possible nonstationarity of the data series, we include the first-difference of the FDI data series.

Trade competition (*Trade_Comp*) – It is constructed as follows.

$$Trade\_Comp_i^{C} = \frac{100}{Max(Trade\_Comp)} \sum_k \left[\frac{Exp_{W,k}^{C}}{Exp_{W,k}^{W}} * \frac{Exp_{W,k}^{i}}{GDP_i} \right]$$

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$Exp^{c}_{W,k}$ is exports from large-country *c* to every other country in the world *(W)* in industrial sector *k* whereas $Exp^{W}_{W,k}$ is exports from every country in the world to every other country in the world (i.e. total global exports) in industrial sector *k*. $Exp^{i}_{W,k}$ is exports from country *i* to every other country in the world in industrial sector *k*, and GDP_i is GDP for country *i*. We assume merchandise exports are composed of five industrial sectors *(K)*, that is, manufacturing, agricultural products, metals, fuel, and food.

This index is normalized using the maximum value of the product in parentheses for every country pair in the sample. Thus, it ranges between zero and one.[34] A higher value of this variable means that country *i*'s has more comparable trade structure to the center economies.

Financial development *(FD)* – It is the first principal component of private credit creation, stock market capitalization, stock market total value, and private bond market capitalization all as shares of GDP.[35]

Legal development *(LEGAL)* – It is the first principal component of law and order *(LAO)*, bureaucratic quality *(BQ)*, and anti-corruption measures *(CORRUPT)*, all from the ICRG database. Higher values of these variables indicate better conditions.

Currency crisis *(CURRENCY)* – It is from Aizenman and Ito (2013) who use the exchange market pressure (EMP) index using the exchange rate against the currency of the base country. We use two standard deviations of the EMP as the threshold to identify a currency crisis.

Banking crisis *(BANKCRISIS)* – It is from Aizenman and Ito (2013) who follow the methodology of Laeven and Valencia (2008, 2010, 2012). For more details, see Appendix 1 of Aizenman and Ito (2013).

Exchange market pressure (EMP) index –It is defined as a weighted average of monthly changes in the nominal exchange rate, the international reserve loss in percentage, and the nominal interest rate. The nominal exchange rate is calculated against the base country that we use to construct the trilemma indexes (see Aizenman, et al., 2008). The weights are inversely related to each country's variances of each of the changes in the three components over the sample countries.

$$EMP_{i,t} = \alpha\,(\%\,\Delta e_{i,t}) + \beta[\Delta(i_{i,t} - i_{b,t}) - \gamma\,(\%\,\Delta r_{i,t} - \%\,\Delta r_{b})$$

where $\alpha = \dfrac{(1/\sigma_{\%\,\Delta e_{i,t}})}{(1/\sigma_{\%\,\Delta e_{i,t}}) + (1/\sigma_{\Delta(i_{i,t}-i_{b,t})}) + (1/\sigma_{\%\,\Delta r_{i,t}-\%\,\Delta r})}$, $\beta = \dfrac{(1/\sigma_{\Delta(i_{i,t}-i_{b,t})})}{(1/\sigma_{\%\,\Delta e}) + (1/\sigma_{\Delta(i_{i,t}-i_{b,t})}) + (1/\sigma_{\%\,\Delta r_{i,t}-\%\,\Delta r})}$,

$\gamma = \dfrac{(1/\sigma_{\%\,\Delta r_{i,t}-\%\,\Delta r})}{(1/\sigma_{\%\,\Delta e_{i,t}}) + (1/\sigma_{\Delta(i_{i,t}-i_{b,t})}) + (1/\sigma_{\%\,\Delta r_{i,t}-\%\,\Delta r})}$

b stands for the "base country," which is defined as the country that a home country's monetary policy is most closely linked with as in Shambaugh (2004) and Aizenman, et al. (2013). The base countries are Australia, Belgium, France, Germany, India, Malaysia, South Africa, the U.K., and

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[34] This variable is an aggregated version of the trade competitiveness variable in Forbes and Chinn (2004). Their index is based on more disaggregated 14 industrial sectors.

[35] Because the private bond market capitalization data go back only to 1990, the FD series before 1990 are extrapolated using the principal component of private credit creation, stock market capitalization, and stock market total values, which goes back to 1976. These two FD measures are highly correlated with each other.

the U.S. The base country can change as it has happened to Ireland, for example. Its base country was the U.K. until the mid-1970s, and changed to Germany since Ireland joined the European Monetary System (EMS).

Table 1-1: Factors Affecting Policy Interest Rate Sensitivity, 1986-2012

		FULL	FULL	IDC	IDC	LDC	LDC	EMG	EMG
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Open Macro Policy	Exchange rate stability	-0.167	-0.349	-0.305	-0.313	4.862	3.392	3.657	3.098
(OMP)		(0.796)	(0.878)	(0.681)	(0.688)	(2.693)*	(2.447)	(2.448)	(2.268)
	Financial openness	0.223	0.249	0.153	0.216	5.455	5.777	7.930	7.491
		(0.720)	(0.805)	(0.703)	(0.709)	(2.403)**	(2.259)**	(2.245)***	(2.154)***
	IR Holding	-1.419	-2.034	-0.588	-0.844	-13.803	-11.343	-12.400	-13.557
		(2.082)	(2.277)	(2.269)	(2.311)	(7.342)*	(6.541)*	(6.254)**	(5.820)**
Macro. Conditions	CA balance (%)	6.550	5.943	-3.462	-1.417	19.282	24.284	41.092	39.017
(MC)		(2.979)**	(3.580)*	(2.942)	(3.033)	(9.666)**	(10.541)**	(10.507)***	(10.451)***
	Inflation Vol.	14.135	9.400	4.767	1.869	19.270	23.910	9.839	10.727
		(11.231)	(6.003)	(17.830)	(17.702)	(34.312)	(15.012)	(28.624)	(12.515)
	Gross debt (%)	0.064		-0.018		-0.963		-1.420	
		(0.467)		(0.352)		(1.592)		(1.289)	
	Budget balance (%)		7.715		-3.462		-2.145		22.313
			(4.818)		(3.235)		(15.342)		(16.492)
External Link	Trade competition	0.442	0.390	-0.538	-2.695	-4.540	-6.454	-11.187	-11.246
(LINK)		(2.764)	(2.800)	(3.345)	(3.458)	(9.166)	(7.550)	(7.868)	(6.633)*
	Trade demand	-0.133	1.263	8.602	9.795	6.868	8.340	11.068	11.898
		(3.104)	(3.422)	(2.166)***	(2.183)***	(11.125)	(10.116)	(9.170)	(8.609)
	FDI from CEs	17.785	19.231	-13.592	-15.571	49.264	44.044	42.633	41.347
		(4.191)***	(4.791)***	(2.792)***	(2.896)***	(16.003)***	(15.113)***	(13.001)***	(12.732)***
Institutional Dev.	Fin. Dev.	-0.346	0.370	1.395	1.490	9.570	7.651	8.137	7.931
(INST)		(0.699)	(0.803)	(0.539)**	(0.547)***	(2.500)***	(2.427)***	(2.207)***	(2.168)***
	Legal Dev.	-0.718	-1.766	0.681	0.837	-4.831	-5.933	-7.132	-7.115
		(1.384)	(1.482)	(1.146)	(1.125)	(6.555)	(5.974)	(5.530)	(5.199)
Crises	Currency crisis	-0.058	-0.739	-0.138	-0.170	-3.589	-2.712	-3.212	-3.422
(CRISIS)		(0.658)	(0.704)	(0.421)	(0.418)	(2.595)	(2.178)	(2.167)	(1.872)*
	Banking crisis	0.415	0.596	0.154	0.174	0.544	1.410	0.766	1.292
		(0.532)	(0.574)	(0.368)	(0.358)	(2.096)	(1.838)	(1.870)	(1.676)
	N	611	674	225	242	386	432	327	371
	Adj. R2	0.05	0.05	0.25	0.24	0.09	0.08	0.12	0.13
	# of countries	59	59	18	18	41	41	31	31
	F-test, OMP	0.88	0.76	0.93	0.88	0.01	0.01	0.00	0.00
	F-test, Macro	0.10	0.01	0.63	0.58	0.24	0.03	0.00	0.00
	F-test, Ext. Link	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	F-test, Inst. Dev.	0.59	0.49	0.02	0.01	0.00	0.01	0.00	0.00
	F-test, All	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. The second estimation is conducted for the estimates $\hat{\gamma}_{Fi}^{c}$ from the first-step estimation that does not include China as one of the center economies. Time fixed effects for the three-year panels and the constant are also included, though their estimates are not reported.

Table 1-2: Factors Affecting Stock Market Sensitivity, 1986-2012

		FULL	FULL	IDC	IDC	LDC	LDC	EMG	EMG
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Open Macro Policy	Exchange rate stability	-0.141	-0.108	0.126	0.164	-0.291	-0.189	-0.318	-0.220
(OMP)		(0.088)	(0.089)	(0.160)	(0.159)	(0.124)**	(0.125)	(0.139)**	(0.139)
	Financial openness	-0.095	-0.011	-0.196	-0.235	-0.207	-0.101	-0.089	0.013
		(0.084)	(0.086)	(0.196)	(0.196)	(0.101)**	(0.113)	(0.116)	(0.126)
	IR Holding	-0.069	-0.068	-0.918	-0.988	0.133	-0.027	0.216	0.057
		(0.230)	(0.243)	(0.637)	(0.632)	(0.302)	(0.326)	(0.330)	(0.368)
Macro. Conditions	CA balance (%)	0.129	0.758	1.345	2.071	-0.104	0.341	-0.047	0.381
(MC)		(0.331)	(0.362)**	(0.795)*	(0.821)**	(0.384)	(0.475)	(0.545)	(0.585)
	Inflation Vol.	1.366	0.476	3.616	4.823	2.111	1.341	1.400	1.111
		(1.490)	(0.620)	(6.275)	(6.289)	(1.618)	(0.695)*	(1.691)	(0.716)
	Gross debt (%)	0.235		0.219		0.171		0.175	
		(0.053)***		(0.093)**		(0.066)***		(0.068)**	
	Budget balance (%)		-0.993		-0.413		-0.714		-0.840
			(0.499)**		(0.908)		(0.703)		(0.963)
External Link	Trade competition	0.197	0.063	-1.474	-1.587	0.692	0.712	0.441	0.490
(LINK)		(0.303)	(0.318)	(0.757)*	(0.767)**	(0.368)*	(0.399)*	(0.404)	(0.434)
	Trade demand	0.239	0.601	0.731	1.107	-0.038	-0.003	0.178	0.198
		(0.336)	(0.339)*	(0.566)	(0.551)**	(0.452)	(0.477)	(0.473)	(0.503)
	FDI from CEs	-0.309	-0.147	0.036	0.257	-1.040	-0.431	-1.270	-0.626
		(0.420)	(0.437)	(0.673)	(0.680)	(0.606)*	(0.651)	(0.626)**	(0.676)
Institutional Dev.	Fin. Dev.	0.090	0.085	0.659	0.631	-0.202	-0.154	-0.154	-0.108
(INST)		(0.077)	(0.080)	(0.144)***	(0.143)***	(0.101)**	(0.112)	(0.110)	(0.120)
	Legal Dev.	0.100	0.006	-0.180	-0.198	0.008	-0.282	-0.015	-0.329
		(0.156)	(0.153)	(0.310)	(0.312)	(0.265)	(0.276)	(0.276)	(0.287)
Crises	Currency crisis	-0.030	-0.028	0.149	0.180	-0.052	-0.032	-0.058	-0.038
(CRISIS)		(0.074)	(0.073)	(0.114)	(0.112)	(0.115)	(0.109)	(0.118)	(0.112)
	Banking crisis	0.023	0.038	0.136	0.106	0.008	-0.002	-0.003	-0.023
		(0.057)	(0.056)	(0.102)	(0.098)	(0.083)	(0.085)	(0.092)	(0.094)
	N	552	594	227	237	325	357	290	322
	Adj. R2	0.03	0.01	0.12	0.11	0.05	0.03	0.03	0.01
	# of countries	50	50	19	19	31	31	26	26
	F-test, OMP	0.27	0.67	0.42	0.28	0.03	0.39	0.14	0.45
	F-test, Macro	0.00	0.08	0.02	0.09	0.03	0.17	0.05	0.28
	F-test, Ext. Link	0.70	0.26	0.18	0.04	0.07	0.28	0.12	0.51
	F-test, Inst. Dev.	0.19	0.46	0.00	0.00	0.12	0.15	0.35	0.26
	F-test, All	0.00	0.24	0.00	0.00	0.02	0.15	0.10	0.47

