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Xiang Li

Author

Xiang Li
Martin Luther University Halle-Wittenberg and
Halle Institute for Economic Research (IWH) –
Member of the Leibniz Association,
Department of Macroeconomics
E-mail: xiang.li@iwh-halle.de
Tel +49 345 7753 805

Editor

Halle Institute for Economic Research (IWH) –
Member of the Leibniz Association

Address: Kleine Maerkerstrasse 8
D-06108 Halle (Saale), Germany
Postal Address: P.O. Box 11 03 61
D-06017 Halle (Saale), Germany

Tel +49 345 7753 60
Fax +49 345 7753 820

www.iwh-halle.de

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Dilemma and Global Financial Cycle: Evidence from Capital Account Liberalisation Episodes

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Abstract

By focusing on the episodes of substantial capital account liberalisation and adopting a new methodology, this paper provides new evidence on the dilemma and global financial cycle theory. I first identify the capital account liberalisation episodes for 95 countries from 1970 to 2016, and then employ an augmented inverse propensity score weighted (AIPW) estimator to calculate the average treatment effect (ATE) of opening capital account on the interest rate comovements with the core country. Results show that opening capital account causes a country to lose its monetary policy independence, and a floating exchange rate regime cannot shield this effect. Moreover, the impact is stronger when liberalising outward and banking flows.

Keywords: average treatment effect, capital control, global financial cycle, monetary policy autonomy, propensity score matching, trilemma

JEL classification: E52, F32, F33, F42

1 Introduction

According to the textbook Mundellian trilemma theory (Mundell, 1963), freeing capital flows means the loss of monetary policy independence only for countries with fixed exchange rates, while a floating exchange rate regime can shield the impacts on monetary autonomy from capital flows. However, the dilemma and "global financial cycle" theory (Rey, 2013) indicate that capital flows but not exchange rates are necessary and sufficient to ensure the loss of local monetary policy autonomy. In addition to the trilemma-dilemma debates, there is a shift in institutional policy attitudes towards capital controls after the global financial crisis (Ostry et al., 2011). In particular, the recent turmoil in cross-border capital flows during the coronavirus pandemic urges a serious reflection on capital account policies. It is high time to revisit the linkage between capital account openness and monetary independence.

In this paper, I investigate the trilemma-dilemma question and the existence of a "global financial cycle" using the evidence from capital account liberalization episodes. Specifically, the research question is, whether and how capital account liberalization affects a country's monetary autonomy, particularly the comovement with the core country's monetary policy.

The innovation in this paper is not in the question itself, which is a classical one and has abounded a body of literature, but in the perspective and methodology. There are two main empirical challenges to answer the research question. First, the level of financial globalization in the past two decades is particularly high, and the change in capital control or capital account openness is mostly marginal. Second, capital account management policies are endogenous to domestic and global economic conditions, thus it is difficult to provide a causal identification. These challenges could explain the fact that capital account is not in the center stage in the vast literature looking into the trilemma or dilemma, and there is surprisingly little cross-country investigation on the direct linkage between capital account liberalization and monetary autonomy. In this study, I tackle these challenges and

contribute to the literature by focusing on a comparison between closed and open capital account during capital account liberalization episodes over half a century for a large number of countries, and adopting a methodology to address the endogeneity of capital account liberalization policies and provide an estimate of the average treatment effect (ATE) on monetary policy comovement.

Specifically, first, I detect substantial increases in capital account openness indicators for each country and identify the exact liberalizing years. The sample for this step is over 95 countries for 1970-2016. Then I construct capital account liberalization episodes as the ten years before and ten years after the liberalizing year. I also keep the countries that have not experienced any capital account events and maintained a closed capital account throughout the sample period. Thus, I have the treatment variable which takes a value of one for the years after liberalization and zero otherwise. Second, I estimate the probability of capital account liberalization using a probit model to explain the treatment dummy, from which I obtain the propensity score of opening capital account for each country-year. Third, I measure monetary policy autonomy mainly as the correlations of the change in short-term interest rates between the local economy and the base economy. Moreover, I also use alternative measures such as the correlations of long-term interest rate, the gaps of credit growth or liquidity growth. Lastly, I compute the augmented inverse propensity score weighted estimator (AIPW), combined with local projections (Jordà, 2005) over the horizon of ten years, to estimate the average treatment effect of capital account liberalization on monetary policy autonomy.

The main findings are threefold. First, opening capital account leads to a significant increase in interest rate correlations with the base economy. Moreover, the effect is strong and persistent over the ten-year horizon. The accumulative ATE is an increase by 0.15 of the short-term interest rate correlation coefficient ten years after capital account liberalization, which is equivalent to enlarging the average interest rate comovements by nearly 60% or 0.4 standard deviations. Sec-

ond, the impact of a strong comovement of monetary policy is not mitigated by floating exchange rate regimes. Besides, it is present when the base economy is either easing or tightening its monetary policy, and for both advanced and emerging economies. Therefore, my findings support the dilemma over the Mundellian trilemma. Third, the trade-off between open capital account and monetary policy independence is stronger for policies that liberalize outward than inward capital flows, and is particularly strong when liberalizing banking-related capital flows.

This study uses the propensity score of financial liberalization to address endogeneity concerns, and the same spirit is shared with Forbes et al. (2015) and Levchenko et al. (2009). However, my work differs from theirs in the following perspectives. First, in terms of the research question, while Forbes et al. (2015) focus on the effects of capital flow management measures on the exchange rate and financial fragility and Levchenko et al. (2009) emphasize the effects on economic growth and volatility, this paper is designed not to evaluate the consequences of capital account liberalization, but to use it as a way to investigate the trilemma-dilemma debates by focusing on the monetary autonomy after liberalization. Second, in terms of methodology, these two papers employ the estimated propensity score in a matching practice and then adopt the difference-in-difference specification, meanwhile, I do not use the propensity scores in matching but follow Jordà and Taylor (2016) to directly employ them in an AIPW estimator to calculate the average treatment effects. Third, though Forbes et al. (2015) include a simple discussion on the interest differentials, they only capture very short-term effects (within six months) using the short sample from 2009 to 2011, in contrast, this paper estimates the long-term effects over ten years using the sample from 1970 to 2016. The different sample and horizon, in addition to a different estimator, could be the reason that they do not find significant impacts but this paper does.

The reminder of this paper is as follows. Section 2 provides a literature review. Section 3 describes the methodology and analytical framework. Section 4 describes the identification of capital account liberalization episodes, the estima-

tion of propensity scores, and the construction of variables. Section 5 presents the empirical results and Section 6 shows robustness checks. Section 7 concludes.

2 Literature

This paper mainly relates to three branches of literature. In addition to a direct linkage to the trilemma-dilemma debates, this paper also adds to the discussion on the international monetary policy spillover to the local credit market, and the effects of financial globalization.

First, it contributes to the studies examining trilemma-dilemma debates by providing new evidence from the capital account liberalization episodes. Decades of studies are devoted to testing the fundamental theory in international finance, that is, the impossible trinity among free capital flow, stable exchange rate, and independent monetary policy. General findings support the trilemma as most studies, including Shambaugh (2004) and the reference therein, show a significant difference between pegged and non-pegged countries and that the trilemma is alive and well. The seminal work by Rey (2013) then revives the field by documenting a dilemma instead of a trilemma, that is, a trade-off between free capital flow and monetary policy independence regardless of the exchange rate regime. Since then, there is vast literature looking into the trilemma-dilemma debates. Findings are inconclusive due to different sample coverage of periods and countries. For instance, Obstfeld (2021) and Obstfeld et al. (2019) find that countries with floating exchange rates are better positioned than those with fixed exchange rates to moderate the impact from global monetary policy shocks and the change in global financial conditions, but floating exchange rate regime alone can not ensure monetary independence; Han and Wei (2018) find evidence between a trilemma and a dilemma as exchange rate flexibility offers some monetary autonomy when the base country tightens its monetary policy but fails to do so when it eases monetary policy; and Georgiadis and Zhu (2021) generally support the trilemma, but

also support the dilemma through the financial channel of exchange rates when the country has negative foreign-currency exposures.

In this branch of literature, the conventional methodology is to use cross-country panel data to relate the domestic policy rate to the base country policy rate, while controlling domestic fundamentals and other global variables, and then investigate the sensitivity of the coefficients to exchange rate flexibility and capital controls. On one hand, this methodology is flawed in that it cannot address the endogeneity of capital control policies, which could be affected by domestic fundamentals and financial conditions, thus the monetary policy. On the other hand, the changes in capital controls, especially the substantial ones, are not in the center stage of the existing studies. Moreover, using the data of the post-1990s only includes marginal changes in capital account controls as financial globalization has been at a high level in this period. However, the role of capital account liberalization is at the center of the global financial cycle and dilemma theory. To the best of my knowledge, this paper is the first one to focus on capital account liberalization episodes back to as early as 1970 and investigate its effect on monetary comovement. Besides, I adopt the AIPW method to account for the endogeneity of the liberalization policy and can estimate the average treatment effect.

Second, this paper relates to the literature on the international monetary transmission to the local credit market. Building on the global financial cycle theory, recently there is increasing interest in the impacts of global factors, captured by capital inflows or U.S. monetary policy, on the local credit cycle. Using micro-level data from a single emerging market, Baskaya et al. (2017) find a strong positive relationship between international capital inflow and local credit supply, and Di Giovanni et al. (2021) show that an easing global financial condition leads to an increase in local lending. Passari and Rey (2015) and Miranda-Agrippino and Rey (2020) show that monetary policy shocks from the U.S. induce strong comovements in the international financial variables such as asset price, global

credit, capital inflows, and the leverage of financial intermediaries. Focusing on the role of U.S. monetary policy, many studies (e.g., Rey, 2016; Jordà et al., 2019; Bräuning and Ivashina, 2020; Kalemli-Özcan, 2019; Born et al., 2020) explore the international credit channel of monetary policy based on the response of risk premium and find that U.S. monetary policy is a powerful driver of global risk appetite. However, these studies are conducted under the framework of a free capital account; in contrast, I investigate how the change from a closed to an open capital account affect the synchronization between local and base economy's credit condition. Moreover, my finding that capital account liberalization narrows the gap of credit growth between the local and base economy is consistent with findings in this branch of literature.

Third, this paper adds to the literature on the effects of capital controls or financial globalization, especially the effect on monetary independence. As summarized in Erten et al. (2021), a majority of the literature on capital controls focuses on the influence on economic growth and financial stability, while direct investigations between capital controls and monetary autonomy are surprisingly limited and largely rely on a single country's experience. For instance, De Gregorio et al. (2000) and Edison and Reinhart (2001) examine the effectiveness of capital controls in Chile, Brazil, Malaysia, and Thailand in the 1990s, and Chamon and Garcia (2016) study the capital control measures in Brazil in 2009-2011. Magud et al. (2018) also show that capital controls in general increase monetary policy independence, with particularly strong effects in Chile and Malaysia. Using loan-level data from Colombia, Dias et al. (2020) evaluate the effects of capital controls on the transmission of domestic and international monetary policy shocks and find that capital controls are effective at reestablishing monetary policy independence. In this paper, I utilize various episodes of countries removing capital controls and adopt a new estimation methodology to provide evidence that liberalizing capital account leads to a loss of monetary autonomy.

3 Methodology

This paper designs to estimate the average treatment effect (ATE) of opening capital account on monetary autonomy. Denote y_t the outcome variable of interest and $D_t = d, d \in \{0, 1\}$ the capital account liberalization treatment. More specifically, I aim to estimate the impacts of the treatment on the difference $y_{t+h} - y_t$, which is the cumulative change in the outcome from t to $t + h$. To identify the causal effect of a treatment in non-experimental data, the following conditional independence assumption (CIA) is required (Rosenbaum and Rubin, 1983):

$$[y_{t+h}(d) - y_t] \perp D_t \mid X_t, \text{ for all } h > 0 \text{ and for } d \in \{0, 1\} \tag{1}$$

where $y_{t+h}(d)$ is the potential outcome when the unit receives the treatment $(d = 1)$ or not $(d = 0)$, X_t is a vector of covariates that could be factors of the treatment policy such that the CIA is satisfied. Equation (1) indicates that the treatment selection is independent of potential outcomes, conditional on the covariates.

Rosenbaum and Rubin (1983) also show that the CIA will continue to hold when conditional on the propensity score predicted from covariates:

$$[y_{t+h}(d) - y_t] \perp D_t \mid p(D_t = 1|X_t) \text{ for all } h > 0 \text{ and for } d \in \{0, 1\} \tag{2}$$

where $p(D_t = 1|X_t)$ is the propensity score indicating the likelihood of receiving a treatment conditional on X_t and one can use a probit model to estimate it. Equation (2) shows that it is sufficient to match the treatment and control group based on propensity scores instead of matching along all dimensions of the covariates.

Denoting the propensity score $p(D_t = 1|X_t) = p_1(X_t)$ and $p(D_t = 0|X_t) = p_0(X_t)$, it is obvious that $p_1(X_t) = 1 - p_0(X_t)$. Then the ATE can be written as:

$$
\begin{aligned}
E\{[y_{t+h}(1)-y_t]-[y_{t+h}(0)-y_t]\} &= E(E\{[y_{t+h}(1)-y_t]-[y_{t+h}(0)-y_t]|X_t\}) \\
&= E\{(y_{t+h}-y_t)[\frac{1\{D_t=1\}}{p_1(X_t)}-\frac{1\{D_t=0\}}{p_0(X_t)}]\}
\end{aligned} \tag{3}
$$

where the last equivalence is based on $E[(y_{t+h}-y_t)1\{D_t=j\}|X_t] = E\{[y_{t+h}(j)-y_t]|X_t\}p_j(X_t)$ for $j=1,0$.

Thus, applying to observable data, it gives the inverse propensity score weighted (IPW) estimator of the ATE:

$$
ATE^h_{IPW} = \frac{1}{N}\Sigma_t\Big\{\Big[\frac{D_t(y_{t+h}-y_t)}{\hat{p}_t}-\frac{(1-D_t)(y_{t+h}-y_t)}{(1-\hat{p}_t)}\Big]\Big\} \tag{4}
$$

where $\hat{p}_t$ is the predicted probability of treatment, $\hat{p}_t = \hat{p}_1(X_t)$ and $1-\hat{p}_t = \hat{p}_0(X_t)$, and it is used to achieve a re-randomization of the treatment.

Following the literature, several improvements are made to the IPW estimator to increase robustness and efficiency of the estimation through weights renormalization and regression adjustment (Lunceford and Davidian, 2004). Specifically, I employ the following augmented inverse propensity score weighted (AIPW) estimator in this paper:

$$
\begin{aligned}
ATE^h_{AIPW} = \frac{1}{N}\Sigma_t\Big\{&\Big[\frac{D_t(y_{t+h}-y_t)}{\hat{p}_t}-\frac{(1-D_t)(y_{t+h}-y_t)}{(1-\hat{p}_t)}\Big] \\
&-\frac{(D_t-\hat{p}_t)}{\hat{p}_t(1-\hat{p}_t)}\left[(1-\hat{p}_t)m^h_1(X_t)+\hat{p}_t m^h_0(X_t)\right]\Big\}
\end{aligned} \tag{5}
$$

In Equation (5), the second term is a regression adjustment component, where $m^h_1(X_t)$ and $m^h_0(X_t)$ is the estimated conditional mean (conditional on X_t) of $y_{t+h}-y_t$ in treated and control subpopulation based on regression. Lastly, I rely on a sandwich estimator of the variance as used in Lunceford and Davidian (2004) to compute clustered robust standard errors.