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. The second estimation is conducted for the estimates $\hat{\gamma}^{c}_{Fi}$ from the first-step estimation that does not include China as one of the center economies. Time fixed effects for the three-year panels and the constant are also included, though their estimates are not reported.

Table 1-3: Factors Affecting REER Sensitivity, 1986-2012

		FULL	FULL	IDC	IDC	LDC	LDC	EMG	EMG
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Open Macro Policy	Exchange rate stability	0.614	0.643	0.425	0.426	0.718	0.807	0.725	0.760
(OMP)		(0.076)***	(0.074)***	(0.099)***	(0.099)***	(0.132)***	(0.121)***	(0.135)***	(0.123)***
	Financial openness	0.348	0.263	-0.083	-0.075	0.377	0.311	0.157	0.074
		(0.077)***	(0.075)***	(0.117)	(0.117)	(0.126)***	(0.121)**	(0.137)	(0.132)
	IR Holding	0.936	0.863	0.385	0.632	1.038	0.919	0.761	0.606
		(0.208)***	(0.202)***	(0.386)	(0.389)	(0.334)***	(0.320)***	(0.331)**	(0.314)*
Macro. Conditions	CA balance (%)	1.096	0.668	1.462	0.944	0.921	0.459	1.360	0.684
(MC)		(0.342)***	(0.328)**	(0.487)***	(0.488)*	(0.545)*	(0.536)	(0.563)**	(0.553)
	Inflation Vol.	3.429	-0.973	1.439	0.866	2.824	-0.840	2.706	-0.868
		(1.234)***	(0.493)**	(3.000)	(2.958)	(1.674)*	(0.671)	(1.672)	(0.634)
	Gross debt (%)	-0.078		-0.119		-0.072		-0.138	
		(0.049)		(0.059)**		(0.078)		(0.075)*	
	Budget balance (%)		0.401		-0.027		1.018		2.366
			(0.472)		(0.534)		(0.963)		(0.956)**
External Link	Trade competition	-1.606	-1.326	-0.703	-0.780	-1.625	-1.262	-1.275	-0.866
(LINK)		(0.275)***	(0.244)***	(0.477)	(0.480)	(0.427)***	(0.372)***	(0.429)***	(0.374)**
	Trade demand	1.744	1.703	1.421	1.176	1.763	1.877	2.022	2.151
		(0.295)***	(0.280)***	(0.358)***	(0.352)***	(0.483)***	(0.460)***	(0.463)***	(0.439)***
	FDI from CEs	-0.618	-0.634	-1.337	-1.283	-0.335	-0.372	-0.110	-0.272
		(0.381)	(0.380)*	(0.425)***	(0.433)***	(0.673)	(0.668)	(0.643)	(0.639)
Institutional Dev.	Fin. Dev.	-0.002	-0.030	0.367	0.353	-0.171	-0.211	-0.076	-0.125
(INST)		(0.071)	(0.070)	(0.091)***	(0.091)***	(0.119)	(0.117)*	(0.119)	(0.117)
	Legal Dev.	-0.103	-0.098	-0.250	-0.188	-0.007	-0.212	0.076	-0.234
		(0.138)	(0.130)	(0.188)	(0.184)	(0.296)	(0.290)	(0.296)	(0.289)
Crises	Currency crisis	0.159	0.121	0.051	0.042	0.282	0.165	0.349	0.207
(CRISIS)		(0.066)**	(0.063)*	(0.070)	(0.070)	(0.127)**	(0.113)	(0.120)***	(0.108)*
	Banking crisis	-0.013	-0.062	0.027	-0.021	0.001	-0.108	-0.092	-0.204
		(0.052)	(0.049)	(0.064)	(0.061)	(0.096)	(0.087)	(0.102)	(0.091)**
	N	537	592	243	260	294	332	254	290
	Adj. R2	0.23	0.22	0.33	0.29	0.22	0.23	0.27	0.28
	# of countries	49	49	19	19	30	30	23	23
	F-test, OMP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	F-test, Macro	0.00	0.03	0.01	0.26	0.12	0.25	0.02	0.01
	F-test, Ext. Link	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	F-test, Inst. Dev.	0.68	0.51	0.00	0.00	0.33	0.10	0.81	0.33
	F-test, All	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. The second estimation is conducted for the estimates $\hat{\gamma}_{Fi}^{c}$ from the first-step estimation that does not include China as one of the center economies. Time fixed effects for the three-year panels and the constant are also included, though their estimates are not reported.

Table 2-1: Interactive Effects and Policy Interest Rate Sensitivity, 1986-2012

	FULL	FULL	FULL	LDC	LDC	LDC	EMG	EMG	EMG
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exchange rate stability	0.330	-0.619	-1.166	5.309	-7.884	-11.771	5.130	-5.971	-3.383
	(0.909)	(1.547)	(1.733)	(2.751)*	(7.206)	(8.226)	(2.570)**	(5.128)	(5.496)
Financial openness	-1.575	0.323	-1.467	-1.269	6.516	5.335	0.974	9.544	3.303
	(1.485)	(0.750)	(1.517)	(5.169)	(3.105)**	(7.412)	(4.436)	(2.450)***	(4.863)
IR Holding	-2.079	-1.826	-2.209	-12.865	-13.232	-10.147	-10.817	-9.973	-9.538
	(2.370)	(2.217)	(2.477)	(7.555)*	(9.713)	(10.706)	(6.644)	(7.006)	(7.298)
CA balance (%)	6.666	13.660	11.367	28.248	41.970	63.029	19.791	32.486	21.459
	(8.238)	(6.801)**	(10.431)	(23.271)	(29.384)	(39.890)	(20.440)	(22.619)	(26.431)
Gross debt (%)	0.133	0.178	0.571	0.497	-0.544	1.770	-0.799	-0.481	0.318
	(0.997)	(0.924)	(1.299)	(3.049)	(4.196)	(5.395)	(2.508)	(2.829)	(3.406)
Trade demand	-6.866	-1.300	-11.344	-4.779	-56.321	-100.895	-2.923	-23.766	-37.035
	(8.407)	(6.050)	(10.104)	(23.448)	(26.507)**	(40.442)**	(19.569)	(18.546)	(26.549)
Fin. Dev.	5.090	0.817	7.242	17.031	30.152	30.181	17.133	19.735	23.187
	(1.670)***	(1.302)	(1.986)***	(4.719)***	(5.726)***	(7.591)***	(3.992)***	(3.985)***	(4.896)***
KAO x CAB	0.682		2.780	-8.557		-35.884	41.950		32.968
	(10.604)		(10.864)	(31.196)		(44.266)	(28.319)		(31.667)
KAO x Debt	-0.076		-0.167	-2.212		-6.466	-1.060		-1.710
	(1.439)		(1.470)	(5.014)		(7.066)	(4.206)		(4.516)
KAO x Trade Demand	9.961		10.946	16.625		43.098	31.202		33.056
	(10.026)		(10.224)	(29.872)		(41.279)	(25.211)		(26.674)
KAO x FD.	-7.340		-7.209	-15.549		18.749	-17.676		-11.610
	(2.097)***		(2.152)***	(6.714)**		(9.583)*	(5.954)***		(6.511)*
ERS x CAB		-13.799	-12.085		-49.790	-52.504		7.265	-2.590
		(10.909)	(12.174)		(43.898)	(49.343)		(35.144)	(37.970)
ERS x Debt		-0.476	-1.044		-3.001	-1.671		-2.863	-2.430
		(1.680)	(1.878)		(7.163)	(7.990)		(4.841)	(5.062)
ERS x Trade Demand		2.812	8.142		123.275	148.706		67.204	62.633
		(10.849)	(12.105)		(48.777)**	(53.871)***		(35.799)*	(36.936)*
ERS x FD.		-1.977	-4.651		-30.529	-43.333		-21.751	-16.831
		(2.200)	(2.469)*		(9.015)***	(10.280)***		(6.665)***	(7.173)**
N	611	611	611	386	386	386	327	327	327
Adj. R2	0.07	0.04	0.07	0.09	0.15	0.18	0.16	0.15	0.16
# of countries	59	59	59	41	41	41	31	31	31
F-test, OMP	0.61	0.76	0.48	0.13	0.07	0.33	0.14	0.00	0.45
F-test, Macro	0.52	0.12	0.40	0.59	0.50	0.43	0.77	0.56	0.88
F-test, Ext. Link	0.00	0.00	0.00	0.12	0.00	0.00	0.27	0.00	0.05
F-test, Inst. Dev.	0.01	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F-test, Int. Terms	0.01	0.63	0.02	0.25	0.00	0.00	0.02	0.01	0.04
F-test, All	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. The estimates for inflation volatility, FDI from the CEs, trade competition, legal development, currency and banking crisis dummies, and time fixed effects are omitted from presentation due to space limitation.

	FULL	FULL	FULL	LDC	LDC	LDC	EMG	EMG	EMG
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exchange rate stability	-0.179	-0.360	-0.336	-0.320	-0.699	-0.696	-0.364	-0.818	-0.806
	(0.088)**	(0.185)*	(0.185)*	(0.126)**	(0.309)**	(0.313)**	(0.140)**	(0.328)**	(0.332)**
Financial openness	0.139	-0.106	0.146	0.007	-0.198	0.016	0.151	-0.129	0.108
	(0.160)	(0.084)	(0.161)	(0.231)	(0.102)*	(0.232)	(0.245)	(0.116)	(0.245)
IR Holding	-0.030	-0.169	-0.111	0.091	-0.053	-0.084	0.208	-0.008	-0.024
	(0.230)	(0.238)	(0.240)	(0.306)	(0.314)	(0.321)	(0.334)	(0.338)	(0.348)
CA balance (%)	1.139	1.391	2.114	1.172	1.124	1.879	1.391	1.679	2.466
	(0.813)	(0.709)*	(1.003)**	(0.919)	(0.933)	(1.166)	(0.992)	(1.047)	(1.226)**
Gross debt (%)	0.084	0.266	0.093	0.046	0.267	0.152	0.046	0.286	0.148
	(0.106)	(0.098)***	(0.136)	(0.124)	(0.134)**	(0.171)	(0.125)	(0.136)**	(0.173)
Trade demand	-0.081	-0.909	-0.721	-0.129	-1.476	-1.377	-0.213	-1.803	-1.900
	(0.968)	(0.619)	(1.073)	(1.088)	(0.828)*	(1.298)	(1.109)	(0.875)**	(1.351)
Fin. Dev.	-0.278	0.200	-0.171	-0.345	-0.010	-0.195	-0.365	-0.048	-0.264
	(0.168)*	(0.141)	(0.202)	(0.186)*	(0.181)	(0.233)	(0.192)*	(0.187)	(0.238)
KAO x CAB	-1.485		-1.151	-1.948		-1.292	-2.555		-1.623
	(1.047)		(1.067)	(1.261)		(1.299)	(1.421)*		(1.468)
KAO x Debt	0.217		0.204	0.219		0.192	0.227		0.224
	(0.147)		(0.148)	(0.205)		(0.208)	(0.210)		(0.211)
KAO x Trade Demand	0.304		-0.067	-0.156		-0.225	0.094		0.048
	(1.106)		(1.121)	(1.325)		(1.329)	(1.360)		(1.359)
KAO x FD.	0.504		0.511	0.261		0.293	0.387		0.378
	(0.211)**		(0.213)**	(0.281)		(0.286)	(0.299)		(0.303)
ERS x CAB		-2.277	-2.244		-1.865	-1.760		-3.054	-2.792
		(1.149)**	(1.154)*		(1.428)	(1.473)		(1.685)*	(1.755)
ERS x Debt		-0.094	-0.024		-0.244	-0.231		-0.301	-0.271
		(0.188)	(0.189)		(0.260)	(0.262)		(0.265)	(0.267)
ERS x Trade Demand		2.574	2.175		3.489	3.329		4.932	4.587
		(1.152)**	(1.165)*		(1.682)**	(1.696)*		(1.819)***	(1.836)**
ERS x FD.		-0.273	-0.272		-0.384	-0.346		-0.228	-0.226
		(0.267)	(0.272)		(0.338)	(0.349)		(0.371)	(0.383)
N	552	552	552	325	325	325	290	290	290
Adj. R2	0.04	0.04	0.04	0.05	0.05	0.05	0.03	0.05	0.04
# of countries	50	50	50	31	31	31	26	26	26
F-test, OMP	0.18	0.14	0.22	0.09	0.03	0.16	0.06	0.06	0.10
F-test, Macro	0.35	0.00	0.10	0.28	0.03	0.10	0.36	0.02	0.08
F-test, Ext. Link	0.84	0.27	0.64	0.18	0.01	0.12	0.48	0.01	0.19
F-test, Inst. Dev.	0.22	0.20	0.61	0.18	0.98	0.67	0.16	0.92	0.49
F-test, Int. Terms	0.04	0.07	0.03	0.45	0.15	0.35	0.25	0.04	0.12
F-test, All	0.00	0.00	0.00	0.03	0.01	0.03	0.08	0.03	0.05

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. The estimates for inflation volatility, FDI from the CEs, trade competition, legal development, currency and banking crisis dummies, and time fixed effects are omitted from presentation due to space limitation.

Table 2-3: Interactive Effects and REER Sensitivity, 1986-2012

	FULL	FULL	FULL	LDC	LDC	LDC	EMG	EMG	EMG
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exchange rate stability	0.623	0.341	0.355	0.735	0.552	0.566	0.743	0.520	0.528
	(0.077)***	(0.160)**	(0.159)**	(0.134)***	(0.327)*	(0.331)*	(0.136)***	(0.329)	(0.335)
Financial openness	0.330	0.362	0.309	0.523	0.431	0.537	0.381	0.188	0.392
	(0.142)**	(0.077)***	(0.140)**	(0.277)*	(0.122)***	(0.266)**	(0.269)	(0.131)	(0.255)
IR Holding	0.944	1.171	1.141	1.042	1.682	1.668	0.717	1.188	1.131
	(0.208)***	(0.212)***	(0.212)***	(0.344)***	(0.333)***	(0.342)***	(0.342)**	(0.326)***	(0.339)***
CA balance (%)	0.413	-0.194	-0.810	-0.139	-2.651	-2.966	0.110	-0.849	-1.175
	(0.737)	(0.640)	(0.895)	(1.056)	(1.024)**	(1.285)**	(1.044)	(1.036)	(1.217)
Gross debt (%)	0.064	-0.175	-0.042	-0.215	-0.435	-0.525	-0.278	-0.464	-0.541
	(0.099)	(0.090)*	(0.123)	(0.155)	(0.155)***	(0.195)***	(0.146)*	(0.147)***	(0.184)***
Trade demand	1.794	0.801	0.705	1.920	1.135	1.200	2.404	1.030	1.072
	(0.722)**	(0.547)	(0.839)	(1.019)*	(0.879)	(1.286)	(0.972)**	(0.843)	(1.212)
Fin. Dev.	-0.165	0.394	0.252	-0.253	0.461	0.371	-0.260	0.475	0.276
	(0.155)	(0.124)***	(0.182)	(0.217)	(0.195)**	(0.256)	(0.213)	(0.186)**	(0.239)
KAO x CAB	0.936		0.975	1.426		0.535	1.873		0.533
	(0.928)		(0.915)	(1.424)		(1.383)	(1.487)		(1.463)
KAO x Debt	-0.228		-0.208	0.258		0.182	0.247		0.151
	(0.135)*		(0.133)	(0.249)		(0.242)	(0.237)		(0.226)
KAO x Trade Demand	-0.033		0.385	-0.052		0.052	-0.291		0.032
	(0.859)		(0.848)	(1.340)		(1.292)	(1.279)		(1.215)
KAO x FD.	0.225		0.210	0.087		0.078	0.271		0.388
	(0.193)		(0.191)	(0.330)		(0.318)	(0.337)		(0.324)
ERS x CAB		2.010	1.827		4.950	4.834		2.873	2.722
		(1.128)*	(1.123)		(1.640)***	(1.672)***		(1.634)*	(1.713)
ERS x Debt		0.223	0.213		0.727	0.714		0.638	0.631
		(0.164)	(0.164)		(0.281)**	(0.284)**		(0.273)**	(0.277)**
ERS x Trade Demand		1.823	1.534		0.759	0.748		1.893	1.809
		(0.998)*	(0.996)		(1.750)	(1.782)		(1.734)	(1.761)
ERS x FD.		-0.798	-0.820		-1.326	-1.280		-1.217	-1.263
		(0.223)***	(0.223)***		(0.348)***	(0.354)***		(0.341)***	(0.354)***
N	537	537	537	294	294	294	254	254	254
Adj. R2	0.23	0.26	0.26	0.21	0.32	0.31	0.27	0.37	0.36
# of countries	49	49	49	30	30	30	23	23	23
F-test, OMP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F-test, Macro	0.10	0.01	0.09	0.22	0.00	0.00	0.13	0.00	0.01
F-test, Ext. Link	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01
F-test, Inst. Dev.	0.23	0.01	0.32	0.47	0.03	0.23	0.46	0.02	0.29
F-test, Int. Terms	0.17	0.00	0.00	0.68	0.00	0.00	0.51	0.00	0.00
F-test, All	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. The estimates for inflation volatility, FDI from the CEs, trade competition, legal development, currency and banking crisis dummies, and fixed effects are omitted from presentation due to space limitation.

Table 3: Net Effects for Developing Countries Conditional on KAOPEN and ERS

(a) Effect of Financial Development (+10 ppt) in the MM-MM Estimation

		KAOPEN*		
		0.00	0.50	1.00
ERS*	0.00	3.02	3.96	4.89
	0.50	0.85	1.79	2.73
	1.00	-1.32	-0.38	0.56

(b) Effect of Trade Demand (+5 ppt) in the MM-MM Estimation

		KAOPEN		
		0.00	0.50	1.00
ERS*	0.00	-5.04	-3.97	-2.89
	0.50	-1.33	-0.25	0.83
	1.00	2.39	3.47	4.55

(c) Effect of Trade Demand (+5 ppt) In the SMT-SMT Estimation

		KAOPEN		
		0.00	0.50	1.00
ERS*	0.00	-0.07	-0.07	-0.08
	0.50	0.01	0.01	0.00
	1.00	0.10	0.09	0.09

(e) Effect of CAB *Deterioration* (−2 ppt) in the REER-REER Estimation

		KAOPEN		
		0.00	0.50	1.00
ERS*	0.00	0.06	0.05	0.05
	0.50	0.01	0.01	0.00
	1.00	-0.04	-0.04	-0.05

(f) Effect of Gross Debt (+10 ppt) in the REER-REER Estimation

		KAOPEN		
		0.00	0.50	1.00
ERS*	0.00	-0.05	-0.04	-0.03
	0.50	-0.02	-0.01	0.00
	1.00	0.02	0.03	0.04

(g) Effect of Financial Development (+10 ppt) in the REER-REER Estimation

		KAOPEN		
		0.00	0.50	1.00
ERS*	0.00	0.04	0.04	0.04
	0.50	-0.03	-0.02	-0.02
	1.00	-0.09	-0.09	-0.08

Note: "*" superscripted to KAOPEN or ERS in the tables means that the interaction term between KAOPEN or ERS and the variable of concern is found to be statistically significant in each respective estimation.