Such AIPW estimator is "double robust" so long as the regression for the outcome is properly specified *or* the propensity score is properly specified (Imbens, 2004), and recently it has been used in macroeconomic studies such as Jordà and Taylor (2016) and Born et al. (2020) to examine the impacts of fiscal austerity shock and risk spread shock.

The AIPW method is a good choice to answer the research question in this paper, that is, whether capital account liberalization causes the country to lose monetary autonomy. Now I show how to translate the methodological language to the economic issue in question.

Starting from the uncovered interest rate parity (UIP), i.e., the expected returns on the same asset of any two currencies are equal when measured in the same currency, the relationship between the nominal interest rate of country i (R_{it}) and that of the base country b (R_{bt}) is the following, when international capital can flow without restrictions :

$$R_{it} = \frac{E^e_{it}}{E_{it}}(1 + R_{bt}) - 1 \tag{6}$$

where E_{it} is the exchange rate denoted as the amount of country i's currency per one unit of base country currency, thus an increase in E_{it} indicates a depreciation of country i, and E^e_{it} is the expected exchange rate of the next period at time t. Note here that I ignore the risk premium under the assumption of similar risks of the same category of assets across economies, which is reasonable for money market instruments (short-term) and government bonds (long-term) with similar maturity.

With capital controls, which can be modeled as a tax charged on capital inflows ($\pi^{in}_{it} \in [0, 1]$) and/or capital outflows ($\pi^{out}_{it} \in [0, 1]$)[1], the return of investing in the base economy asset is subject to both a outflow tax (when exchanged to base economy currency in the current period) and an inflow tax (when exchanged back

[1] π^{in}_{it} could be equal to π^{out}_{it}. Here I distinguish between the inward and outward wedge to fit a more general specification.

to domestic currency in the next period). The link between interest rates of the domestic and base economy can be rewritten as:

$$R_{it} = \frac{E^e_{it}}{E_{it}}(1 - \pi^{out}_{it})(1 - \pi^{in}_{it})(1 + R_{bt}) - 1 \tag{7}$$

Thus:

$$\frac{\partial R_{it}}{\partial R_{bt}} = \frac{E^e_{it}}{E_{it}}(1 - \pi^{out}_{it})(1 - \pi^{in}_{it}) \tag{8}$$

That is, the domestic interest rate is a function of the interest rate in the base economy, exchange rate thus its regime, and capital controls. More specifically, the extent to which the domestic interest rate is affected by the interest rate in the base economy depends on the exchange rate regime and capital control policies. For instance, a fixed exchange rate and open capital account ($\frac{E^e_{it}}{E_{it}} = 1, \pi^{out/in}_{it} = 0$) indicate that the local interest rate must comove with the base country and their correlation is one, thus the country has no monetary autonomy. Generally speaking, given exchange rate regime and expectation, more capital control (an increase in $\pi^{out/in}_{it}$) contributes to a more independent monetary policy. Meanwhile, the impact of a more flexible exchange rate regime is uncertain as it depends on the direction of exchange rate expectation.

A measurement of the interest rate comovement is the y_t in equation (5), and I am interested in the cumulative change of the interest rate correlation along a ten-year horizon ($y_{t+h} - y_t, h = 1, 2, ...10$). A higher correlation indicates more spillover from the base economy and less monetary policy autonomy for the local economy. For capital control policy, I see it as the key treatment in this study and create a dummy variable indicating capital account liberalization episode, which is the D_t in equation (5). Moreover, I use a set of variables, including logarithm of GDP per capita, the volatility of economic growth, trade openness, degree of democracy, and exchange rate stability, to predict the likelihood of opening capital account and obtain the propensity score $\hat{p}_t$. Details of identifying capital

account liberalization and calculating the propensity scores are described in the next section.

One possible concern of the identification strategy, especially when disentangling the trilemma and dilemma, is that opening capital account could be a joint decision with exchange rate regime which might also affect monetary policy co-movement. To address this concern, I take three measures. First, I include exchange rate stability and country-fixed effects when estimate the propensity score of capital account liberalization, thus the time-invariant country-specific exchange rate regime characteristics are absorbed and the volatility of exchange rate is controlled. Second, I separately estimate the impact of liberalizing capital account for a subsample of countries with flexible exchange rate regime, thus the endogenous choice of exchange rate regime is minimized. Third, I include the exchange rate regime and stability in the X_t in equation (5). In X_t, I additionally include GDP growth and inflation to account for the role of Taylor-rule in domestic monetary policy, and trade openness and oil price to account for the current account influence and global factors[2], which can capture various macroeconomic shocks.

4 Data

4.1 Capital Account Liberalization Treatment

Capital account liberalization is the treatment variable in this study. Generally speaking, I identify the exact year in which a country liberalized its capital account from 1970 to 2016, that is, converting from a closed account to an open one, by finding the substantial jumps of capital account openness indicators. Admittedly, capital account liberalization is not a one-time event but rather a continuous process. However, using this method to generate the treatment variable of capital account liberalization is reasonable in the following senses.

[2]VIX is usually used to account for global factors, but it is not available until the 1980s while my sample starts from 1970. Oil price is shown in the literature as an important and significant variable of global factors in driving capital flows and global financial cycle (Reinhart and Reinhart, 2009; Drechsel et al., 2019; Forbes and Warnock, 2021).

First, governments were determined in certain years to liberalize their capital accounts and removed many constraints on international capital flow. These years mark a substantial shift in capital account liberalization and can form strong before-and-after contrasts, which can be used as a quasi-experiment. For instance, Larrain (2015) and Larrain and Stumpner (2017) adopt a similar approach to identify open years and employ a difference-in-difference specification to study the dynamic impact of capital account liberalization. Second, I impose the restriction that the liberalization treatment should last for at least ten years after the initial event, and the capital account is closed for at least ten years before the liberalization event, thus, the contrast between closed to open capital account is substantial in the twenty-year window and there is no reversal within. This step means that my sample of capital account liberalization is the more structural and long-standing ones, instead of cyclical and temporary ones that are regularly adjusted over the business cycle. In other words, I limit the sample to the removing of "walls" instead of episodically opening "gates" (Klein, 2012; Klein and Shambaugh, 2015). Third, my way of constructing the treatment of capital account liberalization is similar to the way Jordà and Taylor (2016) and Born et al. (2020) generating the treatment variable of fiscal austerity and risk premium increase, respectively, to estimate their average treatment effects.

I mainly follow the literature, including Levchenko et al. (2009), Braun and Raddatz (2007), and Li and Su (2021), with some supplements and revisions to find liberalizing years of each country based on *de jure* capital account openness indicators. Specifically, I use regressions to identify the year that substantially changes the 10-year average of the *de jure* indicator in the 20-year window centered around that year. I use the capital account openness index from Chinn and Ito (2008) (Chinn-Ito hereafter) as baseline analysis, but also report results based on the other two widely-used indicators from Quinn and Toyoda (2008) (Quinn-Toyoda hereafter) and Fernández et al. (2016) (FKRSU hereafter) as ro-

bustness checks. Each index has its advantages and disadvantages.[3] For instance, the Chinn-Ito index has the broadest country coverage and is widely used in the literature, but one of the components in this index involves a five-year moving average of the absence of capital controls which could affect the identification of a structural break; the Quinn-Toyoda index does not account for the activities of capital transactions masked under the current account; the FKRSU index is able to distinguish different directions and types of liberalization (i.e., inward or outward liberalization, and liberalization of FDI, portfolio equity, portfolio debt, or other investment), but it is only available since 1995, and I need to follow Bekaert et al. (2016) to extend it back to 1970 to have the pseudo-FKRSU index.[4] However, as you will see in the robustness checks, the main findings in this paper do not depend on the choice of capital account openness indicators. Due to space limitations, I explain the detailed procedures to find the structural break year based on each of the three *de jure* capital account openness indicators in Section A2 in the appendix, and report the identified liberalizing years for each country in Table A1.[5] In short, I construct a dataset documenting the capital account history of each country, that is, either its capital account has remained closed or liberalized during the entire sample period, or it has experienced a substantial change from a closed to an open capital account in specific years.

The endogeneity or selection bias is the biggest empirical challenge in this literature (Erten et al., 2021), as capital account liberalization is not a random choice nor an exogenous policy shock, and its timing and level could be affected by the outcome variables. Similar to the propensity score matching method used

[3]For a detailed comparison between each index, please refer to Erten et al. (2021) which provides a systemic review.

[4]$FKRSU^{j}_{i,t} = \alpha_{i,t} + \beta_1 KA\_OPEN_{i,t} + \beta_2 CAP_{i,t} + \beta_3 CUR_{i,t} + \delta_i + \epsilon_{i,t}$, where j is each type of openness in FKRSU indicators, $KA\_OPEN_{i,t}$ is the Chinn-Ito index, $CAP_{i,t}$ and $CUR_{i,t}$ are from the Quinn-Toyoda indicators. Li and Su (2021) provide a detailed description of extending the FKRSU indicators.

[5]Here is an example of Brazil. Based on the Chinn-Ito index, I identify that Brazil substantially opened its capital account in 2000 and this liberalization episode ends in 2011. This is consistent with Goldfajn and Minella (2007) who document in detail the important reference points since the late 1990s in the process of capital account liberalization of Brazil and with Chamon and Garcia (2016) who document the tightening of capital account restrictions in Brazil in the early 2010s.

in Levchenko et al. (2009) and Forbes et al. (2015), the re-randomization of the AIPW method is a good way to deal with this issue by re-assigning the weights based on the probability of opening the capital account. To do that, I estimate a probit model of the capital account liberalization treatment and use the predicted probability as the propensity score ($\hat{p}$). Specifically, I estimate:

$$pscore_{it} = Pr(Open_{it} = 1|Covariates) \tag{9}$$

where $Open_{it}$ equals 1 if the capital account of country i is open in year t. For countries whose capital accounts have always been closed (open), $Open_{it}$ takes a value of 0 (1). For countries that have experienced a liberalization episode, i.e., shifting from a closed capital account to a liberalized capital account, the value of $Open_{it}$ is 1 in the post-liberalization period and 0 otherwise. In the covariates, I follow Levchenko et al. (2009) and use the logarithm of GDP per capita, the standard deviation of GDP per capita growth for the past five years, and trade openness to account for economic growth and volatility, and the democracy index, *polity*2 from the Polity IV Project, to account for the political environment. Besides, I also include an index of exchange rate stability in the covariates. The choice of the covariates is based on their accountability for capital account openness and data availability to achieve a large coverage. Country fixed effect is specified by including the country average of each variable.

[Table 1 here]

I present the results of probit estimation in Table 1, in which each column represents the estimates using the $Open_{it}$ identified based on each of the three indicators as shown in the title. It shows that all covariates are significant and the explanatory power is high as the area under the receiver operating characteristic (AUROC) reaches 0.85 in all columns. These results indicate that the probit model performs well in predicting capital account liberalization. The predicted values are used as the propensity scores. Figure 1 reports the distribution of propensity

scores for the treated and control units, respectively. It shows that the distribution of treated country-years spike at a value close to one and that of the control spike at a value close to zero, and there is considerable overlap between the distributions. This confirms again that the propensity score estimation is satisfactory to apply the AIPW estimator.

[Figure 1 here]

After the above two procedures, i.e., structural break identification and probit estimation, I now have capital account liberalization treatment episodes and propensity scores. Lastly, as mentioned before, I do not use the countries whose capital account is always open and only keep the countries that have never liberalized their capital account and the countries that have experienced liberalization. Moreover, for each liberalization episode, I restrict the sample to a twenty-year window. Specifically, I require the liberalization treatment to last for at least ten years and the capital account is closed for at least ten years before the liberalization event. This is to make sure that there is enough contrast before and after the treatment and the treatment is persistent.

Combine this restriction with data availability of monetary policy independence explained in the next section, in the baseline analysis which is based on liberalization identification from the Chinn-Ito index, I have 48 capital account liberalization episodes (for 26 emerging countries and 22 advanced economies) and another 35 countries that never liberalized capital account in the sample period (all emerging countries), which are marked in bold fonts in Table A1 in the appendix.

4.2 Monetary Policy Dependence

Unlike existing studies that examine the coefficients of base country's monetary policy rates on local rates while capital account openness only appears as a classification instrument (Georgiadis and Zhu, 2021; Miranda-Agrippino and Rey, 2020; Han and Wei, 2018), this paper focuses on the coefficients of capital account liberalization treatment on the monetary policy comovements. More specifically, the

dependent variable is a measurement of monetary policy dependence of the local economy on the base economy. The base economy is the country that affects local economy's monetary policy the most. I mainly use the base country list defined in Shambaugh (2004), and manually assign for those countries whose data is not available based on the country's economic history and IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*. Though the monetary policy of U.S. has the largest influence across countries and time, many economy's base country is not the U.S.; for instance, European countries more-or-less followed German monetary policy in the pre-euro era, and African countries were tied to the former colonial powers.

I use three measurements of monetary policy dependence and the main findings do not depend on the choice of that. First, in the baseline analysis, I use the correlation coefficients of the *change* in interest rates between the local and the base economy (i.e., $\Delta Short$-$\Delta Short$ and $\Delta Long$-$\Delta Long$ *Correlation*). To construct the correlations, I manually collect short-term and long-term interest rate data for a large number of countries going back to the 1970s as many capital account liberalization episodes happened in the early years. I use short-term interest rate in the main analysis as monetary policy conventionally targets at the short end, then I provide the results based on long-term interest rate in the robustness checks.

Specifically, I first obtain the short-term and long-term interest rates from the IMF International Financial Statistics (IFS), and then expand the country coverage using additional data from Datastream and national statistical bureaus. The specific tenors of short-term and long-term in IFS are different across countries, but the major indicator for the short-term interest rate is the three-month interbank rate, and that for the long-term interest rate is the ten-year government bond yield.[6] Thus, I mainly search for these two indicators for countries that are not included in IFS, but other tenors are used when the two specific tenors are not available for the country. I aim for consistency across countries to the

[6]For instance, in the IFS database, the U.S. short-term interest rate is the federal funds rate (FFR) and its long-term interest rate is the ten-year government bond yield.

greatest extent possible. Moreover, since I control country fixed effects and use the cumulative change in the interest rate change correlations in the estimation, different tenors used in different countries should not cause major concern as long as the same tenor is applied across years within a country. Table A2 in the appendix describes the interest rate definition, data source, and time coverage for each country.

I then compute the short-term (long-term) correlation as the correlation coefficients of the change in short-term (long-term) interest rates between the local economy and the base economy in the past five years. To utilize more observations in computing the correlation coefficients, I use quarterly instead of annual interest rates of the same data series. Specifically, for each country-year, I use the time series of the changes in local country's interest rates and the base country's interest rates in the past twenty quarters to calculate the Pearson's pairwise correlation coefficient.[7] The correlation coefficients of short-term interest rate changes are used in the baseline analysis and that of long-term interest rate changes are used in robustness check.