Table 4-1: Factors Affecting Exchange Market Pressure Sensitivity to Core Interest Rates, 1986-2012

		FULL (1)	FULL (2)	LDC (3)	LDC (4)	EMG (5)	EMG (6)
Open Macro Policy	Exchange rate stability	19.51	42.38	109.52	116.18	-27.89	18.89
(OMP)		(74.81)	(65.80)	(178.29)	(151.16)	(166.17)	(143.51)
	Financial openness	29.82	-18.37	-176.90	-267.83	-64.27	-124.24
		(69.70)	(60.91)	(153.11)	(132.45)**	(143.52)	(125.55)
	IR Holding	308.11	246.58	555.75	353.87	577.64	382.42
		(198.48)	(178.78)	(478.13)	(414.46)	(413.08)	(373.90)
Macro. Conditions	CA balance (%)	237.08	120.23	-182.76	-530.44	251.10	343.03
(MC)		(289.19)	(274.40)	(617.52)	(622.50)	(671.41)	(611.66)
	Inflation Vol.	914.73	445.22	3,224.51	608.21	457.93	196.27
		(1,245.72)	(492.18)	(2,521.27)	(949.83)	(2,134.15)	(781.49)
	Gross debt (%)	-86.98		-127.91		-152.37	
		(45.22)*		(101.25)		(80.82)*	
	Budget balance (%)		129.37		1,423.31		362.80
			(369.62)		(900.83)		(967.51)
External Link	Trade competition	-31.18	37.31	577.77	771.16	-59.62	260.37
(LINK)		(261.70)	(232.57)	(578.58)	(492.02)	(493.08)	(426.45)
	Trade demand	337.07	42.98	-173.50	-422.24	205.64	-107.52
		(293.46)	(256.64)	(704.03)	(599.29)	(574.06)	(501.74)
	FDI from CEs	-1,366.16	-973.90	-806.81	-646.05	308.98	348.21
		(387.70)***	(347.64)***	(1,017.54)	(885.59)	(816.23)	(731.21)
Institutional Dev.	Fin. Dev.	-164.75	-144.22	-551.32	-525.94	-284.73	-316.95
(INST)		(67.36)**	(60.63)**	(159.12)***	(142.14)***	(138.00)**	(124.21)**
	Legal Dev.	96.50	90.87	-33.72	-3.74	-164.35	-287.82
		(134.15)	(112.62)	(417.41)	(350.29)	(347.30)	(299.65)
Crises	Currency crisis	66.02	41.14	75.07	51.40	128.84	53.55
(CRISIS)		(63.20)	(53.84)	(165.46)	(130.15)	(136.54)	(109.50)
	Banking crisis	-9.38	2.81	-80.82	-54.80	-58.82	-60.30
		(51.47)	(43.73)	(133.33)	(108.92)	(118.01)	(97.87)
	N	625	678	382	418	321	355
	Adj. R2	0.14	0.11	0.09	0.09	0.10	0.11
	# of countries	59	59	40	40	30	30
	F-test, OMP	0.44	0.43	0.34	0.13	0.54	0.53
	F-test, Macro	0.23	0.72	0.33	0.43	0.31	0.90
	F-test, Ext. Link	0.01	0.02	0.60	0.30	0.90	0.89
	F-test, Inst. Dev.	0.04	0.06	0.00	0.00	0.07	0.01
	F-test, All	0.01	0.05	0.08	0.05	0.39	0.14

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. The second estimation is conducted for the estimates $\hat{\gamma}_{Fi}^{C}$ from the first-step estimation that does not include China as one of the center economies. Time fixed effects for the three-year panels and the constant are also included, though their estimates are not reported.

Table 4-2: Factors Affecting Exchange Market Pressure Sensitivity to Core REER, 1986-2012

		FULL	FULL	LDC	LDC	EMG	EMG
		(1)	(2)	(3)	(4)	(5)	(6)
Open Macro Policy	Exchange rate stability	-4.296	-5.331	-1.954	-4.870	1.244	-2.477
(OMP)		(3.269)	(3.274)	(3.291)	(3.384)	(4.044)	(4.165)
	Financial openness	-9.415	-7.166	-7.360	-6.084	-8.324	-6.339
		(3.046)***	(3.031)**	(2.827)***	(2.965)**	(3.493)**	(3.644)*
	IR Holding	-14.635	-15.171	-9.791	-10.705	-11.470	-12.454
		(8.674)*	(8.896)*	(8.827)	(9.279)	(10.053)	(10.852)
Macro. Conditions	CA balance (%)	-21.217	-16.464	-24.993	-15.372	-31.781	-20.494
(MC)		(12.638)*	(13.654)	(11.400)**	(13.936)	(16.339)*	(17.753)
	Inflation Vol.	14.329	58.052	-2.863	73.630	13.702	80.103
		(54.439)	(24.490)**	(46.546)	(21.265)***	(51.937)	(22.682)***
	Gross debt (%)	1.207		-0.992		0.257	
		(1.976)		(1.869)		(1.967)	
	Budget balance (%)		-8.721		-14.180		-24.878
			(18.392)		(20.168)		(28.082)
External Link	Trade competition	16.175	16.889	16.344	17.914	13.900	15.391
(LINK)		(11.437)	(11.572)	(10.681)	(11.015)	(12.000)	(12.377)
	Trade demand	-14.134	-7.330	-25.070	-20.335	-33.885	-27.703
		(12.824)	(12.770)	(12.997)*	(13.417)	(13.970)**	(14.563)*
	FDI from CEs	20.388	17.320	23.582	21.515	34.115	32.611
		(16.943)	(17.298)	(18.785)	(19.826)	(19.864)*	(21.223)
Institutional Dev.	Fin. Dev.	-8.604	-8.868	-7.133	-6.044	-8.104	-6.107
(INST)		(2.943)***	(3.017)***	(2.938)**	(3.182)*	(3.358)**	(3.605)*
	Legal Dev.	21.851	24.437	7.902	7.784	15.612	15.026
		(5.862)***	(5.604)***	(7.706)	(7.842)	(8.452)*	(8.697)*
Crises	Currency crisis	7.238	7.495	7.464	8.885	6.067	6.188
(CRISIS)		(2.762)***	(2.679)***	(3.055)**	(2.914)***	(3.323)*	(3.178)*
	Banking crisis	5.694	7.428	2.254	3.863	7.808	9.125
		(2.249)**	(2.176)***	(2.461)	(2.439)	(2.872)***	(2.841)***
	N	625	678	382	418	320	355
	Adj. R2	0.15	0.18	0.12	0.18	0.14	0.19
	# of countries	59	59	40	40	30	30
	F-test, OMP	0.00	0.01	0.02	0.03	0.06	0.12
	F-test, Macro	0.37	0.04	0.14	0.00	0.27	0.00
	F-test, Ext. Link	0.31	0.35	0.19	0.26	0.10	0.20
	F-test, Inst. Dev.	0.00	0.00	0.05	0.14	0.02	0.09
	F-test, All	0.00	0.00	0.00	0.00	0.00	0.00

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. The second estimation is conducted for the estimates $\hat{\gamma}_{Fi}^{C}$ from the first-step estimation that does not include China as one of the center economies. Time fixed effects for the three-year panels and the constant are also included, though their estimates are not reported.

Table 4-3: Factors Affecting Exchange Market Pressure Sensitivity to Core Exchange Market Pressure, 1986-2012

		FULL	FULL	LDC	LDC	EMG	EMG
		(1)	(2)	(3)	(4)	(5)	(6)
Open Macro Policy (OMP)	Exchange rate stability	-0.091 (0.115)	-0.134 (0.115)	0.207 (0.140)	0.095 (0.153)	0.055 (0.167)	0.007 (0.181)
	Financial openness	0.330 (0.107)***	0.195 (0.107)*	0.589 (0.120)***	0.443 (0.134)***	0.590 (0.144)***	0.424 (0.159)***
	IR Holding	0.363 (0.304)	0.425 (0.314)	-0.254 (0.376)	-0.185 (0.420)	-0.209 (0.414)	-0.134 (0.472)
Macro. Conditions (MC)	CA balance (%)	1.305 (0.443)***	0.597 (0.482)	1.327 (0.485)***	0.852 (0.631)	1.494 (0.673)**	1.051 (0.772)
	Inflation Vol.	5.177 (1.910)***	0.502 (0.864)	5.963 (1.981)***	4.604 (0.963)***	6.017 (2.140)***	4.199 (0.987)***
	Gross debt (%)	-0.140 (0.069)**		-0.252 (0.080)***		-0.268 (0.081)***	
	Budget balance (%)		0.721 (0.649)		1.888 (0.914)**		2.322 (1.222)*
External Link (LINK)	Trade competition	-0.634 (0.401)	-0.568 (0.408)	-0.355 (0.455)	-0.377 (0.499)	-0.246 (0.494)	-0.355 (0.538)
	Trade demand	0.687 (0.450)	0.773 (0.450)*	-0.829 (0.553)	-0.470 (0.608)	-0.594 (0.576)	-0.187 (0.633)
	FDI from CEs	-1.636 (0.594)***	-1.859 (0.610)***	0.428 (0.800)	-0.081 (0.898)	-0.245 (0.818)	-0.781 (0.923)
Institutional Dev. (INST)	Fin. Dev.	0.138 (0.103)	0.100 (0.106)	0.269 (0.125)**	0.235 (0.144)	0.217 (0.138)	0.163 (0.157)
	Legal Dev.	-0.311 (0.206)	0.019 (0.198)	-0.794 (0.328)**	-0.554 (0.355)	-0.703 (0.348)**	-0.405 (0.378)
Crises (CRISIS)	Currency crisis	0.205 (0.097)**	0.143 (0.094)	0.424 (0.130)***	0.538 (0.132)***	0.382 (0.137)***	0.547 (0.138)***
	Banking crisis	0.028 (0.079)	0.131 (0.077)*	-0.068 (0.105)	0.097 (0.110)	-0.150 (0.118)	0.021 (0.124)
	N	625	678	382	418	321	355
	Adj. R2	0.22	0.19	0.31	0.27	0.32	0.30
	# of countries	59	59	40	40	30	30
	F-test, OMP	0.02	0.15	0.00	0.01	0.00	0.07
	F-test, Macro	0.00	0.19	0.00	0.00	0.00	0.00
	F-test, Ext. Link	0.02	0.01	0.22	0.52	0.37	0.49
	F-test, Inst. Dev.	0.26	0.53	0.02	0.13	0.07	0.41
	F-test, All	0.00	0.01	0.00	0.00	0.00	0.00

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. The second estimation is conducted for the estimates $\hat{\gamma}_{Fi}^{C}$ from the first-step estimation that does not include China as one of the center economies. Time fixed effects for the three-year panels and the constant are also included, though their estimates are not reported.