Second, I use the correlation coefficients of the *level* in interest rates between the local and the base economy (i.e., *Short-Short Correlation*). For this measurement, I directly adopt the monetary policy independence measurement in Aizenman et al. (2008), which is calculated as the reciprocal of the annual correlation of the monthly interest rates between the home country and the base country, and reverse it to the correlation measurement thus a higher value indicates more monetary policy dependence.[8] The main difference between this and the first measurement is computing the correlation based on the *change* or *level* in interest rates. The problem with the interest rate level correlations is a possibility of spurious correlation and erroneous conclusions, especially when compare between flexible and fixed exchange rate regimes, as pointed out in Shambaugh (2004),

[7] I also use the data in the past 12 or 40 quarters to compute alternative correlation measurements and present the results in the appendix in Figure A2.

[8] Specifically, the monetary policy independence in Aizenman et al. (2008) is calculated as $1 - \frac{corr-(-1)}{1-(-1)}$, and I obtain the *corr* from a reversed computation.

thus I use the interest rate change correlations in the baseline and provide the results using interest rate level correlations in the robustness check.

Third, since the comovement of credit supplies in responses to monetary policy changes in the base economy is an important aspect in the global financial cycle studies (Rey, 2013; Miranda-Agrippino and Rey, 2020), I also use the differences of credit growth rates and broad money supply growth rates between the local and the base economy as alternative dependent variables in the robustness check. The data of broad money supply and domestic credit is from the World Development Indicators (WDI). I first calculate the broad money supply growth and domestic credit growth for each country and then calculate the difference with that of the base economies. The panel (a) in Table 2 presents the summary statistics of the outcome variables used in this study.

Figure 2 shows the time series of short-term interest rate level in panel (a) and the correlation measurement in panel (b) for emerging countries and advanced countries separately.[9] It demonstrates many variations across the sample period. First, the interest rates of the base economies hiked in the 1980s and kept declining after that. Its short-term rates came nearly to zero after the 2007-2008 financial crisis. Second, the average short-term interest rates are higher in emerging countries than that in advanced economies after the early 1980s. As shown in Panel (a), the average short-term interest rate in emerging economies reached as high as 40% in the mid-1990s, meanwhile, the highest rate in advanced economies was less than 15% in the early 1980s. Moreover, the rates for emerging economies were more volatile than those for advanced economies. Third, the interest rate comovement, using both the change and level of rates, is very volatile, and the average comovement with the base economies is stronger in advanced economies than that in emerging economies. Besides, Table 2 shows that the average change

[9]I use the IMF classification of advanced and emerging economies. The advanced economies in the main analysis include Australia, Cyprus, Czech Republic, Denmark, Finland, France, Greece, Iceland, Ireland, Israel, Italy, Japan, Malta, New Zealand, Norway, Portugal, Singapore, Slovak Republic, Slovenia, South Korea, Spain, and United Kingdom. The rest are emerging economies.

correlations are 0.25 with a standard deviation of 0.35, while the average level correlations are smaller at 0.18 but with a larger standard deviation of 0.43.

[Figure 2 here]

4.3 Exchange Rate Regime

The key difference between trilemma and dilemma lies in the role of exchange rate regime, which could also confound capital account openness and monetary policy dependence. So I control the exchange rate regime and stability in the estimation and show the impact of opening capital account on monetary policy comovement using the full sample and floater subsample, respectively.

I identify the exchange rate regime using the coarse *de facto* exchange rate arrangement classification by Ilzetzki et al. (2019). Following Han and Wei (2018), I treat category 1 in Ilzetzki et al. (2019)'s dataset as a fixed exchange rate regime and the remaining categories 2-6 as flexible exchange rate regime. A heat map of the fixed-flex regimes across countries and years is shown in the appendix Figure A1. For the stability of exchange rates, I take the measurement from Aizenman et al. (2008), which is a normalized index of the annual standard deviations of the monthly exchange rate between the home country and the base country, and a larger value indicates more stable movement of the exchange rates.[10]

4.4 Other Controls

In the regression to obtain the conditional mean of dependent variables for the treated and control groups, that is, $m_1^h(X_t)$ and $m_0^h(X_t)$ in equation (5), I include a vector of control variables to account for economic fundamentals. Specifically, I control the current and one-year lagged terms of GDP growth rate, inflation, trade openness, and the exchange rate stability. This control set is different from that one used in estimating the likelihood of capital account liberalization and

[10]Specifically, the exchange rate stability is calculated as $\frac{0.01}{0.01+sd(\Delta(log(E)))}$, and Aizenman et al. (2008) apply a correction to avoid the downward bias in the index.

generating the propensity scores as described in Section 4.1. The panel (b) in Table 2 presents the summary statistics of the control variables.

[Table 2 here]

5 Empirical Results

5.1 Baseline Results

Figure 3 and Table 3 show the benchmark results of the paper. The AIPW estimates of the ATE of capital account liberalization on the short-term interest rate *change* correlations with the base economy using the full sample and the subsample of countries with flexible exchange rates, along with their 95% and 90% confidence intervals, are shown in the left and right panels, respectively. The figure demonstrates that the interest rate comovement increases significantly after removing capital controls.

[Figure 3 here]

[Table 3 here]

Specifically, panel (a) of Figure 3 shows that the correlation between short-term interest rate changes in this country and the base country increases significantly, and the effect of enlarged correlation is large and persistent over the 10-year window. Based on the full sample result, the correlation increases by 0.03 at impact, though with a slight decline in the third year, the accumulative effects keep increasing and reach 0.15 ten years after capital account liberalization. On one hand, considering that the average short-term interest change correlation coefficient is 0.25, these results indicate that a free capital account tends to enlarge the comovement of short-term interest rates by nearly 60% in ten years. On the other hand, considering the standard deviations of the correlation coefficient, the effects of capital account liberalization are an increase of interest rate comovements by

more than 0.4 standard deviations. All these results show that capital account liberalization leads to a significant loss of monetary policy autonomy.

Next, I examine whether the above finding holds in countries with floating exchange rates. Specifically, I restrict the sample to countries with flexible exchange rates against the currency in the base economy.[11] Panel (b) in Figure 3 presents the results for the subset of floating countries and Table 3 reports the detailed estimates for the full sample and floater sample. The cumulative responses for floating countries are very similar to that obtained from the full sample. Though the statistical and economic significance is slightly smaller than that in the full sample in the first four years, the magnitudes of the effects are even larger in the later horizons. Overall, the results mean that a flexible exchange rate regime is not able to shield the economy against the monetary policy spillover effects after capital account liberalization, thus it is against the predictions based on the Mundellian trilemma. Therefore, my findings provide empirical support to the global financial cycle theory: as long as the capital account is liberalized, the country tends to lose its monetary policy independence, even when it has a flexible exchange rate regime.

To sum up, these baseline results show that liberalizing capital flows enlarges the comovement of interest rates with the core economy. Moreover, these effects are of large economic significance and lasts in the ten-year horizon. The robust findings in the subsample of floating countries yield support for the dilemma over the trilemma theory.

5.2 Asymmetric Effects

Now I turn to investigate the possible asymmetric effects between base economy monetary policy easing and tightening, and between the advanced economies and emerging economies.

[11] I do not separately report the results using the subset of pegged countries because the sample size is very small. The same practice of reporting results of the full sample and that of the floating subsample is adopted in Miranda-Agrippino and Rey (2020) as well.

To begin with, building on the baseline findings that capital account liberalization does weaken the monetary policy independence by increasing the interest rate comovements with the core economy, I am interested to see whether the enlarged interest rate correlation is asymmetric between easing and tightening periods in the the base economy. Therefore, I split the sample into two bins, that is, an easing bin when the change in short-term interest rates in the base economy is non-positive and a tightening bin when it is positive, and then re-apply the AIPW estimator.

Figure 4 shows that the increase in the interest rates correlation is present in both cases, but stronger when the core economy is tightening rather than easing its monetary policy. Specifically, when base economy's monetary policy eases, the impact on the short-term interest rate change correlations are insignificant in the first eight years, then it becomes significantly positive thereafter though with a relatively small magnitude. In contrast, when the base economy's monetary policy is tightening, opening capital account causes a more pronounced and faster increase in the interest rate comovement. The increased correlation is significant since the first year and remains persistent over the ten years after liberalization. Comparing panels (a) and (b) in Figure 4, the response of monetary policy comovement in the tightening case is stronger that in the easing case.

[Figure 4 here]

Next, I split the sample into advanced economies (AE) and emerging economies (EME), and examine whether the increase in interest rate comovement is different between these two country groups.

Figure 5 shows that there is a contrast of dynamics between EMEs and AEs. In emerging economies, it takes more than nine years for the interest rate comovement to significantly increase, and the impact is even sometimes negative before that. Meanwhile, in advanced economies, the effects of capital account liberalization on the interest rate comovement is a large and significant increase at impact and persistently climbing over the ten years. These results indicate that

the transmission of the global financial cycle is slower to emerging markets than to advanced economies, and the loss of monetary policy autonomy after capital account liberalization is more severe for the latter group.

[Figure 5 here]

Therefore, I conclude that the trade-off between an open capital account and monetary autonomy is more pronounced when the base economy tightens than eases its monetary policy. In addition, the short-run spillover to the interest rate is more pronounced when the country is an advanced economy, while it takes a long time to observe the effect when the country is an emerging economy.

5.3 Capital Account Liberalization Categories

One of the benefits to focus on capital account liberalization is that I can investigate whether there are different impacts on monetary policy autonomy from removing the barriers of different categories of capital flows. The heterogeneity among capital flows is shown important in the literature regarding the response to global factors and the international transmission of monetary policy (Forbes and Warnock, 2014; Baskaya et al., 2017; Avdjiev et al., 2020). In this section, I examine the role of the direction and types of capital account liberalization.

For this purpose, I make use of the capital account liberalization dates identified based on the pseudo-FKRSU index, which extends Fernández et al. (2016)'s index back to 1970. It enables a granular measurement of capital account openness by different categories of assets. There are ten specific categories in the original FKRSU dataset, here I aggregate them into four categories: (i) foreign direct investment (FDI), (ii) portfolio equity, (iii) portfolio bond, and (iv) other investment. The first three categories are original and the last category, i.e., other investment, is the average of the rest seven categories.[12] The reason is that the

[12]The ten categories in the original FKRSU dataset by Fernández et al. (2016) are: direct investment; portfolio equity; portfolio bond; money market; collective investment; derivatives; financial credits; real estate; commercial credits; guaranties, sureties & financial backup facilities.

four categories are consistent with the usual classification in the Balance of Payment (BOP) table and it helps to mitigate collinearity concerns on capital control policies towards different categories of assets. Moreover, the data also allows me to distinguish the direction of capital account liberalization and investigate whether inward and outward liberalization shows different impacts. For simplicity, here I only utilize direction distinction at the aggregated level and do not distinguish the directions in the subcategorical analysis of four types of capital flows.[13]

[Figure 6 here]

Figure 6 shows the results by the direction of capital account liberalization, where the impact of inward liberalization is shown in the left panel and that of outward liberalization is shown in the right panel. They are similar in the sense that the interest rate change correlations are significantly increased, especially in the first four years in both cases, but the magnitudes are stronger, and realizing speeds are faster when the country allows capital outflows than inflows. These results suggest that the pressure of capital outflow when liberalize a country's capital account is the main reason for the country to closely follow the monetary policy in the base economy.

Similarly, Figure 7 presents the results by categories of capital account liberalization. The four panels correspond to the impact of liberalizing cross-border FDI, portfolio equity, portfolio bond, and other investment. The increase in interest rate comovement is the largest and most persistent when liberalizing other investment, which is usually interpreted as banking sector flows in the literature. In contrast, the impact of liberalizing portfolio investments, in particular the equity investment, disappear in the second half of the ten-year horizon. More specifically, over ten years, liberalizing banking flows still shows an increase of monetary policy correlation by 0.14, while the effects of liberalizing other categories of capital flows are much smaller or insignificant.

[13]The results distinguishing direction and type at the same time, i.e., liberalization of inward outward FDI, inward and outward portfolio equity, inward and outward portfolio bond, inward and outward other investment, are available upon request.

In other words, compared with liberalizing equity instruments (i.e., FDI and portfolio equity), liberalizing debt instruments (i.e., portfolio bond and other investment) is more likely to induce strong monetary policy comovement with the base economy. This relates to the distinction between equity-led and debt-led capital flows in Forbes and Warnock (2014) and Georgiadis and Zhu (2021), which find that debt-led capital flows are more associated with global factors. My findings also confirm the importance of debt instruments, and indicate that the global financial cycle is less concerned with the change in foreign ownership and state-contingent payoff through equity and FDI, but more likely to be the results of the change in financing conditions through foreign lending.

[Figure 7 here]

6 Robustness Check

In this section, I show that the main finding, that is, a loss of monetary autonomy after capital account liberalization, does not rely on the choice of the interest rate comovement measurement, the capital account openness measurement, and the sample period.

First of all, I use the long-term interest rate change correlations as the outcome variable and show the results in Figure 8. Long-term interest rate is useful in this study because of two reasons. First, studies have shown that long-term interest rates are important in the trilemma-dilemma discussion. For instance, Obstfeld (2021) tests the trilemma and find that the effects on long-term rates are even stronger with flexible exchange rates, and Bräuning and Ivashina (2020) show that global bank flows to emerging economies are also affected by long-term U.S. interest rates. Second, it is important in the era of monetary policy hitting the zero lower bound (ZLB), and the effects on long-term rates could be the main force of transmission when the central banks ease monetary policy that directly impacts long-term rates but not short-term rates.

[Figure 8 here]

Results show that liberalizing capital account also significantly increases the comovements of long-term interest rates with the core economy, and this effect also holds in the floating countries. Specifically, the long-term interest rate comovement increases significantly by 0.04 and 0.24 by three and nine years after liberalization and the impact is persistent and stable across the ten-year horizon. Using the subsample of floaters, the results are smaller in the middle stage but still show large economic significance over the long run. The larger increase in long-term interest rate comovement compared with that in short-term interest rate is consistent with Obstfeld (2021).

Second, correlations of the change in interest rates are the key variables for monetary autonomy in the literature, however, other ways can also be utilized to account for the monetary policy comovement and global financial cycle. First, I use the correlation of the level instead of change in interest rates between the local and base economy. Second, I take the quantity perspective of monetary policy in addition to the price perspective, as significant reductions in both the price gap and amount growth gap to the base economy are strong evidence of a loss in monetary autonomy. Jordà et al. (2017) have shown that the business cycle correlations are tightly linked with the growth of credit, and Obstfeld et al. (2019) demonstrate the importance of domestic financial conditions, such as credit growth, in addition to interest rates. Thus, I replace the outcome variable with the change in credit growth gap and broad money growth gap. A decrease in the gap indicates a stronger monetary policy comovement.[14] Results are presented in Figure 9. For each alternative outcome variable, I present the results estimated using both the full sample and the subsample of countries with flexible exchange rate regimes.

Panel (a) shows that the short-term interest rate level correlations in this

[14] However, note that the flaws of all these gap measurements are that the reduction of gaps may not necessarily reflect the loss of monetary policy independence but could be the contaminated by effects of removing financial frictions after capital account liberalization.

country and the base country increases throughout the ten-year window. The effect is an increase by 0.02 at impact and then keeps growing to an increase by 0.16 in the tenth year. Comparing panel (b) with panel (a), flexible exchange rate seems to shield the monetary policy comovement in the first four years after capital account liberalization, but after that the cumulative responses for floating countries are very similar to that obtained from the full sample.

[Figure 9 here]

Panel (c) to (f) demonstrate that capital account liberalization closes the gaps of broad money supply and credit growth growth, and the impact on the broad money supply is stronger. Compared to the broad money growth gap, the reduction in the credit growth gap is flatter and the magnitudes of effects are also smaller. These results suggest that there is a strong international transmission of liquidity after liberalizing the account, and this international transmission is likely to be slightly mitigated by domestic monetary policy transmission efficiency to credit.

Third, I show the results using the Quinn-Toyoda and the aggregated pseudo-FKRSU indicators to identify capital account liberalization treatment in Figure 10. Using alternative indicators results in different sample sizes and slightly different magnitudes of estimates, but the main findings that financial globalization significantly increases the correlation of interest rates between domestic and the core economy remain. I also estimate the impact using the subsets of floating economies based on liberalization identified from these two alternative openness indicators, and the results are again very similar to that using the full sample, with smaller magnitudes but still significant increases in interest rate comovement. Overall, it is robust that a flexible exchange rate regime does not isolate the monetary policy spillover from the core economy.

[Figure 10 here]

Lastly, studies including Born et al. (2020) show that there are important changes in interest rate environments after the global financial crisis, so I test whether the main findings are affected by the post-crisis years by re-estimating the baseline specification but limit the sample to years before 2007.

Results are shown in Figure 11. It shows that the increase in interest rate change correlations due to capital account liberalization is still present but the magnitude is smaller when the post-crisis years are excluded. Specifically, the impact only becomes significant in the seventh and sixth year after liberalization, and the accumulative increase in correlation increases by 0.11 and 0.12 over the ten years, for the full sample and floater subsample, respectively. These results suggest that the international monetary policy comovement due to capital account liberalization works in the pre-crisis years with weaker significance, and the global financial cycle becomes stronger after the global financial crisis.

[Figure 11 here]

7 Conclusion

This paper revisits the trilemma-dilemma debates by employing the AIPW estimator to capital account liberalization episodes back to the 1970s of a large number of countries. I find evidence supporting the dilemma and global financial cycle theory, as opening capital account leads to a significant and persistent increase in interest rate comovements, as well as reductions in money supply and credit growth gaps, between the local and the base economy, and the impact is not mitigated by floating exchange rate regimes. Moreover, granular classification of capital account liberalization shows that the trade-off between an open capital account and monetary policy independence is stronger for policies that liberalize outward than inward capital flows, and its long-run effect is the strongest when liberalizing banking flows.

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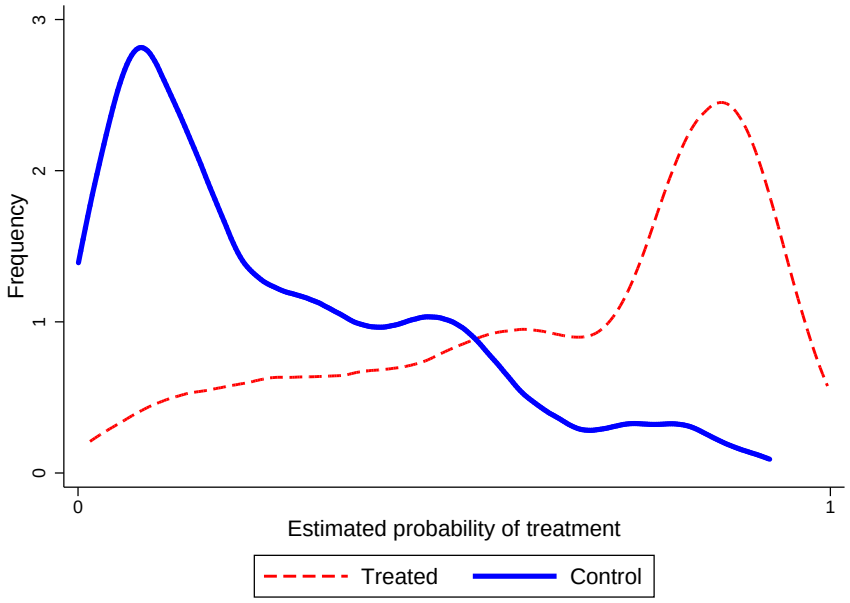
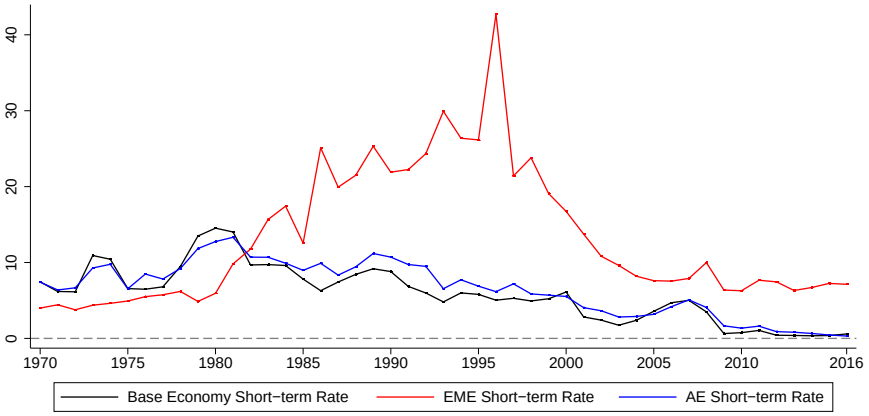
Figures and Tables

Figure 1: Propensity Score Distribution

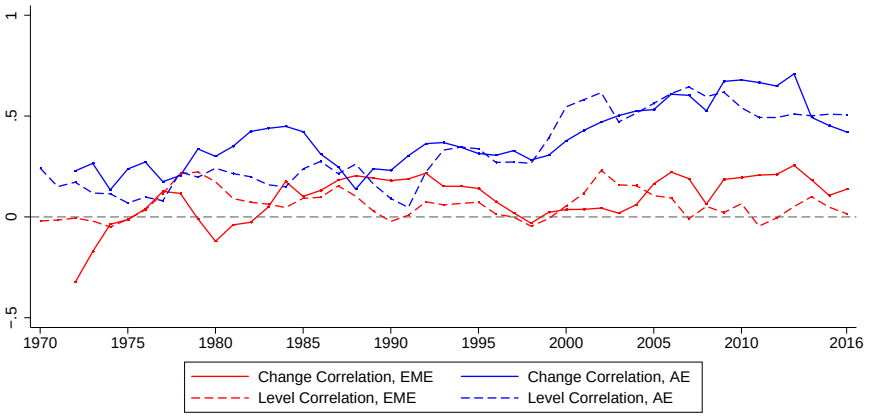


Notes: This figures shows the distribution of the propensity scores for the treated units in red dashed line and that for the control units in blue solid line.

Figure 2: Interest Rates and Interest Rate Correlations



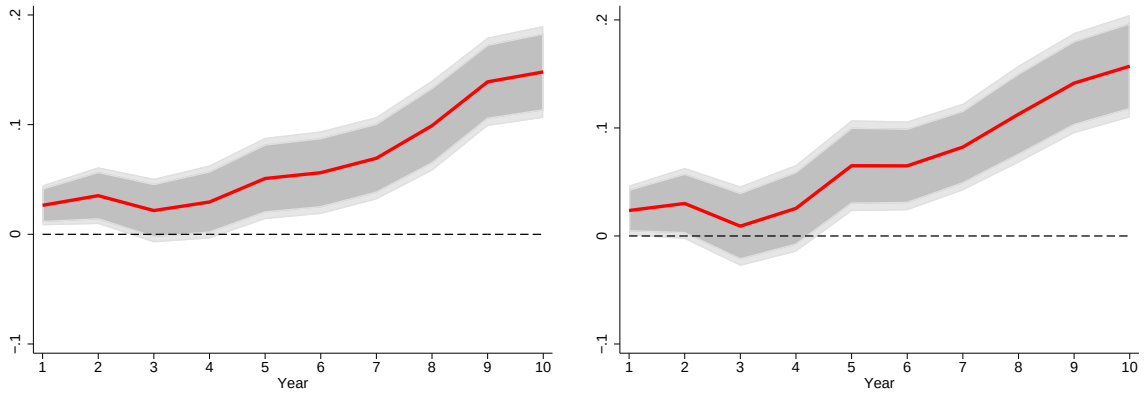
(a) Interest Rates



(b) Interest Rate Correlations

Note: Panel (a) shows the average short-term interest rate for the base economy, emerging economies and advanced economies from 1970 to 2016, respectively. Panel (b) shows the average interest rate correlation coefficients with the base economy for emerging economies and advanced economies, respectively. The correlation coefficients are calculated based on the change or level of quarterly short-term interest rates between the local economy and the base economy in the past twenty quarters. The unit of the y-axis is percentage points in panel (a) and decimal in panel (b).

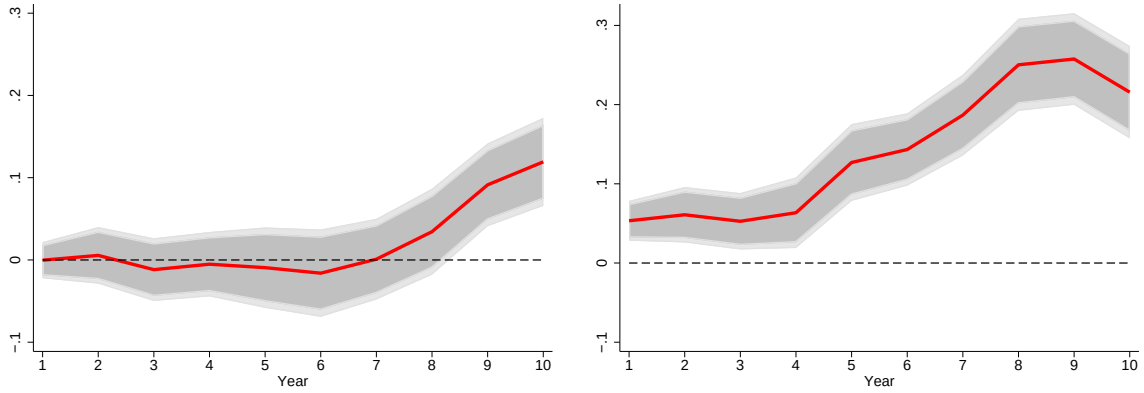
Figure 3: Average Treatment Effect of Capital Account Liberalization



(a) Full Sample (b) Floaters Subsample

Notes: This figures shows the average treatment effects (ATE) based on the AIPW estimator. The dependent variable is the accumulative change in short-term interest rate correlations between local economy and the base economy. The left panel presents the estimates using the full sample and the right panel presents that using the subsample of floaters. The solid lines show the point estimates of the ATE, and the dark and light shades show the 95% and 90% confidence interval of the estimates.

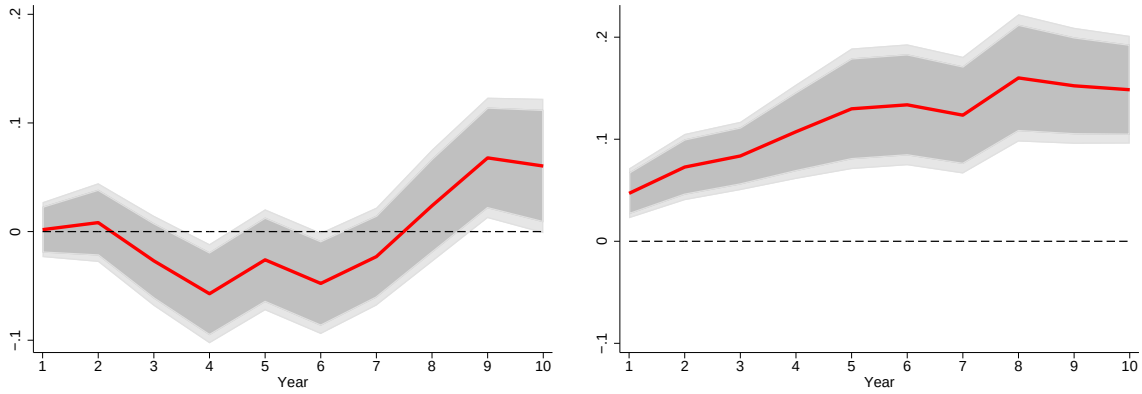
Figure 4: Average Treatment Effect of Capital Account Liberalization, by Base Economy Easing and Tightening



(a) Base Economy Easing (b) Base Economy Tightening

Notes: This figures shows the average treatment effects (ATE) based on the AIPW estimator. I split the sample into two bins, one of base economy monetary policy easing (when the change in short-term interest rates is non-positive) and one of it tightening (when the change in short-term interest rates is positive). Panel (a) shows the results of base economy easing and panel (b) shows the results of base economy tightening. The dependent variable is the accumulative change in short-term interest rate change correlations between local economy and the base economy. The solid lines show the point estimates of the ATE, and the dark and light shades show the 95% and 90% confidence interval of the estimates.

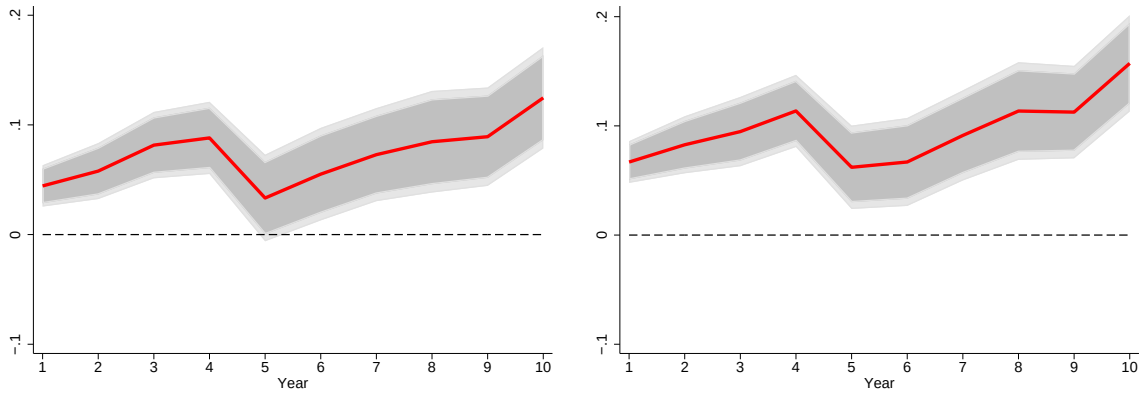
Figure 5: Average Treatment Effect of Capital Account Liberalization, by EME and AE



(a) EME (b) AE

Notes: This figures shows the average treatment effects (ATE) based on the AIPW estimator. I split the sample into two bins, one of emerging economies (EME) and one of advanced economies (AE). Panel (a) shows the results of EME subsample and panel (b) shows the results of AE subsample. The dependent variable is the accumulative change in short-term interest rate change correlations between local economy and the base economy. The solid lines show the point estimates of the ATE, and the dark and light shades show the 95% and 90% confidence interval of the estimates.