Table 5: Interactive Effects and Exchange Market Pressure Sensitivity to Core Exchange Market Pressure, 1986-2012

	Corr. b/w CE's MM and Countries' EMP			Corr. b/w CE's REER and Countries' EMP			Corr. b/w CE's EMP and Countries' EMP		
	FULL	LDC	EMG	FULL	LDC	EMG	FULL	LDC	EMG
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exchange rate stability	-186.31	-84.62	-161.73	8.351	19.587	18.713	-0.277	0.402	0.439
	(171.16)	(371.54)	(314.44)	(6.225)	(6.890)***	(7.407)**	(0.220)	(0.302)	(0.322)
Financial openness	51.15	-258.35	-262.67	-10.296	-21.161	-17.558	-0.204	0.097	0.118
	(153.17)	(331.24)	(272.59)	(5.571)*	(6.143)***	(6.421)***	(0.197)	(0.269)	(0.280)
IR Holding	561.50	1,090.15	888.59	-20.095	-14.726	-6.901	0.460	-0.058	-0.087
	(245.98)**	(487.00)**	(427.27)**	(8.947)**	(9.031)	(10.064)	(0.317)	(0.395)	(0.438)
CA balance (%)	-593.36	-2,641.66	-652.60	59.261	67.269	28.283	1.191	0.973	2.029
	(1,051.28)	(1,780.93)	(1,482.22)	(38.237)	(33.026)**	(34.914)	(1.353)	(1.446)	(1.520)
Gross debt (%)	-156.83	-313.78	-240.79	-5.544	-2.352	-0.804	-0.029	-0.281	-0.357
	(131.08)	(241.32)	(191.05)	(4.768)	(4.475)	(4.500)	(0.169)	(0.196)	(0.196)*
Trade demand	-537.11	-1,027.42	-2,726.26	39.433	8.589	14.270	-2.600	-3.573	-3.522
	(992.73)	(1,784.10)	(1,478.31)*	(36.107)	(33.085)	(34.822)	(1.278)**	(1.448)**	(1.516)**
Fin. Dev.	-250.45	-500.85	-276.97	-11.077	-10.351	-12.094	0.827	0.495	0.240
	(202.33)	(342.08)	(280.57)	(7.359)	(6.344)	(6.609)*	(0.260)***	(0.278)*	(0.288)
KAO x CAB	-1,912.78	-2,522.00	-817.90	-54.082	-24.893	-68.213	-3.164	-3.496	-2.907
	(1,103.96)*	(1,990.26)	(1,803.57)	(40.153)	(36.908)	(42.483)	(1.421)**	(1.616)**	(1.849)
KAO x Debt	-122.31	-129.68	-39.58	5.922	-7.144	-5.077	-0.108	-0.170	-0.198
	(147.74)	(312.96)	(251.57)	(5.373)	(5.804)	(5.926)	(0.190)	(0.254)	(0.258)
KAO x Trade Demand	-32.80	748.99	984.54	-21.672	18.136	-0.896	4.677	5.619	5.333
	(1,022.77)	(1,834.10)	(1,487.89)	(37.200)	(34.012)	(35.047)	(1.317)***	(1.489)***	(1.526)***
KAO x FD.	514.79	56.77	-304.72	-8.619	-16.551	-19.001	-0.635	-0.326	-0.243
	(216.95)**	(427.73)	(364.40)	(7.891)	(7.932)**	(8.584)**	(0.279)**	(0.347)	(0.374)
ERS x CAB	4,295.00	6,439.94	2,488.60	-65.220	-108.129	-1.265	3.797	4.131	1.684
	(1,219.04)***	(2,204.84)***	(2,141.21)	(44.338)	(40.888)***	(50.437)	(1.569)**	(1.790)**	(2.196)
ERS x Debt	269.16	508.41	298.50	6.127	10.041	6.626	-0.013	0.313	0.431
	(188.07)	(358.44)	(286.88)	(6.840)	(6.647)	(6.758)	(0.242)	(0.291)	(0.294)
ERS x Trade Demand	2,276.38	3,485.31	4,992.84	-75.257	-90.629	-89.484	-1.263	-2.984	-2.035
	(1,168.05)*	(2,392.58)	(2,099.68)**	(42.484)*	(44.369)**	(49.458)*	(1.504)	(1.942)	(2.153)
ERS x FD.	-783.07	-502.29	97.01	17.335	26.167	32.941	-0.510	-0.038	0.225
	(254.94)***	(471.76)	(426.71)	(9.273)*	(8.749)***	(10.051)***	(0.328)	(0.383)	(0.438)
N	625	382	321	625	382	320	625	382	321
Adj. R2	0.23	0.22	0.13	0.16	0.18	0.16	0.22	0.31	0.32
# of countries	59	40	30	59	40	30	59	40	30
F-test, OMP	0.11	0.16	0.18	0.03	0.00	0.01	0.17	0.48	0.46
F-test, Macro	0.48	0.13	0.60	0.29	0.23	0.88	0.04	0.01	0.01
F-test, Ext. Link	0.00	0.00	0.31	0.05	0.07	0.17	0.02	0.06	0.13
F-test, Inst. Dev.	0.32	0.26	0.61	0.00	0.21	0.06	0.01	0.11	0.42
F-test, Int. Terms	0.00	0.05	0.17	0.11	0.01	0.02	0.00	0.00	0.02
F-test, All	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. The estimates for inflation volatility, trade competition, legal development, currency and banking crisis dummies, and fixed effects are omitted from presentation due to space limitation.

Table 6: Interactive Effects for Developing Countries Conditional on KAOPEN and ERS

(a) Effect of CAB *Deterioration* (–2 ppt)
in the MM-EMP Estimation

		KAOPEN		
		0.00	0.50	1.00
ERS*	0.00	52.83	27.61	2.39
	0.50	-11.57	-36.79	-62.01
	1.00	-75.97	-101.19	-126.41

(b) Effect of Financial Development
(+10 ppt) in the REER-EMP Estimation

		KAOPEN*		
		0.00	0.50	1.00
ERS*	0.00	-1.04	-1.86	-2.69
	0.50	0.27	-0.55	-1.38
	1.00	1.58	0.75	-0.07

(e) Effect of CAB *Deterioration* (–2 ppt)
in the EMP-EMP Estimation

		KAOPEN*		
		0.00	0.50	1.00
ERS*	0.00	-0.02	0.02	0.05
	0.50	-0.06	-0.03	0.01
	1.00	-0.10	-0.07	-0.03

(c) Effect of CAB *Deterioration* (–0.02
ppt) in the REER-EMP Estimation

		KAOPEN		
		0.00	0.50	1.00
ERS*	0.00	-1.35	-1.10	-0.85
	0.50	-0.26	-0.02	0.23
	1.00	0.82	1.07	1.32

(f) Effect of Trade Demand (+5 ppt) by
the CE in the EMP-EMP Estimation

		KAOPEN*		
		0.00	0.50	1.00
ERS	0.00	-0.18	-0.04	0.10
	0.50	-0.25	-0.11	0.03
	1.00	-0.33	-0.19	-0.05

(d) Effect of Trade Demand (+5 ppt) in
the REER-EMP Estimation

		KAOPEN		
		0.00	0.50	1.00
ERS*	0.00	0.43	0.88	1.34
	0.50	-1.84	-1.38	-0.93
	1.00	-4.10	-3.65	-3.20

Note: "*" superscripted to KAOPEN or ERS in the tables means that the interaction term between KAOPEN or ERS and the variable of concern is found to be statistically significant in each respective estimation.