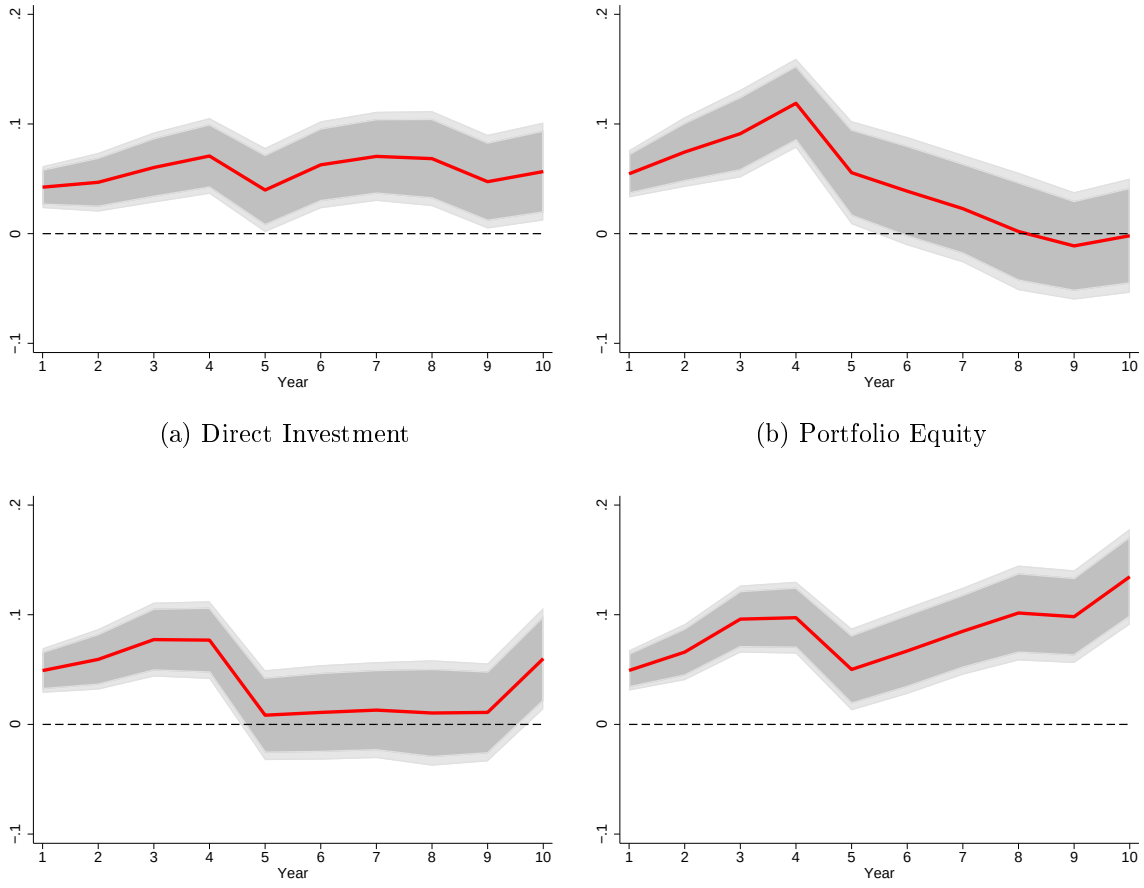
Figure 6: Average Treatment Effect of Inward and Outward Capital Account Liberalization



(a) Inward Liberalization (b) Outward Liberalization

Notes: This figures shows the average treatment effects (ATE) based on the AIPW estimator. Panel (a) shows the results when the country removes the barriers of inward capital flows and panel (b) shows that of outward capital flows. The dependent variable is the accumulative change in short-term interest rate change correlations between local economy and the base economy. The solid lines show the point estimates of the ATE, and the dark and light shades show the 95% and 90% confidence interval of the estimates.

Figure 7: Average Treatment Effect of Four Types of Capital Account Liberalization



(a) Direct Investment

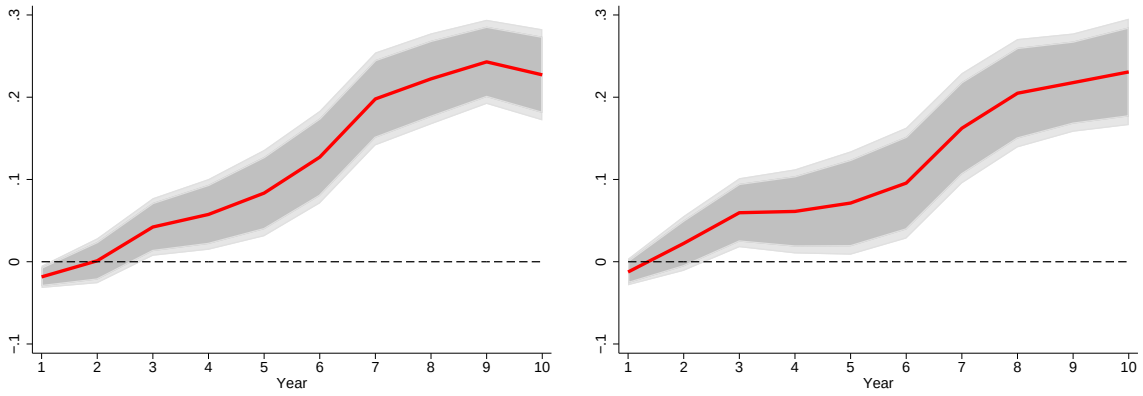
(b) Portfolio Equity

(c) Portfolio Bond

(d) Other Investment

Notes: This figures shows the average treatment effects (ATE) based on the AIPW estimator. Panel (a) shows the results when the country removes the barriers of FDI flows, panel (b) shows that of portfolio equity flows, panel (c) shows that of portfolio bond flows, and panel (d) shows that of other investment flows. The dependent variable is the accumulative change in short-term interest rate change correlations between local economy and the base economy. The solid lines show the point estimates of the ATE, and the dark and light shades show the 95% and 90% confidence interval of the estimates.

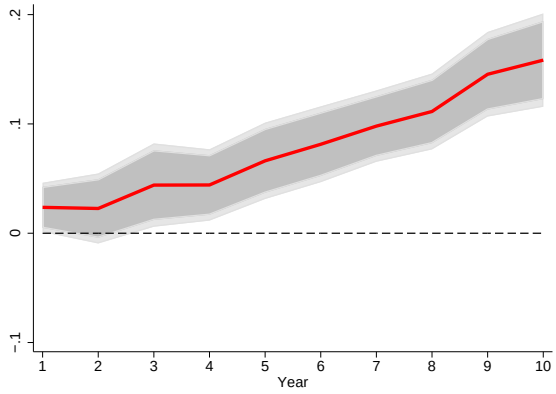
Figure 8: Robustness Check: Long-term Interest Rate Correlation



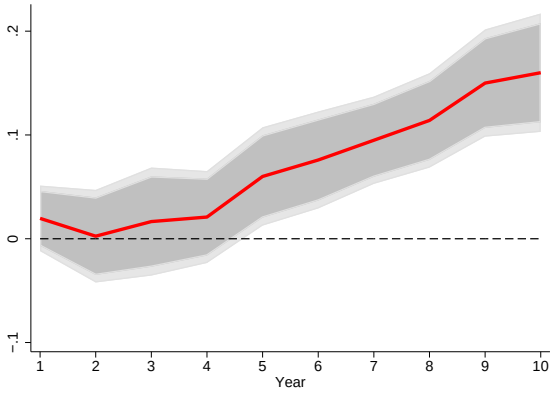
(a) Full Sample (b) Floaters Subsample

Notes: This figures shows the average treatment effects (ATE) based on the AIPW estimator. The dependent variable is the accumulative change in long-term interest rate change correlations between local economy and the base economy. The left panel presents the estimates using the full sample and the right panel presents that using the subsample of floaters. The solid lines show the point estimates of the ATE, and the dark and light shades show the 95% and 90% confidence interval of the estimates.

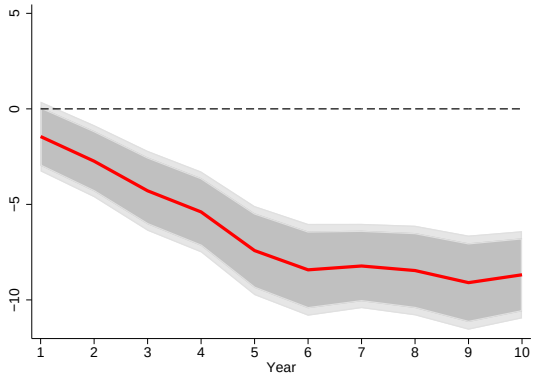
Figure 9: Average Treatment Effect of Capital Account Liberalization: Alternative Measurements of Monetary Policy Comovement



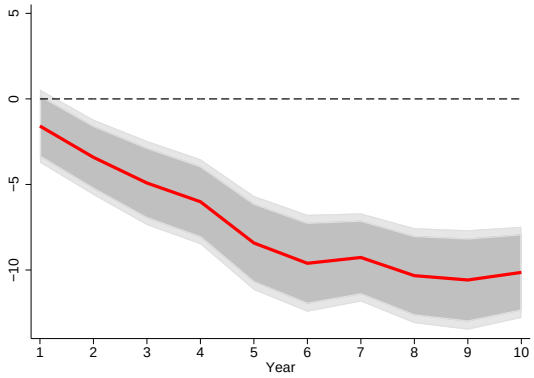
(a) Interest Rate Level Correlation, Full Sample



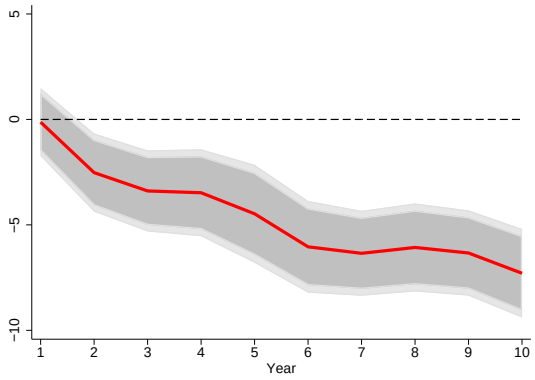
(b) Interest Rate Level Correlation, Floaters



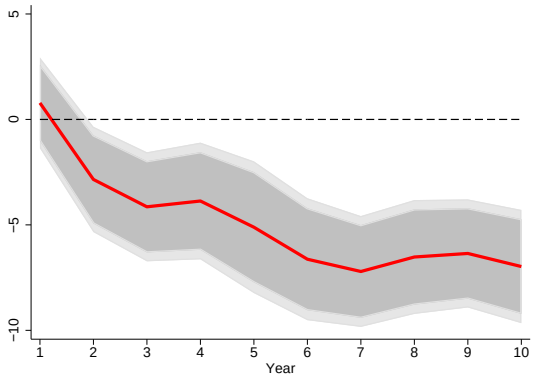
(c) Broad Money Growth Gap, Full Sample



(d) Broad Money Growth Gap, Floaters



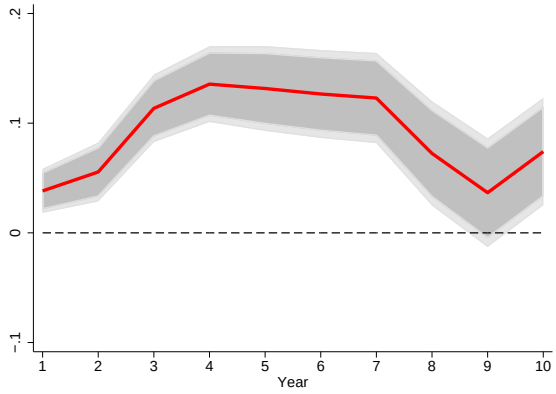
(e) Domestic Credit Growth Gap, Full Sample



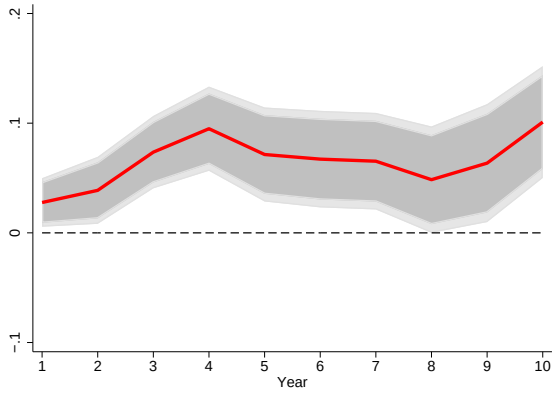
(f) Domestic Credit Growth Gap, Floaters

Notes: This figures shows the average treatment effects (ATE) based on the AIPW estimator. The dependent variable is the accumulative change in short-term interest rate level correlations between local economy and the base economy in panels (a) and (b), the accumulative change in the broad money supply growth gap between local economy and the base economy in panels (c) and (d), and the accumulative change in the domestic credit growth gap between local economy and the base economy in panels (e) and (f). Panels (a) (c) (e) present the results using the full sample and panels (b) (d) (f) present that using the subsample of floaters. The solid lines show the point estimates of the ATE, and the dark and light shades show the 95% and 90% confidence interval of the estimates. The unit of the y-axis is percentage points.

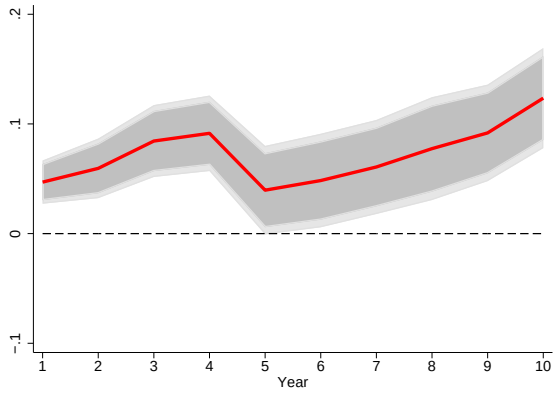
Figure 10: Robustness Check: Capital Account Liberalization Identified by Quinn-Toyoda and pseudo-FKRSU



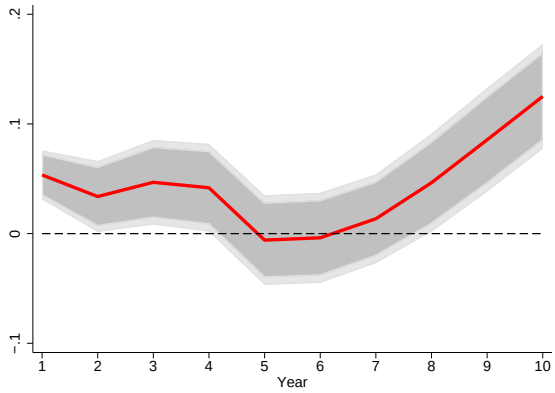
(a) Quinn-Toyoda, Full Sample



(b) Quinn-Toyoda, Floater Subsample



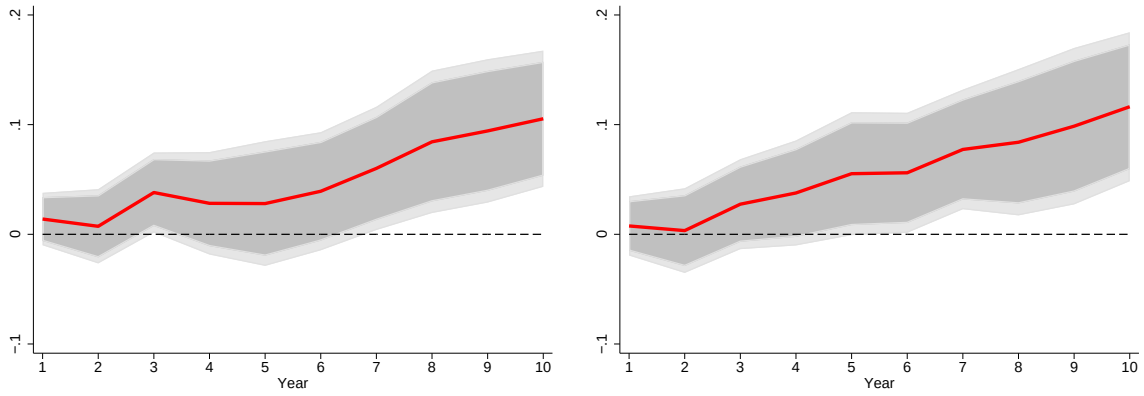
(c) pseudo-FKRSU, Full Sample



(d) pseudo-FKRSU, Floater Subsample

Notes: This figures shows the average treatment effects (ATE) based on the AIPW estimator. In panels (a) and (b), the treatment of capital account liberalization is identified based on the Quinn-Toyoda index (Quinn and Toyoda, 2008); in panels (c) and (d), the treatment of capital account liberalization is identified based on the pseudo-FKRSU index (Fernández et al., 2016). The dependent variable is the accumulative change in short-term interest rate change correlations between local economy and the base economy. Panels (a) (c) present the results using the full sample and panels (b) (d) present that using the subsample of floaters. The solid lines show the point estimates of the ATE, and the dark and light shades show the 95% and 90% confidence interval of the estimates.