Figure 1: Correlations of the Short-Term Interest Rates with the United States
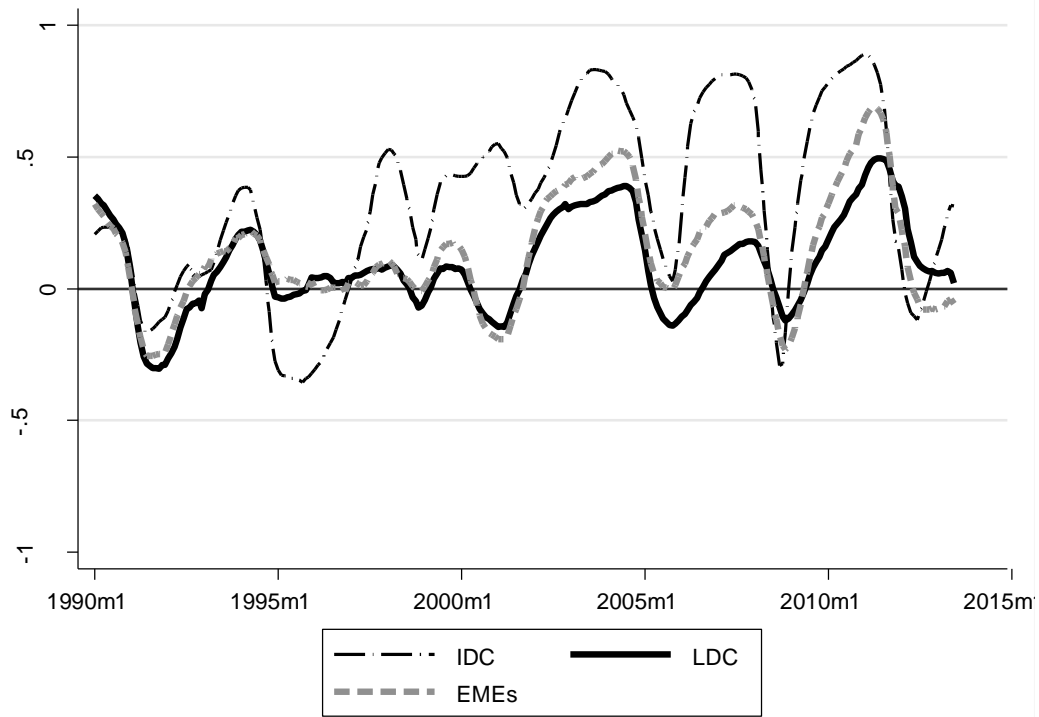
Figure 2: Correlations of the Long-Term Interest Rates with the U.S.
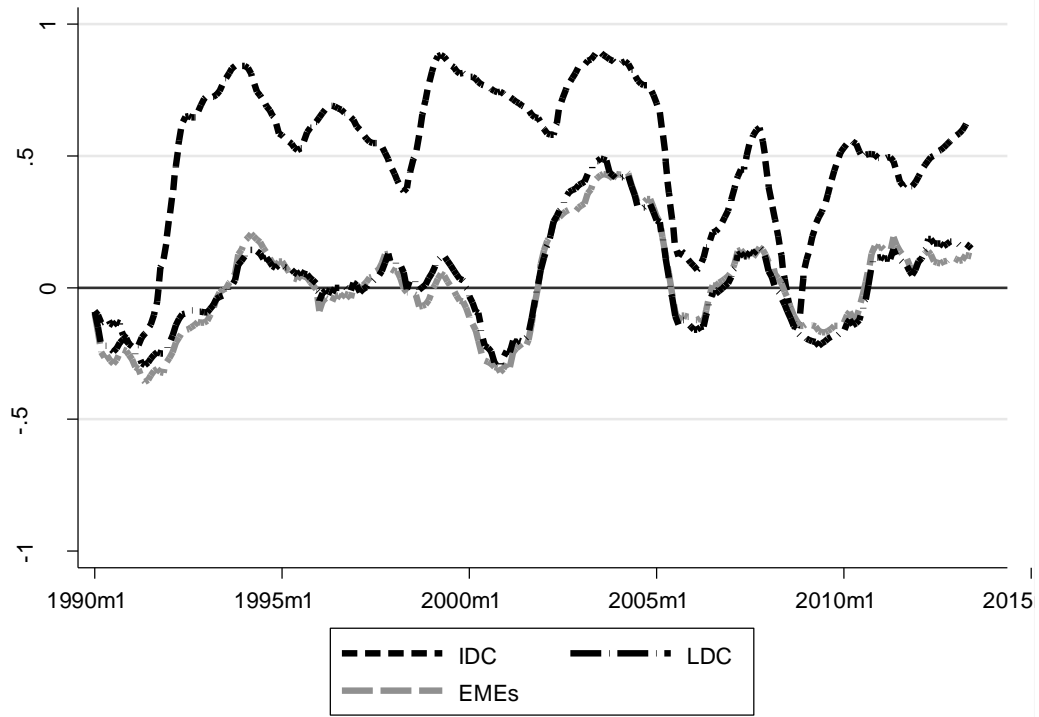
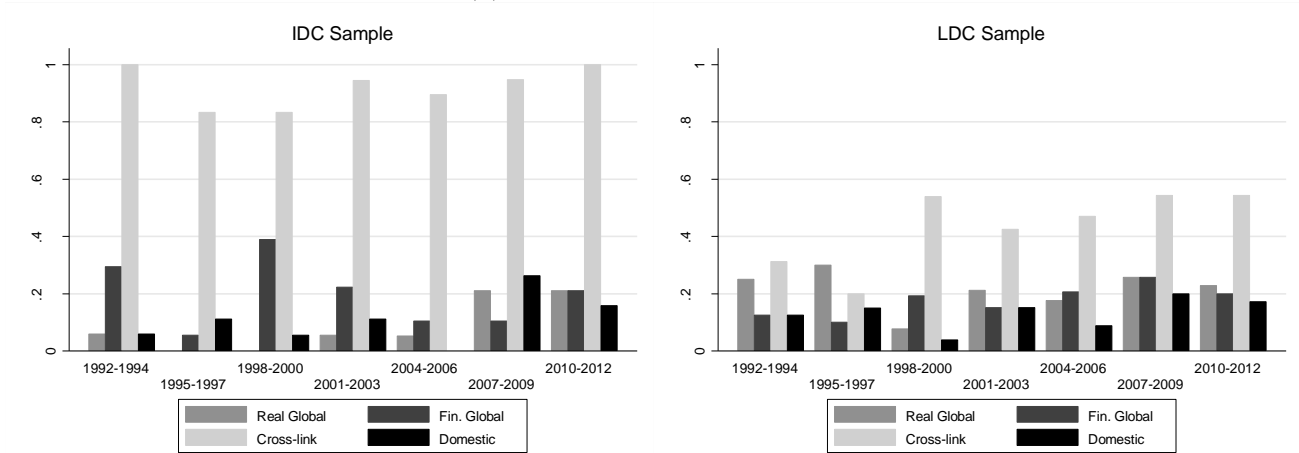**Figure 3: Correlations of the Stock Market Price Indexes with the U.S.**
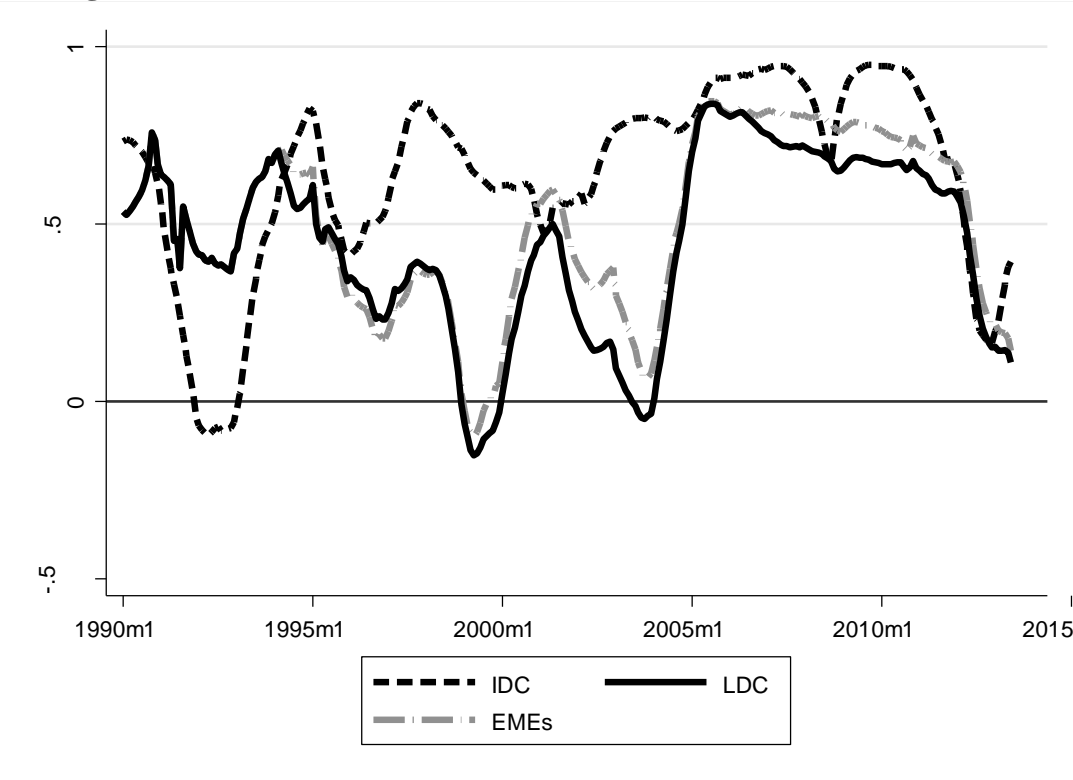
Figure 4: Proportion of Significant F-Tests

(a) Policy Interest Rate
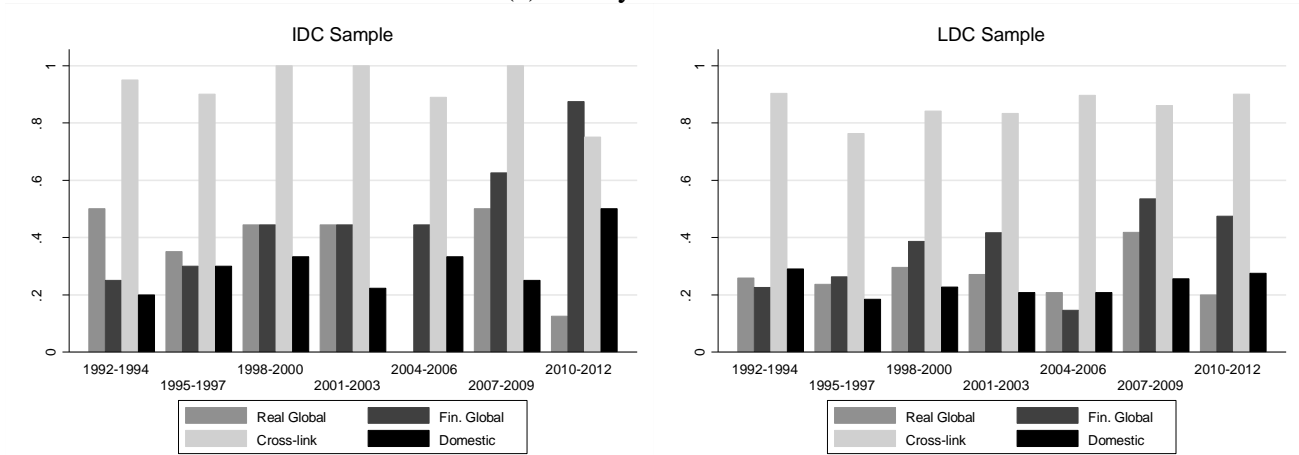
(b) Stock Market Price Index

(c) Term spread
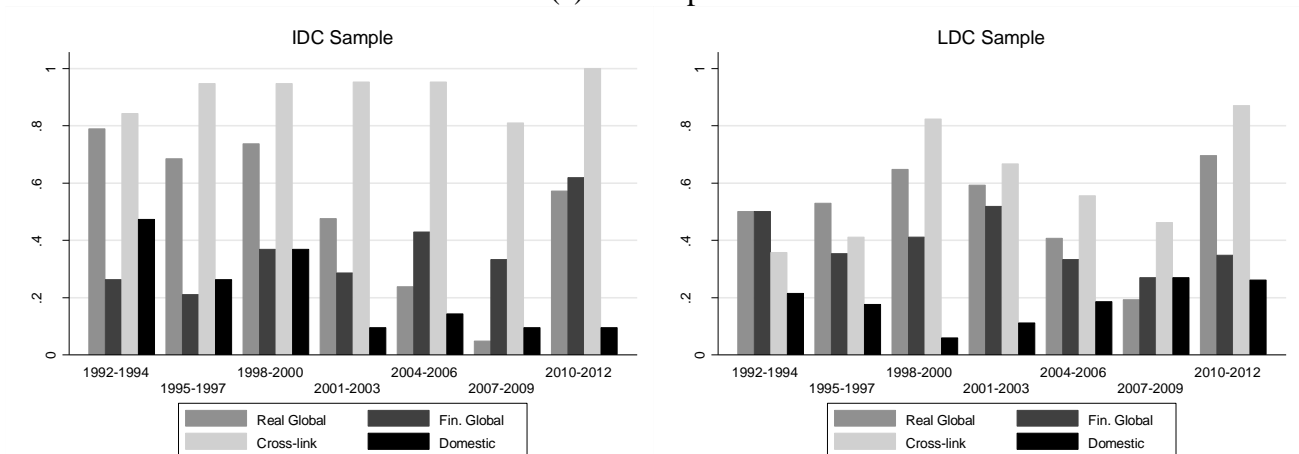
Figure 4: continued
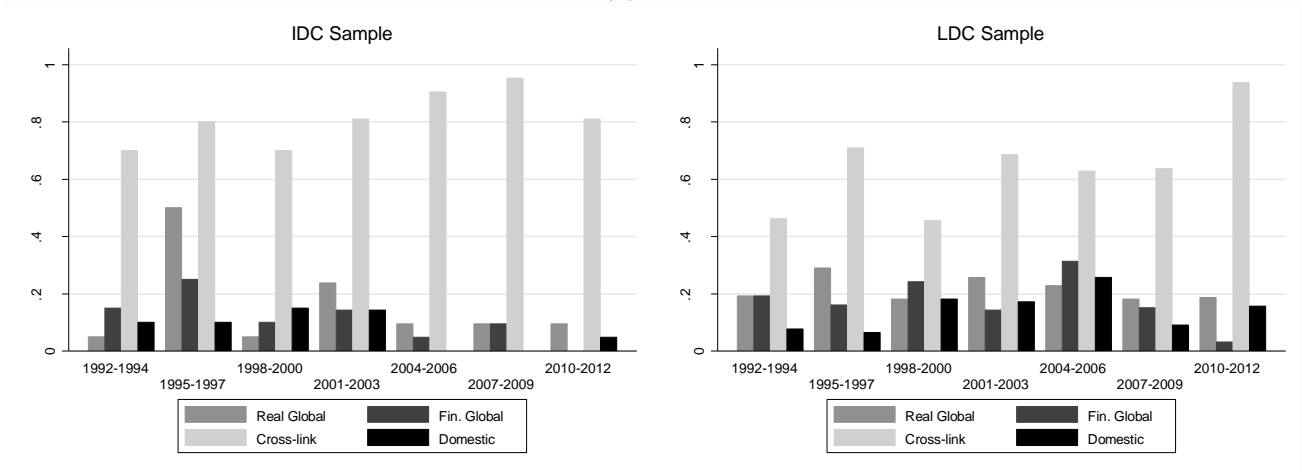(d) REER