Figure 11: Robustness Check: Before Global Financial Crisis



(a) Full Sample (b) Floaters Subsample

Notes: This figures shows the average treatment effects (ATE) based on the AIPW estimator. Here the sample is limited to the years before 2007. The dependent variable is the accumulative change in short-term interest rate change correlations between local economy and the base economy. Panel (a) presents the results using the full sample and panel (b) presents that using the subsample of floaters. The solid lines show the point estimates of the ATE, and the dark and light shades show the 95% and 90% confidence interval of the estimates.

Table 1: Probit Estimates of Capital Account Liberalization Treatment

	Chinn-Ito	Quinn-Toyoda	Pseudo-FKRSU
Ln (GDP per capita)	0.466***	0.626***	0.605***
	(0.067)	(0.085)	(0.085)
Volatility of GDP per capita Growth	-0.036***	-0.040***	-0.031***
	(0.008)	(0.009)	(0.009)
Trade Openness	0.004***	0.003**	0.001
	(0.001)	(0.001)	(0.001)
Polity2	0.050***	0.083***	0.083***
	(0.005)	(0.006)	(0.006)
Exchange Rate Stability	-0.072	-0.182**	-0.316***
	(0.084)	(0.091)	(0.092)
Constant	-4.883***	-4.054***	-4.193***
	(0.164)	(0.196)	(0.195)
Obs	5332	4089	4089
Loglik	-2510.738	-1953.693	-1943.343
WaldTestChi2	14.857	105.710	72.192
WaldTestPval	0.011	0.000	0.000
AUROC	0.850	0.852	0.857
seAUROC	0.005	0.006	0.006

Notes: This table shows the probit estimates of the probability of capital account liberalization. Column (1), (2), and (3) show the results when the dependent variable $Open_{it} \in \{0, 1\}$ is identified using Chinn-Ito, Quinn-Toyoda, and pseudo-FKRSU indicators of capital account openness, respectively. Country fixed effect is included in the estimation. Standard errors are shown in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 2: Summary Statistics

	Mean	Standard Deviation	Min	Max	N
Panel (a): Outcome Variables					
ΔShort-ΔShort Correlation	0.246	0.354	-0.659	1.000	1604
ΔLong-ΔLong Correlation	0.287	0.357	-0.795	0.986	1041
Short-Short Correlation	0.183	0.426	-0.890	1.000	1593
Broad Money Growth Gap	11.717	16.403	-32.143	144.392	912
Domestic Credit Growth Gap	8.930	21.201	-56.911	568.827	1203
Panel (b): Control Variables					
Ln(GDP per capita)	8.852	1.472	5.393	11.425	1604
Growth Volatility	2.423	1.822	0.130	16.814	1601
Trade Openness	77.331	53.599	9.136	437.327	1604
Political Institution	6.211	5.127	-9.000	10.000	1570
GDP Growth	3.620	3.585	-20.599	25.163	1604
Inflation	7.355	10.990	-4.478	121.608	1604
Oil Price	49.510	28.807	3.560	98.570	1604
Fixed Exchagne Rate Regime	0.277	0.448	0.000	1.000	1604
Exchange Rate Stability Index	0.500	0.279	0.004	1.000	1604

Table 3: ATE Estimates: Full Sample and Floater Sample

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	Cumulative ATE: ΔShort-ΔShort Correlation									
Full Sample	0.026***	0.035***	0.022*	0.029**	0.051***	0.056***	0.069***	0.099***	0.139***	0.148***
	(0.005)	(0.008)	(0.012)	(0.013)	(0.015)	(0.016)	(0.019)	(0.020)	(0.019)	(0.018)
Floater Sample	0.024***	0.030***	0.009	0.026	0.065***	0.065***	0.082***	0.113***	0.142***	0.157***
	(0.007)	(0.011)	(0.015)	(0.018)	(0.018)	(0.019)	(0.023)	(0.024)	(0.023)	(0.021)

Notes: This table shows the average treatment effects (ATE) based on the AIPW estimator for countries using the full sample and the floater sample. The dependent variable is the accumulative change in short-term interest rate change correlations between local economy and the base economy. The full sample results are those shown in the panel (a) of Figure 3 and the floater sample results are those shown in the panel (b) of Figure 3. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Internet Appendix

Dilemma and Global Financial Cycle: Evidence from Capital Account Liberalization Episodes

A1 Constructing the Pseudo-FKRSU Indicators

I follow Bekaert et al. (2016) to extend the original FKRSU indicators (starting from 1995) back to 1970 using the fitted values based on the estimates from a regression of original FKRSU series on the Chinn-Ito index as well as the Quinn-Toyoda CAP and CUR indices:

$$FKRSU^{j}_{i,t} = \alpha_{i,t} + \beta_1 \text{KA\_OPEN}_{it} + \beta_2 \text{CAP}_{i,t} + \beta_3 \text{CUR}_{i,t} + \epsilon_i + \varepsilon_{i,t}$$

where j is each of the FKRSU data series from Fernández et al. (2016). KA_OPEN is the Chinn-Ito index (Chinn and Ito, 2008), CAP and CUR comes from the Quinn-Toyoda index (Quinn and Toyoda, 2008), all standardized to [0,1] with higher values indicating more liberalization. The equations are estimated separately for OECD and non-OECD samples to account for the different slope and coefficients in developed and developing economies. I replace the predicted value with 1 if it exceeds 1 and with 0 if it is lower than 0. The original Chinn-Ito index covers 1970-2015 and Quinn-Toyoda index covers 1970-2014, thus the constructed pseudo-FKRSU index covers 1970-2014.

Please refer to Table A2 and A3 in Li and Su (2021) of the estimates of the most aggregated capital account openness index in the original FKRSU and pseudo-FKRSU along with the Chinn-Ito and Quinn-Toyoda CAP series. The regressions perform well in generating the pseudo-FKRSU indicators, as the adjusted R-square is 0.80 for OECD samples and as high as 0.91 for non-OECD samples and the within R-square which is net of country fixed effects is 0.46 for OECD samples and 0.42 for non-OECD samples, and all the explanatory variables are statistically significant. In addition, the correlation between the pseudo-FKRSU and original FKRSU is estimated to be 0.85 and statistically significant at the 1% significance level.

A2 Identification of the Exact Capital Account Liberalization Year

Here I describe step-by-step the procedure to identify the years of capital account liberalization for each country. This methodology has been applied in Braun and Raddatz (2007) and Li and Su (2021). I first describe the steps taken to find the structural break year using Chinn and Ito (2008)'s original KAOPEN index, and then I also conduct the identification using the Quinn-Toyoda and pseudo-FKRSU indicators. The following steps are conducted for each country.

- Determine the beginning and end years of the valid sample. The beginning year is the first year in which the $KAOPEN$ variable is not missing, and the end year is the last year of that period. The sample period can differ for each country.

- For each year t, create the variable $DUMMY_t$ and let it be 0 for the 10 years before year t (i.e., years $t-10$ to $t-1$) and 1 for the 10 years after year t (i.e., years t to $t+10$).

- Regress $KAOPEN$ on $DUMMY_t$ and obtain a coefficient for each year t. Store the value of the coefficient as well as its T-value for each year and generate two variables for them, $BETA_t$ and T_t. The period (years) two years after the sample starts or two years before the sample ends is called the edge years, and I replace their $BETA_t$ and T_t with missing values. In addition, if $BETA_t$ equals 0, I replace it and T_t with missing values as well.

- Generate the variable $MARK_t$, which is coded 1 if the average capital account openness in the 10-year period after year t changes significantly into positive from an average negative capital account openness in the 10-year period before year t, and -1 otherwise.

  Specifically, $MARK_t$ equals 1 if the following criteria are simultaneously satisfied: (i) the average value of $KAOPEN$ in years $[t, t+10)$ is positive,

(ii) the average value of $KAOPEN$ in years $[t-10, t)$ is negative, (iii) T_t is higher than 1.96, and (iv) $BETA_t$ is not missing. Similarly, $MARK_t$ equals -1 if the following criteria are simultaneously satisfied: (i) the average value of $KAOPEN$ in years $[t, t+10)$ is negative, (ii) the average value of $KAOPEN$ in years $[t-10, t)$ is positive, (iii) T_t is lower than -1.96, and (iv) $BETA_t$ is not missing.

I temporarily replace the value of $MARK_t$ with 0 if it is not valued as 1 or -1 following the criteria described above, and t does not belong to the edge years.

- To deal with $MARK_t$ in the edge years based on the $KAOPEN$ values, specifically, I apply the following rules: (i) If the $KAOPEN$ value in the edge years is the same as that in the closest non-edge years, I let the $MARK_t$ variable take the same value as that of the closest non-edge years; (ii) If the $KAOPEN$ value in the edge years is even larger than that in the closest non-edge years with $MARK_t$ equaling 1, then their values of $MARK_t$ are also 1; and (iii) If the $KAOPEN$ value in the edge years is even smaller than that in the closest non-edge years with $MARK_t$ equaling -1, then their values of $MARK_t$ are also -1. For the remaining years, $MARK_t$ temporarily takes the value of 0. Hence, I replace them with the same value as the last non-missing $MARK_t$ values of either 1 or -1.

- Determine the exact year in which the country liberalized or closed its capital account. The beginning year of capital account liberalization is the first year in which the value of $MARK_t$ changed to 1 from -1, or the first non-edge year with $MARK_t$ equaling 1 and the value of $MARK_t$ in the closest edge year is missing. The end year of capital account liberalization is the first year in which the value of $MARK_t$ changed to -1 from 1, or the last non-edge year with $MARK_t$ equaling 1 and the value of $MARK_t$ in the closest edge year is missing. Thus, I identify the exact year of capital account liberalization

as the beginning year and a liberalization period of [beginning year, end year][15].

- Finally, identify the countries for which the capital account is never or always liberalized. Specifically, for countries that always have negative values of $KAOPEN$, I see their capital account has never liberalized; for those countries that always have positive values of $KAOPEN$, I see their capital account as always liberalized. In addition, if $MARK_t$ is 0 for each year, and the average value of $KAOPEN$ in the sample period is negative, or $MARK_t$ is -1 for each year, I also identify that the country has never liberalized. If $MARK_t$ is 0 for all the years and the average value of $KAOPEN$ is positive, then I identify that the country has always liberalized.

Thus, I construct a dataset documenting the capital account history of each country, that is, either its capital account has remained closed or liberalized during the entire sample period, or it has experienced change from a closed to an open capital account in a specific year. In addition to the $KAOPEN$ indicator, I use the Quinn-Toyoda and the pseudo-FKRSU indicator to determine the capital account liberalization years and periods for each country. Instead of using 0 as the critical point of the capital account openness indicator as the $KAOPEN$ data lie in the range of $[-4, 4]$, I find the counterpart critical value in the Quinn-Toyoda and pseudo-FKRSU indicator, which lies in the range of $[0, 1]$ by regressing Quinn-Toyoda (pseudo-FKRSU) on $KAOPEN$, and use the constant term as the equivalent to 0 in the KAOPEN dataset. I name the estimated constant $ZERO_{QuinnToyoda}$ ($ZERO_{pseudoFKRSU}$) and then replace the criteria of $KAOPEN$ being positive with a Quinn-Toyoda value larger than $ZERO_{QuinnToyoda}$ and $KAOPEN$ being negative with a Quinn-Toyoda value smaller than $ZERO_{QuinnToyoda}$; same applies for pseudo-FKRSU and $ZERO_{pseudoFKRSU}$. The remainder of the process is the same as described above. The identified lib-

[15]Using the Chinn-Ito dataset, I have identified at most two liberalization periods for each country. It the two liberalization periods has a gap larger than ten years, I see the two episodes for the same country as two independent observations.

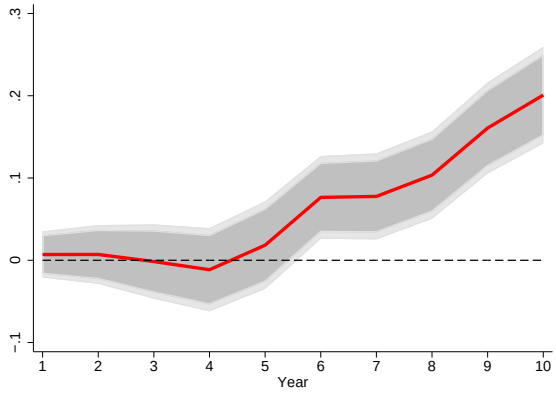
eralization dates for each country based on these three indices are provided in the data file.

A3 Additional Figures and Tables

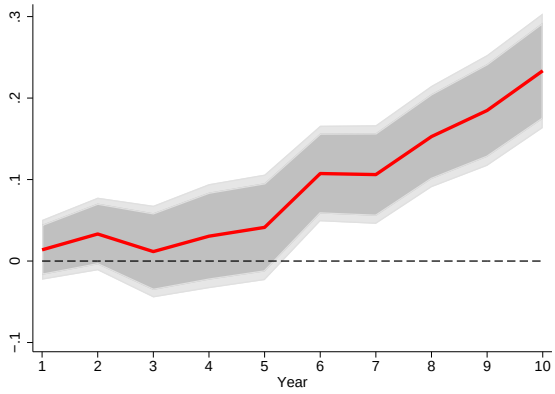
Figure A1: Heat Map of Exchange Rate Regimes

Notes: Purple (dark) color indicates flexible exchange rate regime and yellow (light) color indicates fixed exchange rate regime. The exchange rate regime is defined based on the coarse *de facto* exchange rate arrangement classification by Ilzetzki et al. (2019). Category 1 in Ilzetzki et al. (2019)'s dataset is treated as a fixed exchange rate regime and the remaining categories 2-6 as flexible exchange rate regime.