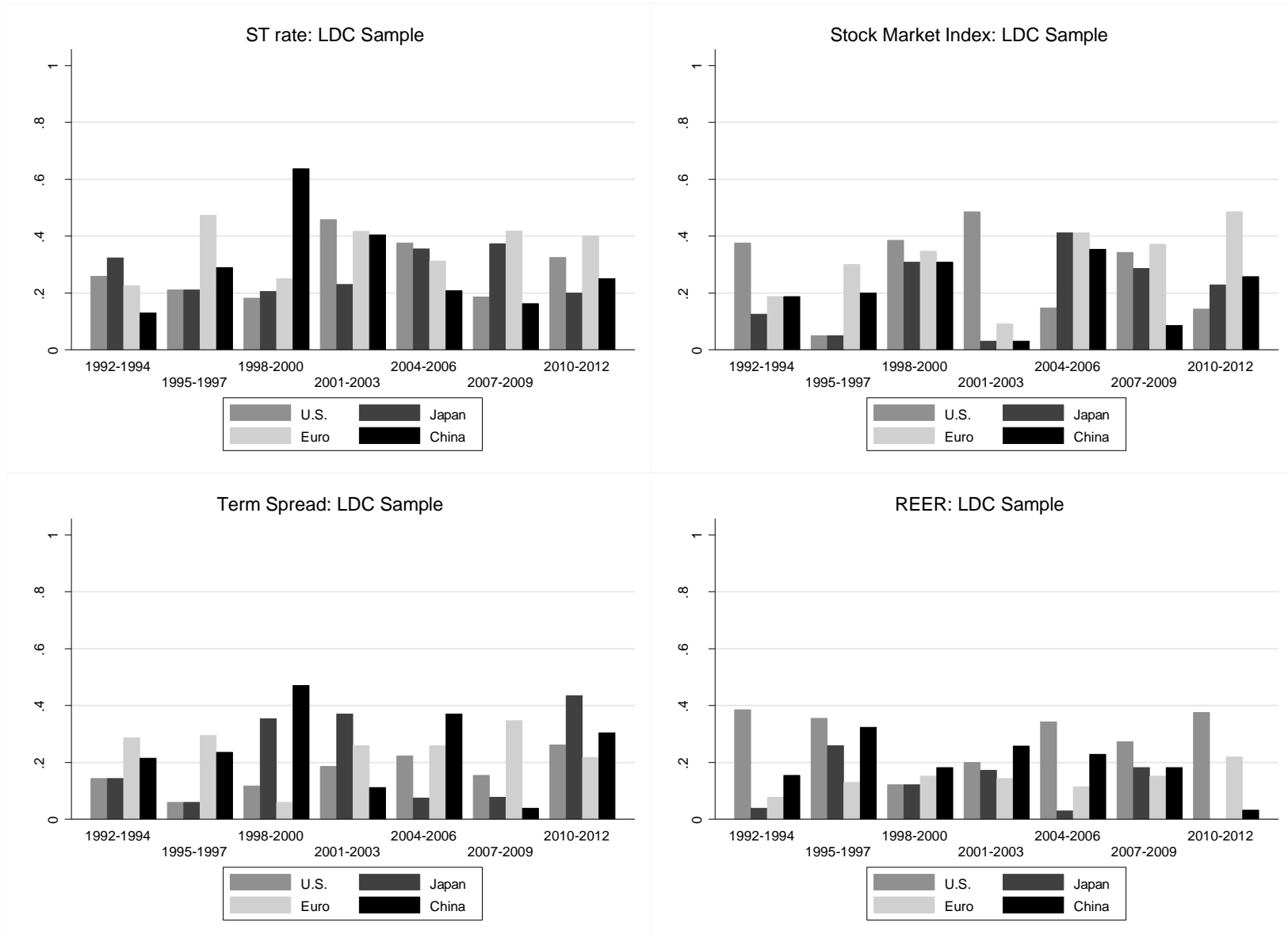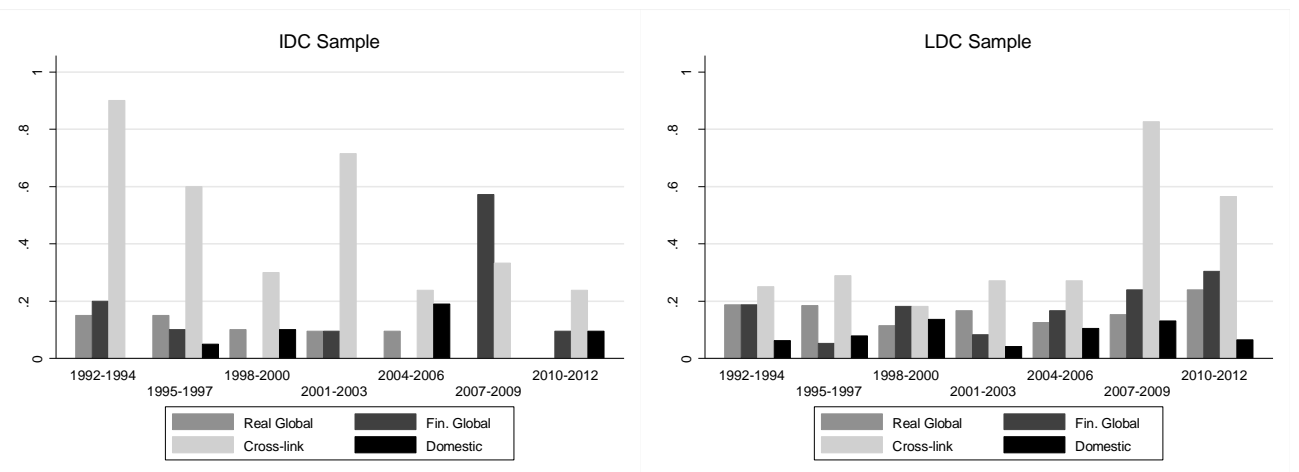# Figure 5: Proportion of Significant $\hat{\gamma}_c > 0$ Tests

ST rate: LDC Sample

Stock Market Index: LDC Sample

Term Spread: LDC Sample

REER: LDC Sample

Figure 6: Contribution to Adjusted R2 of Adding China as a Center economy
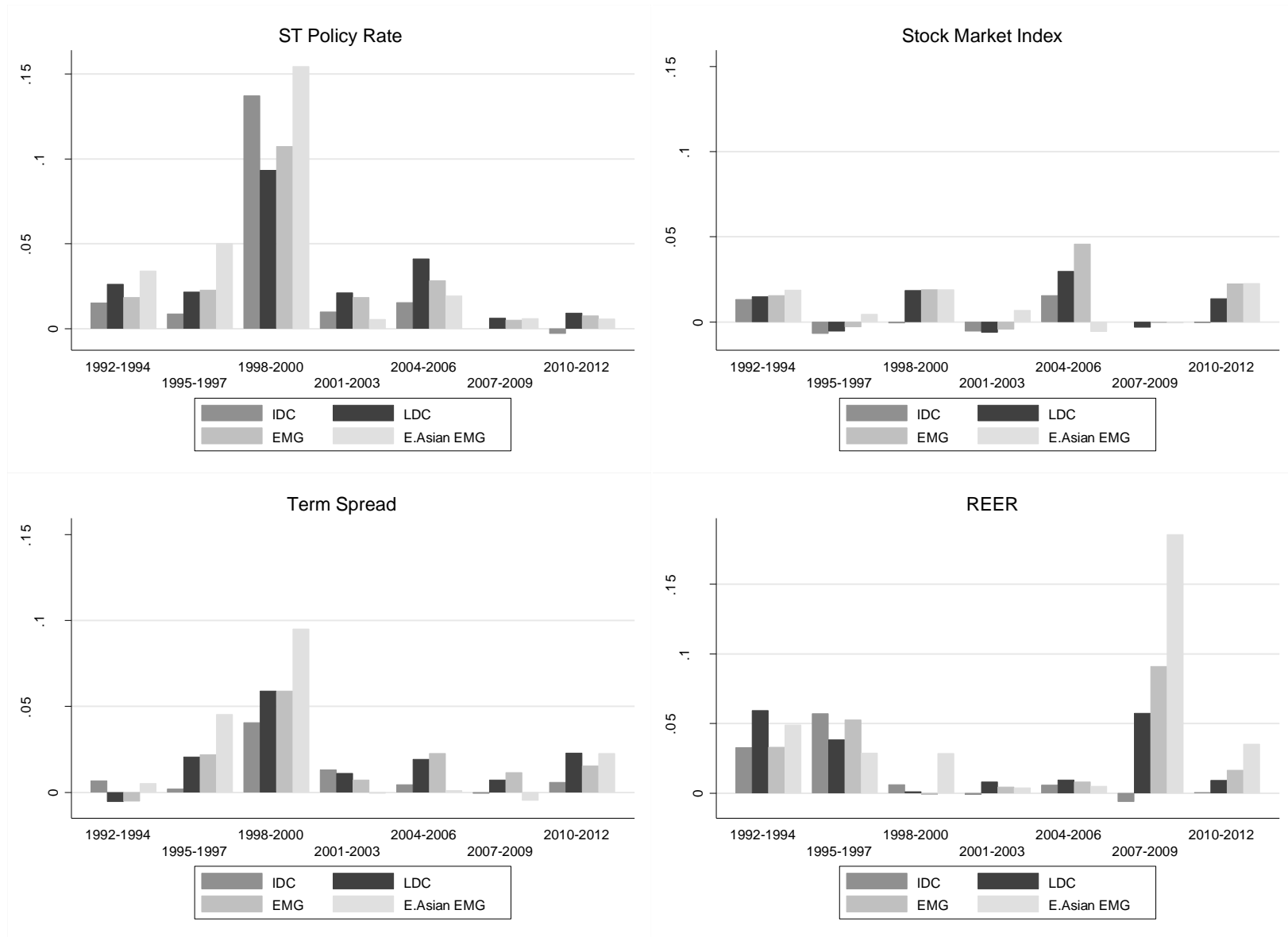
**Figure 7: Exchange Rate, Interest Rate, and Real Money Stock of a Peripheral Country (PH)
In Response to a Rise in the *REER* of the Center Economies (CE)**