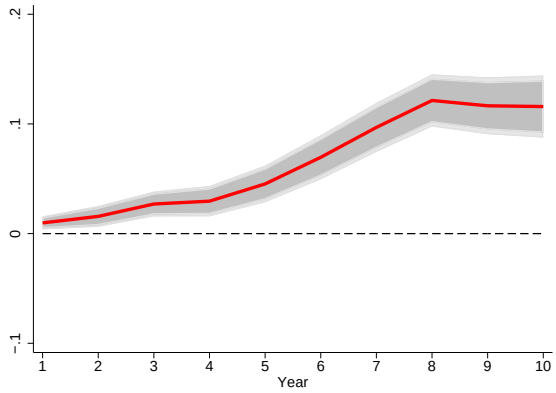
Figure A2: Average Treatment Effect of Capital Account Liberalization: Calculating Correlations Using Different Numbers of Quarters



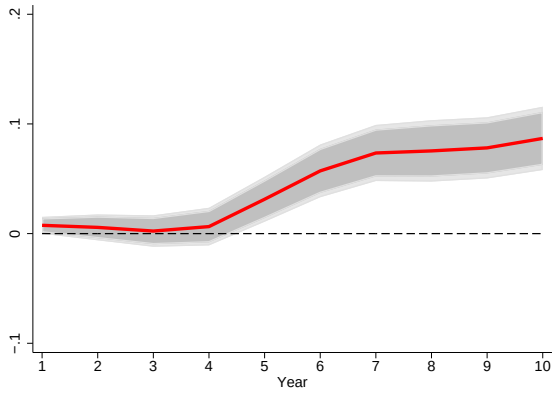
(a) 12 Quarters, Full Sample



(b) 12 Quarters, Floaters Subsample



(c) 40 Quarters, Full Sample



(d) 40 Quarters, Floaters Subsample

Notes: This figures shows the average treatment effects (ATE) based on the AIPW estimator. The dependent variable is the pairwise correlation coefficients of the change in short-term interest rates between local economy and the base economy in the past 12and 40 quarters in panels (a)-(b) and (c)-(d), respectively. Panels (a) (c) present the estimates using the full sample and panels (b) (d) present that using the subsample of floaters. The solid lines show the point estimates of the ATE, and the dark and light shades show the 95% and 90% confidence interval of the estimates.

Table A1: Identification of Capital Account Liberalization

Country	Identification Based on Chinn-Ito Index	Identification Based on Quinn-Toyoda Index	Identification Based on Pseudo-FKRSU Index	Sample Range Chinn-Ito Index	Sample Range Quinn-Toyoda Index	Sample Range Pseudo-FKRSU Index
Afghanistan	Never			1970-2000		
Albania	Never	2008-2014	2008-2014	1995-2016	1991-2014	1995-2014
Algeria	Never	Never	Never	1970-2016	1963-2014	1970-2014
Angola	Never			1993-2016		
Antigua and Barbuda	Always			1985-2009		
Argentina	1988-1999	1985-1997	1985-1998	1970-2016	1950-2014	1970-2014
Armenia	Always			1996-2016		
Aruba	Never			1992-2016		
Australia	**1978-2014**	1977-2014	1977-2012	1970-2016	1950-2014	1970-2014
Austria	Always	1970-2013	Always	1970-2016	1950-2014	1970-2014
Azerbaijan	2010-2016	2001-2014	2004-2014	1996-2016	1992-2014	1996-2014
Bahamas	Never	Never	Never	1977-2016	1972-2007	1977-2007
Bahrain	Always	Always	Always	1976-2016	1971-2007	1976-2007
Bangladesh	**Never**	Never	Never	1976-2016	1971-2014	1976-2014
Barbados	Never	Never	Never	1974-2016	1970-2014	1974-2014
Belarus	**Never**	2010-2013	Never	1996-2016	1992-2014	1996-2014
Belgium	Always	Always	Always	1970-2016	1950-2014	1970-2014
Belize	Never			1985-2016		
Benin	**Never**			1979-2016		
Bhutan	Never			1985-2016		
Bolivia	1970-1975; 1988-2016	Always	1988-2014	1970-2016	1950-2014	1970-2014
Bosnia and Herzegovina	2001-2008			1999-2016		

Botswana	**1994-2016**	Always	1989-2014	1972-2016	1967-2014	1972-2014
Brazil	**2000-2011**	2002-2013	2002-2012	1970-2016	1950-2014	1970-2014
Bulgaria	**2000-2016**	1995-2014	1998-2014	1994-2016	1990-2014	1994-2014
Burkina Faso	**Never**	Never	Never	1988-2016	1962-2014	1988-2014
Burundi	**Never**			1970-2016		
Cambodia	1999-2015	1998-2014	1998-2012	1973-2016	1955-2014	1973-2014
Cameroon	Never	1970-1996	Never	1970-2016	1962-2014	1970-2014
Canada	Always	Always	Always	1970-2016	1950-2014	1970-2014
Cape Verde	**Never**			1982-2016		
Central African Republic	Never			1970-2016		
Chad	Never			1970-2016		
Chile	**1995-2016**	1992-2014	1992-2014	1970-2016	1950-2014	1970-2014
China	**Never**	Never	Never	1984-2016	1950-2014	1984-2014
Colombia	**Never**	1988-2000	1991-2003	1970-2016	1950-2014	1970-2014
Comoros	Never			1981-2016		
Congo	Never	Never	Never	1970-2016	1962-2014	1970-2014
Costa Rica	1990-2014	1988-2014	1988-2013	1970-2016	1950-2014	1970-2014
Cote d'Ivoire	**Never**	Never	Never	1970-2016	1961-2014	1970-2014
Croatia	**1999-2016**	Always	Always	1996-2016	1992-2014	1996-2014
Cyprus	**1998-2016**	1996-2012	1997-2012	1970-2016	1961-2014	1970-2014
Czech Republic	**1996-2016**	Always	1996-2014	1996-2016	1990-2014	1996-2014
Democratic Republic of Congo	Never			1970-2012		
Denmark	**1981-2016**	Always	1970-2014	1970-2016	1950-2014	1970-2014
Djibouti	Always			1982-2016		
Dominica	Never			1982-2016		
Dominican Republic	1999-2014	1982-2014	1997-2012	1970-2016	1950-2014	1970-2014

Ecuador	1971-1975;1994-2014	1985-2014	1986-2012	1970-2016	1950-2014	1970-2014
Egypt	**1991-2008**	1989-2014	1990-2012	1970-2016	1950-2014	1970-2014
El Salvador	1989-2016	1986-2014	1987-2012	1970-2016	1950-2014	1970-2014
Equatorial Guinea	Never			1973-2016		
Eritrea	Never			1998-2016		
Estonia	Always	Always	Always	1996-2016	1992-2014	1996-2014
Ethiopia	Never	Never	Never	1970-2016	1950-2014	1970-2014
Fiji	Never	Never	Never	1975-2016	1971-2007	1975-2007
Finland	**1971-2016**	1981-2014	1971-2014	1970-2016	1950-2014	1970-2014
France	**1983-2016**	Always	Always	1970-2016	1950-2014	1970-2014
Gabon	Never	1998-2014	Never	1970-2016	1963-2014	1970-2014
Gambia	1985-2016	Always	1985-2006	1971-2016	1967-2007	1971-2007
Georgia	Always	Always	Always	1996-2016	1992-2014	1996-2014
Germany	Always	Always	Always	1970-2016	1950-2014	1970-2014
Ghana	**Never**	2001-2014	Never	1970-2016	1957-2014	1970-2014
Greece	**1990-2014**	1980-2014	1987-2014	1970-2016	1950-2014	1970-2014
Grenada	Never			1979-2016		
Guatemala	1970-1978;1989-2016	1973-2014	1990-2014	1970-2016	1950-2014	1970-2014
Guinea	Never			1970-2016		
Guinea-Bissau	**Never**			1981-2016		
Guyana	1989-2016			1970-2016		
Haiti	1971-1975;1991-2016	1991-2014	1990-2014	1970-2016	1950-2014	1970-2014
Honduras	1970-1975;1992-2003	1989-2014	1990-2014	1970-2016	1950-2014	1970-2014
Hong Kong	Always	Always	Always	1970-2016	1950-2014	1970-2014
Hungary	**1993-2016**	1992-2014	1993-2014	1986-2016	1981-2014	1986-2014
Iceland	**1988-2002**	1992-2002	1989-2002	1970-2016	1950-2014	1970-2014

India	**Never**	Never	Never	1970-2016	1950-2014	1970-2014
Indonesia	**1972-2009**	1970-1995;2008-2014	Always	1970-2016	1950-2014	1970-2014
Iran	2001-2016	Never	Never	1970-2016	1950-2014	1970-2014
Iraq	Never	Never	Never	1970-2002	1950-2014	1970-2002
Ireland	**1983-2016**	1970-2014	1973-2014	1970-2016	1950-2014	1970-2014
Israel	**1992-2016**	1991-2014	1991-2014	1970-2016	1950-2014	1970-2014
Italy	**1982-2016**	Always	1979-2014	1970-2016	1950-2014	1970-2014
Jamaica	1988-2016	1985-2014	1987-2012	1970-2016	1961-2014	1970-2014
Japan	**1972-2016**	1977-2014	1972-2014	1970-2016	1950-2014	1970-2014
Jordan	**1992-2016**	1992-2014	1991-2014	1970-2016	1950-2014	1970-2014
Kazakhstan	Never	2004-2014	Never	1996-2016	1992-2014	1996-2014
Kenya	**1992-2016**	1990-2014	1991-2014	1970-2016	1963-2014	1970-2014
Kiribati	Always			1990-2005		
Kuwait	Always			1970-2016		
Kyrgyz Republic	**1997-2009**	Always	Always	1997-2016	1992-2014	1997-2014
Laos	1970-1972	Never		1970-2016	1960-2007	1970-2007
Latvia	Always	Always	Always	1996-2016	1992-2014	1996-2014
Lebanon	Always	Always	Always	1970-2016	2000-2014	2000-2014
Lesotho	**Never**			1972-2016		
Liberia	1970-1985;**1997-2015**	Always	Always	1970-2016	1954-2014	1970-2014
Libya	Never	Never	Never	1970-2016	1958-2014	1970-2014
Lithuania	Always	Always	Always	1996-2016	1992-2014	1996-2014
Macedonia	2001-2016			1997-2016		
Madagascar	**Never**	Never	Never	1970-2016	1963-2014	1970-2014
Malawi	**Never**			1970-2016		
Malaysia	**1970-1996**	1985-1991;2009-2014	1970-1991	1970-2016	1957-2014	1970-2014

Maldives	Always			1982-2016		
Mali	**Never**			1970-2016		
Malta	**1998-2016**	1996-2014	1997-2014	1972-2016	1968-2014	1972-2014
Marshall Islands	Always			1996-2016		
Mauritania	**Never**			1970-2016		
Mauritius	**1989-2016**	1986-2014	1987-2012	1972-2016	1968-2014	1972-2014
Mexico	1970-1977;**1990-2016**	1988-2014	1989-2014	1970-2016	1950-2014	1970-2014
Micronesia	Always			1996-2016		
Moldova	**Never**			1996-2016		
Mongolia	1996-2016			1995-2016		
Morocco	**Never**	Never	Never	1970-2016	1958-2014	1970-2014
Mozambique	**Never**	Never	Never	1988-2016	1983-2014	1988-2014
Myanmar	**Never**	Never	Never	1970-2016	1950-2014	1970-2014
Namibia	Never			1994-2016		
Nepal	Never	Never	Never	1970-2016	1961-2014	1970-2014
Netherlands	Always	Always	Always	1970-2016	1950-2014	1970-2014
Netherlands Antilles	1970-1976;1995-2009			1970-2009		
New Zealand	**1975-2016**	1975-2014	1976-2014	1970-2016	1950-2014	1970-2014
Nicaragua	1970-1973;1989-2016	1988-2014	1988-2014	1970-2016	1950-2014	1970-2014
Niger	**Never**			1970-2016		
Nigeria	**Never**	2010-2014	Never	1970-2016	1960-2014	1970-2014
Norway	**1986-2016**	1979-2014	1980-2014	1970-2016	1950-2014	1970-2014
Oman	Always			1977-2016		
Pakistan	**Never**	Never	Never	1970-2016	1950-2014	1970-2014
Panama	Always	Always	Always	1970-2016	1950-2014	1970-2014
Papua New Guinea	2002-2015			1979-2016		

Paraguay	**1990-2016**	1986-2014	1986-2014	1970-2016	1950-2014	1970-2014
Peru	**1989-2016**	1986-2014	1986-2014	1970-2016	1950-2014	1970-2014
Philippines	**1991-2001**	1989-2012	1989-2012	1970-2016	1950-2014	1970-2014
Poland	**2001-2014**	1995-2014	1996-2014	1986-2016	1985-2014	1986-2014
Portugal	**1985-2016**	1982-2014	1984-2014	1970-2016	1950-2014	1970-2014
Qatar	Always			1976-2016		
Romania	**1997-2016**	1995-2014	1996-2014	1976-2016	1972-2014	1976-2014
Russia	**2002-2015**	2000-2014	2001-2012	1996-2016	1992-2014	1996-2014
Rwanda	**2006-2016**	2004-2014	2004-2014	1970-2016	1960-2014	1970-2014
Saint Kitts and Nevis	Never			1988-2016		
Saint Lucia	2003-2016			1983-2016		
Saint Vincent and the Grenadines	Never			1983-2016		
Samoa	Never			1975-2016		
San Marino	Always			1996-2016		
Sao Tome and Principe	1997-2014			1981-2016		
Saudi Arabia	Always	Always	Always	1970-2016	1956-2014	1970-2014
Senegal	**Never**	1993-2014	Never	1970-2016	1961-2014	1970-2014
Seychelles	Always			1981-2016		
Sierra Leone	**Never**	Never	Never	1970-2016	1961-2014	1970-2014
Singapore	**1974-2016**	Always	Always	1970-2016	1957-2014	1970-2014
Slovak Republic	**2000-2016**	Always	1998-2014	1996-2016	1990-2014	1996-2014
Slovenia	**1997-2016**	Always	Always	1996-2016	1992-2014	1996-2014
Solomon Islands	Never			1982-2016		
Somalia	Never			1970-2007		
South Africa	**Never**	2002-2014	Never	1970-2016	1950-2014	1970-2014
South Korea	**2000-2015**	1988-2014	1995-2014	1970-2016	1954-2014	1970-2014

Spain	**1984-2016**	1979-2014	1980-2014	1970-2016	1950-2014	1970-2014
Sri Lanka	**1988-2002**	Never	Never	1970-2016	1950-2014	1970-2014
Sudan	Never	1994-2014	1998-2012	1970-2016	1955-2014	1970-2014
Suriname	Never	Never	Never	1970-2016	1960-2014	1970-2014
Swaziland	Never			1973-2016		
Sweden	Always	1972-2014	Always	1970-2016	1950-2014	1970-2014
Switzerland	Always	Always	Always	1996-2016	1950-2014	1996-2014
Syria	Never	1970-1970	Never	1970-2016	1950-2014	1970-2014
Tajikistan	**Never**			1997-2016		
Tanzania	**Never**	Never	Never	1970-2016	1961-2014	1970-2014
Thailand	**Never**	1986-1996;2012-2013	Never	1970-2016	1950-2014	1970-2014
Togo	**Never**			1970-2016		
Tonga	2007-2016			1989-2016		
Trinidad and Tobago	1988-2016	1988-2014	1988-2014	1970-2016	1962-2014	1970-2014
Tunisia	**Never**	Never	Never	1970-2016	1956-2014	1970-2014
Turkey	**2007-2016**	1988-2012	1987-2012	1970-2016	1950-2014	1970-2014
Turkmenistan	Never			1996-2016		
Uganda	1990-2016	1989-2014	1990-2014	1970-2016	1962-2014	1970-2014
Ukraine	**Never**	Never	Never	1996-2016	1992-2014	1996-2014
United Arab Emirates	Always			1976-2016		
United Kingdom	**1974-2016**	1970-2014	1974-2014	1970-2016	1950-2014	1970-2014
United States	Always	Always	Always	1970-2016	1950-2014	1970-2014
Uruguay	**1974-2016**	Always	1973-2014	1970-2016	1950-2014	1970-2014
Uzbekistan	Never	Never	Never	1996-2016	1992-2014	1996-2014
Vanuatu	Always			1985-2000		
Venezuela	1971-1978;**1992-2001**	1970-1977		1970-2016	1950-2014	1970-2014

Vietnam	**Never**	2012-2014	2012-2014	1970-2016	1956-2014	1970-2014
Yemen	Always			1995-2016		
Zambia	**1991-2016**	1988-2014	1989-2014	1970-2016	1963-2014	1970-2014
Zimbabwe	**Never**	Never	Never	1984-2016	1979-2014	1984-2014

Note: The episodes and countries in bold fonts are the ones used in the baseline analysis, resulting from the sample restriction (drop the countries whose capital account is always open; the liberalization lasts for at least ten years and the capital account is closed for at least ten years before the liberalization event) and data availability of interest rate comovements.