*Exchange rate
= price of CE's currency in PH's currency*

E_1

E_0

$R_{CE} + \dfrac{E^{e\,\prime} - E}{E}$

$R_{CE} + \dfrac{E^e - E}{E}$

$R_{PH,0}$

$R_{PH,1}$

PH's Interest Rate

$\left(\dfrac{M}{P}\right)_1$

$\left(\dfrac{M}{P}\right)_0$

*PH's Real Money
Stock*
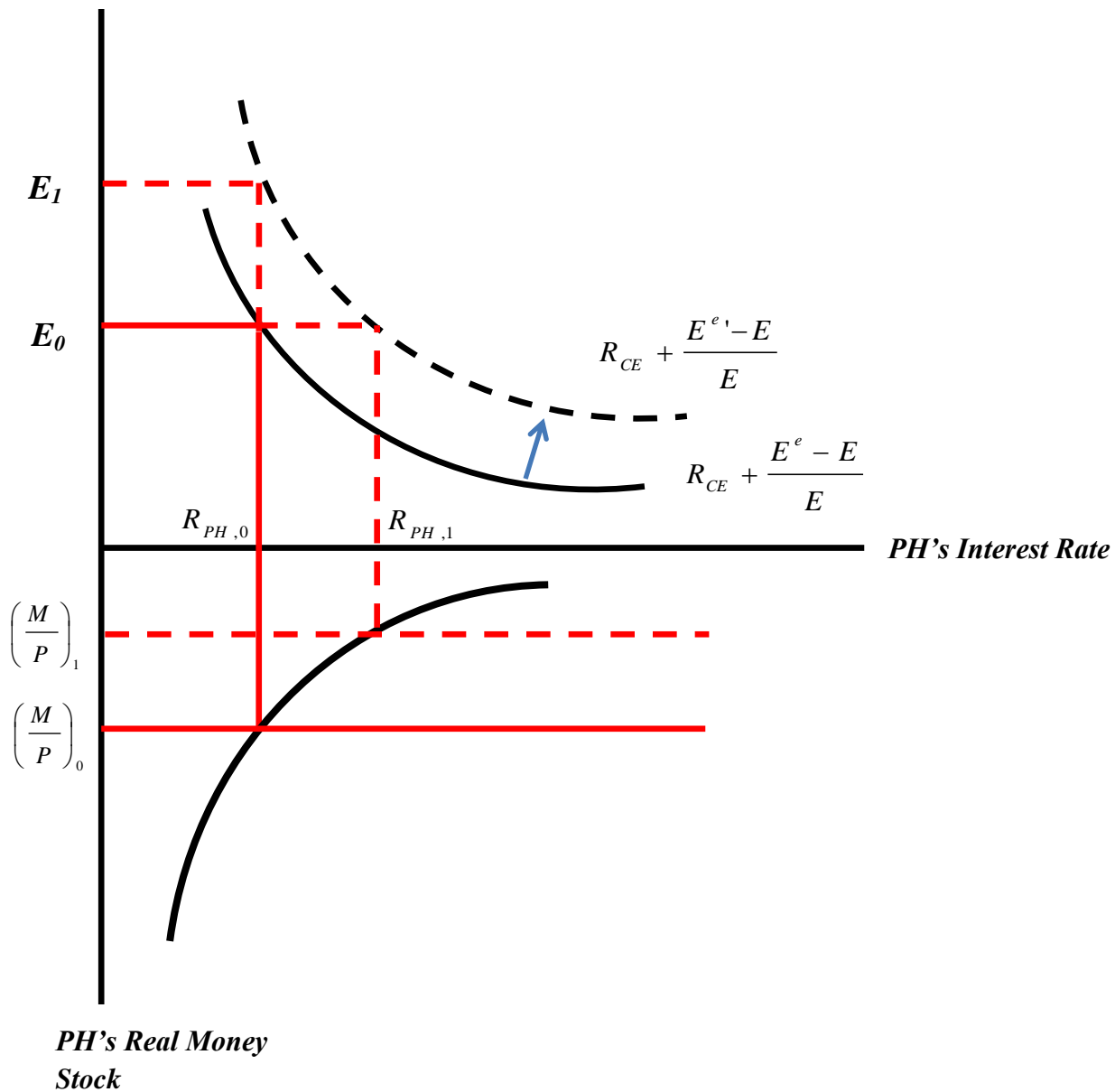
Figure 8: Proportion of Significant F-Tests – EMP Response

(a) Policy Interest Rate
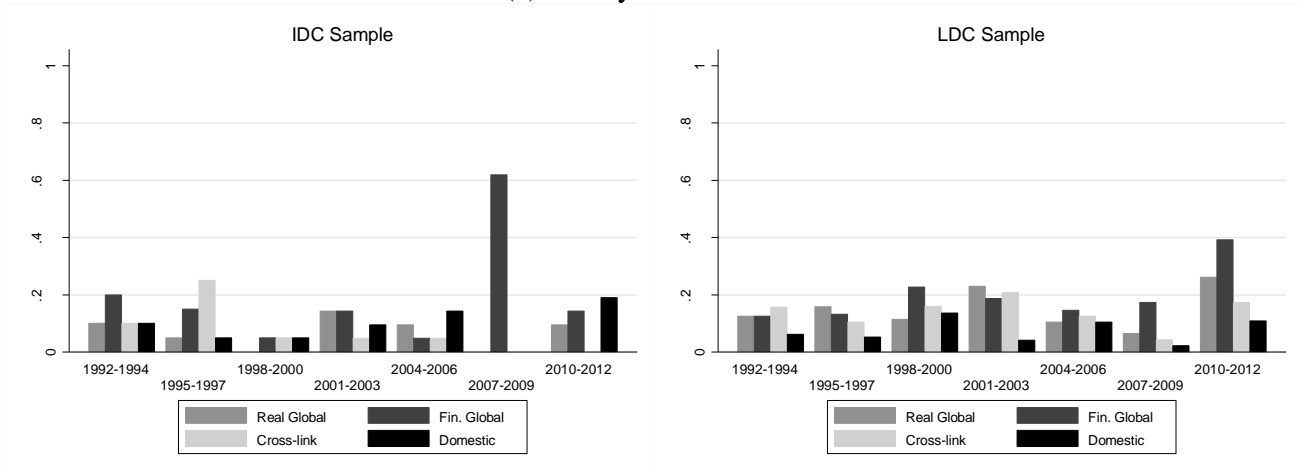
(b) REER
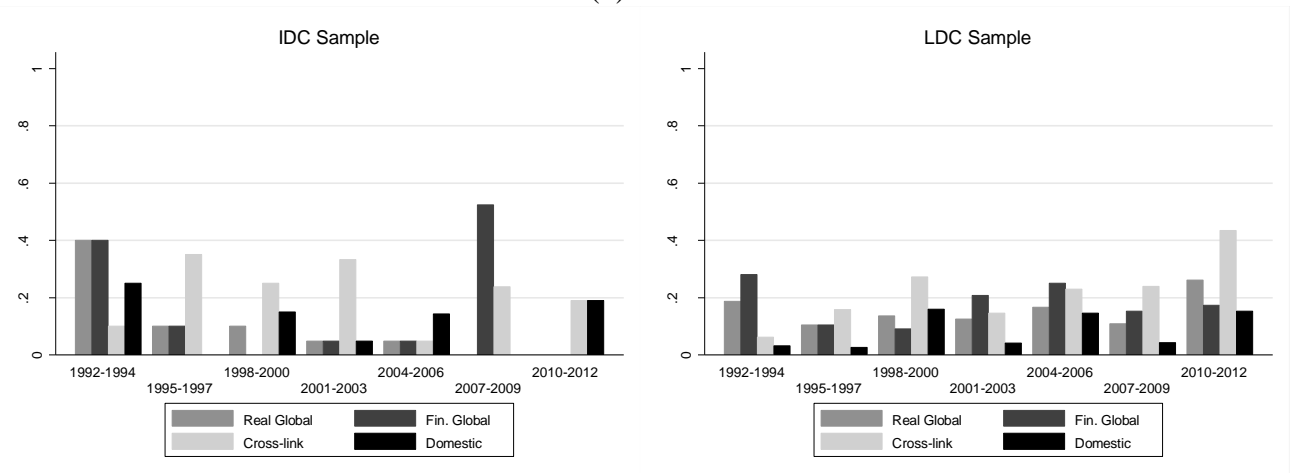
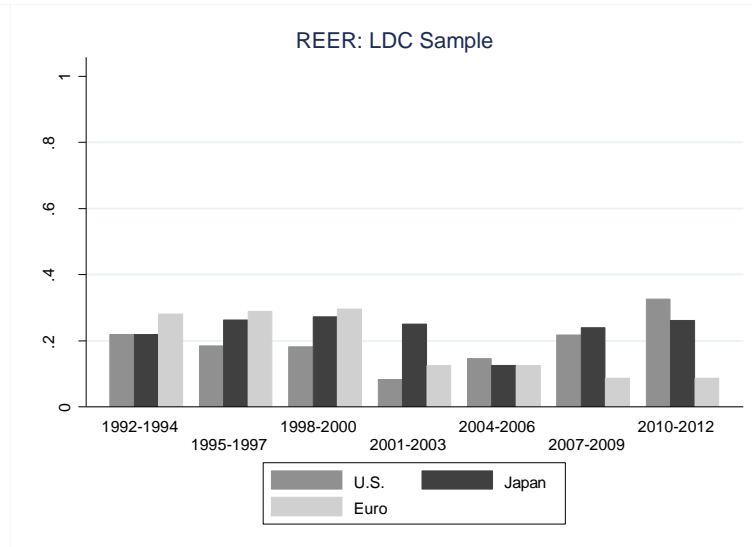### (c) EMP

Figure 9: Proportion of Significant $\hat{\gamma}_c > 0$ or $\hat{\gamma}_c < 0$ Tests
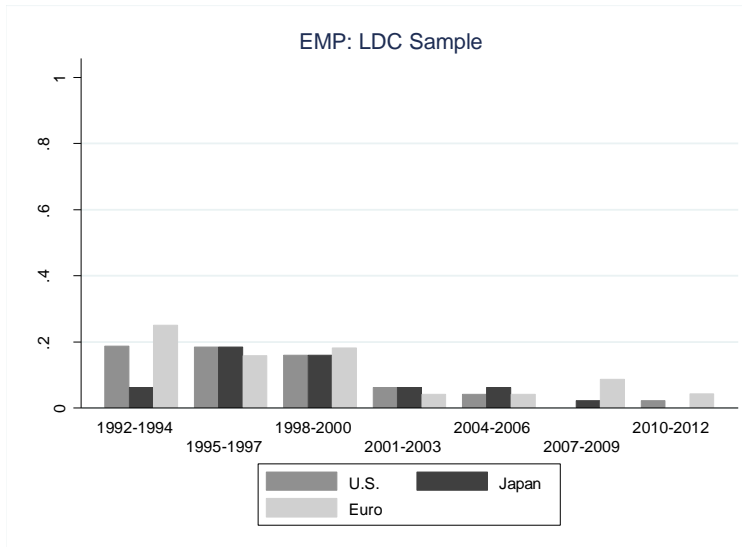
(a) Policy Interest Rate ($\hat{\gamma}_c > 0$)   (b) REER ($\hat{\gamma}_c > 0$)

(c) EMP ($\hat{\gamma}_c > 0$)   (d) EMP ($\hat{\gamma}_c < 0$)