Table A2: Sources and Definitions for Interest Rates

Country	Long-term Interest Rates	Short-term Interest Rates
Afghanistan		IFS, Money Market (2006-2016)
Algeria		IFS, Money Market (1995-2016)
Angola	IFS, Government Securities, Government Bonds (2013-2016)	IFS, Money Market (2005-2016)
Anguilla		IFS, Money Market (2001-2016)
Antigua and Barbuda		IFS, Money Market (2001-2016)
Argentina	Datastream, Government Benchmark Bid Yield 10 Years (2006-2016)	IFS, Money Market (2010-2016)
Armenia	IFS, Government Securities, Government Bonds (2000-2017)	IFS, Money Market (1995-2016)
Aruba		IFS, Money Market (1986-2016)
Australia	IFS, Government Securities, Government Bonds (1970-2016)	IFS, Money Market (1976-2016)
Austria	IFS, Government Securities, Government Bonds (1971-2016)	OECD, 3-Month or 90-Day Interbank Rates and Yields (1990-2016)
Belarus	National Bank of the Republic of Belarus, Government Long-Term Bonds Yield (2004-2016)	National Bank of the Republic of Belarus, Rate On Interbank Credits and Deposits - Over 60 Days (2003-2016)
Bahrain		IFS, Money Market (1986-2011)
Bangladesh	IFS, Government Securities, Government Bonds (2006-2016)	IFS, Money Market (1997-2016)
Belgium	IFS, Government Securities, Government Bonds (1970-2016)	OECD, 3-Month or 90-Day Interbank Rates and Yields (1970-2016)
Benin		IFS, Money Market (2001-2016)
Bolivia		IFS, Money Market (1995-2014)
Botswana	IFS, Government Securities, Government Bonds (2003-2016)	Bank of Botswana, 3-Month Treasury Bill Rate (2005-2016)
Brazil		IFS, Money Market (1970-2016)
Bulgaria	IFS, Government Securities, Government Bonds (2003-2016)	IFS, Money Market (1991-2016)
Burundi		Banque de la Republique du Burundi, 3-Month Treasury Bill Rate (2007-2016)
Burkina Faso	IFS, Government Securities, Government Bonds (2012-2015)	IFS, Money Market (2001-2016)

Canada	IFS, Government Securities, Government Bonds (1970-2016)	IFS, Money Market (1975-2016)
Chile	OECD, 10-Year Government Bond Yields (2005-2016)	OECD, 3-Month or 90-Day Interbank Rates and Yields (1998-2016)
China	Datastream, 10-Year Government Bond Yields (2003-2016)	State Administration of Foreign Exchange, 2-Month Interbank Rate (1996-2016)
Macao		IFS, Money Market (1988-2016)
Colombia	Datastream, 10-Year Government Bond Yields (2003-2016)	OECD, 3-Month or 90-Day Interbank Rates and Yields (1998-2016)
Democratic Republic of Congo		IFS, Money Market (2007-2016)
Croatia	Eurostat, Harmonised Government 10-Year Bond Yield (2006-2016)	Datastream, 3-Month Interbank Rate (1998-2016)
Cyprus	IFS, Government Securities, Government Bonds (1997-2016)	Central Bank of Cyprus, 3-Month Interbank Rate (2000-2006)
Czech Republic	IFS, Government Securities, Government Bonds (2000-2016)	IFS, Money Market (1993-2016)
Cote d'Ivoire	IFS, Government Securities, Government Bonds (2012-2015)	IFS, Money Market (2001-2016)
Denmark	IFS, Government Securities, Government Bonds (1983-2016)	Danmarks Nationalbank, 3-Month Interbank Rate (1989-2016)
Dominica		IFS, Money Market (2001-2016)
Dominican Republic		IFS, Money Market (1996-2016)
Egypt		Datastream, 3-Month Interbank Rate (2002-2016)
Ethiopia	IFS, Government Securities, Government Bonds (1986-2016)	
Fiji	IFS, Government Securities, Government Bonds (2001-2016)	
Finland	IFS, Government Securities, Government Bonds (1987-2016)	IFS, Money Market (1977-2016)
France	IFS, Government Securities, Government Bonds (1970-2016)	Datastream, Natixis 3-Month Interbank Rate (1988-2016)
Georgia		IFS, Money Market (2008-2016)
Germany	IFS, Government Securities, Government Bonds (1970-2016)	Datastream, Natixis 3-Month Interbank Rate (1986-2016)
Ghana	IFS, Government Securities, Government Bonds (2004-2016)	IFS, Money Market (2003-2016)
Greece	IFS, Government Securities, Government Bonds (1986-2016)	Bank of Greece, 3-Month Interbank Rate (1994-2016)
Grenada		IFS, Money Market (2001-2016)
Guinea		IFS, Money Market (1986-2016)
Guinea-Bissau		IFS, Money Market (2001-2016)

Hong Kong		IFS, Money Market (2990-2016)
Hungary	IFS, Government Securities, Government Bonds (2001-2016)	National Bank of Hungary, 3-Month Interbank Rate (1996-2016)
Iceland	IFS, Government Securities, Government Bonds (1992-2016)	IFS, Money Market (1986-2016)
India	IFS, Government Securities, Government Bonds (1970-2016)	IFS, Money Market (1970-2016)
Indonesia	Datastream, 10-Year Government Bond Yields (2004-2016)	IFS, Money Market (1983-2016)
Ireland	OECD, 10-Year Government Bond Yields (1971-2016)	IFS, Money Market (1972-2016)
Israel	OECD, 10-Year Government Bond Yields (1997-2016)	OECD, 3-Month Interbank Rate (1992-2016)
Italy	Bank of Italy, 1-Year Government Bond Yields (1970-2016)	IFS, Money Market (1970-2016)
Jamaica		IFS, Money Market (1998-2016)
Japan	IFS, Government Securities, Government Bonds (1999-2016)	IFS, Money Market (1985-2016)
Jordan	Central Bank of Jordan, Treasury Bills (2006-2016)	IFS, Money Market (1999-2016)
Kenya		Central Bank of Kenya, Interbank Rate (1992-2016)
Kazakhstan	The National Bank of Kazakhstan, Treasury Bills (1999-2016)	Kazakhstan Stock Exchange, 3-Month Interbank Rate (2004-2016)
Kuwait		IFS, Money Market (1979-2016)
Kyrgyz Republic	IFS, Government Securities, Government Bonds (2009-2016)	IFS, Money Market (1996-2016)
Latvia	OECD, 10-Year Government Bond Yields (2001-2016)	OECD, 3-Month Interbank Rate (1998-2016)
Libya		IFS, Money Market (1970-2004)
Lithuania	IFS, Government Securities, Government Bonds (2001-2016)	IFS, Money Market (1993-2016)
Luxembourg	IFS, Government Securities, Government Bonds (1977-2016)	
Madagascar		IFS, Money Market (1990-2016)
Malawi		Reserve Bank of Malaw, Interbank Rate (2010-2016)
Malaysia	IFS, Government Securities, Government Bonds (1992-2016)	IFS, Money Market (1971-2016)
Maldives	IFS, Government Securities, Government Bonds (2014-2016)	
Mali		IFS, Money Market (2001-2016)
Malta	IFS, Government Securities, Government Bonds (2001-2016)	Central Bank of Malta, 3-Month Interbank Rate (1997-2007)

Mauritania		Banque Centrale de Mauritanie, 3-Month Treasury Bill Rates (2011-2016)
Mauritius	IFS, Government Securities, Government Bonds (2002-2016)	IFS, Money Market (1979-2016)
Mexico	IFS, Government Securities, Government Bonds (2001-2016)	IFS, Money Market (1981-2016)
Moldova	IFS, Government Securities, Government Bonds (1997-2016)	National Bank of Moldova (2000-2016)
Mongolia	IFS, Government Securities, Government Bonds (2013-2016)	IFS, Money Market (2003-2016)
Montenegro		
Montserrat		IFS, Money Market (2001-2016)
Morocco	IFS, Government Securities, Government Bonds (1997-2016)	IFS, Money Market (1980-2016)
Mozambique		IFS, Money Market (1998-2016)
Myanmar	IFS, Government Securities, Government Bonds (2010-2016)	Central Statistical Organization, Myanmar, 3-Month Treasury Bill Rates (2015-2016)
Nepal	IFS, Government Securities, Government Bonds (1981-2016)	
Netherlands Antilles	IFS, Government Securities, Government Bonds (1983-2009)	
Netherlands	DNB - De Nederlandsche Bank, 10-Year Government Bond Yields (1970-2016)	DNB - De Nederlandsche Bank, 3-Month Interbank Rates (1978-2016)
New Zealand	IFS, Government Securities, Government Bonds (1987-2016)	IFS, Money Market (1985-2016)
Niger	IFS, Government Securities, Government Bonds (2014-2015)	IFS, Money Market (2001-2016)
Nigeria		CBN - Central Bank of Nigeria, 3-Month Deposit Rates (1970-2016)
Norway	IFS, Government Securities, Government Bonds (1970-2016)	Norges Bank, 3-Month Interbank Rate (1979-2016)
Oman		IFS, Money Market (2004-2016)
Pakistan	IFS, Government Securities, Government Bonds (1991-2016)	IFS, Money Market (1970-2016)
Panama		IFS, Money Market (2002-2016)
Papua New Guinea	IFS, Government Securities, Government Bonds (2005-2016)	IFS, Money Market (2000-2016)
Paraguay		IFS, Money Market (1990-2016)
Peru		IFS, Money Market (1995-2016)

Philippines	IFS, Government Securities, Government Bonds (1994-2016)	IFS, Money Market (1977-2016)
Poland	IFS, Government Securities, Government Bonds (2001-2016)	IFS, Money Market (1990-2016)
Portugal	IFS, Government Securities, Government Bonds (1970-2016)	OECD, 3-Month Interbank Rate (1986-2016)
Qatar		IFS, Money Market (2004-2016)
Romania	IFS, Government Securities, Government Bonds (2005-2016)	IFS, Money Market (1995-2016)
Russia	Datastream, 10-Year Government Bond Yields (2004-2016)	IFS, Money Market (1995-2016)
Rwanda		IFS, Money Market (1996-2016)
Saudi Arabia		Saudi Central Bank, 3-Month Interbank Rate (2007-2016)
Senegal	IFS, Government Securities, Government Bonds (2012-2016)	IFS, Money Market (2001-2016)
Serbia		IFS, Money Market (2005-2016)
Seychelles	IFS, Government Securities, Government Bonds (1989-2016)	Central Bank of Seychelles, 3-Month Treasury Bill Rates (2009-2016)
Sierra Leone		BSL - Bank of Sierra Leone, 3-Month Trasury Bill Rates (2008-2016)
Singapore	IFS, Government Securities, Government Bonds (1999-2016)	IFS, Money Market (1972-2016)
Slovak Republic	IFS, Government Securities, Government Bonds (2000-2016)	OECD, 3-Month Interbank Rate (1996-2016)
Slovenia	IFS, Government Securities, Government Bonds (2002-2016)	IFS, Money Market (1992-2016)
Solomon Islands	IFS, Government Securities, Government Bonds (1981-2016)	
South Africa	IFS, Government Securities, Government Bonds (1970-2016)	OECD, Interbank Rate (1970-2016)
South Korea	IFS, Government Securities, Government Bonds (1973-2016)	IFS, Money Market (1976-2016)
Spain	IFS, Government Securities, Government Bonds (1978-2016)	OECD, 6-Month Interbank Rate (1970-2016)
Sri Lanka	Central Bank of Sri Lanka, 12-Month Treasury Bill Rates (1997-2016)	Central Bank of Sri Lanka, 3-Month Treasury Bill Rates (1997-2016)
Saint Kitts and Nevis		IFS, Money Market (2001-2016)
Saint Lucia		IFS, Money Market (2001-2016)
Saint Vincent and the Grenadines		IFS, Money Market (2001-2016)
Suriname		IFS, Money Market (2001, 2016)
Swaziland		IFS, Money Market (1989-2016)
Sweden	IFS, Government Securities, Government Bonds (1970-2016)	IFS, Money Market (1970-2016)

Switzerland	SNB - Swiss National Bank, 10-Year Government Bond Yields (1970-2016)	OECD, Interbank Rate (1972-2016)
Taiwan	Central Bank of the Republic of China (Taiwan), 10-Year Government Bond Yield (1995-2016)	Central Bank of the Republic of China (Taiwan), Interbank Rate (1981-2016)
Tajikistan		IFS, Money Market (2002-2016)
Tanzania		Bank of Tanzania, 61-90 Days Interbank Rate (2000-2016)
Thailand	Bank of Thailand, 10-Year Government Bond Yield (1977-2016)	IFS, Money Market (1989-2016)
Togo	IFS, Government Securities, Government Bonds (2012-2015)	IFS, Money Market (2001-2016)
Tunisia	Central Bank of Tunisia, 15-Year Government Bond Yields (2008-2016)	IFS, Money Market (2001-2016)
Turkey	OECD, Long-Term Interest Rate On Government Bonds (2005-2016)	OECD, Interbank Rate (1986-2016)
Ukraine		IFS, Money Market (1996-2016)
United Kingdom	IFS, Government Securities, Government Bonds (1970-2016)	IFS, Money Market (1970-2016)
United States	IFS, Government Securities, Government Bonds (1970-2016)	IFS, Money Market (1970-2016)
Uruguay		IFS, Money Market (1991-2016)
Uzbekistan		IFS, Money Market (2013-2016)
Vanuatu	IFS, Government Securities, Government Bonds (1989-2016)	IFS, Money Market (1986-2016)
Venezuela	IFS, Government Securities, Government Bonds (1999-2016)	Oxford Economics, Short-term Interest Rate (1980-2016)
Vietnam		Datastream, 3-Month Interbank Rate (1999-2016)
Zambia		Oxford Economics, Short-term Interest Rate (1980-2016)

Halle Institute for Economic Research –
Member of the Leibniz Association

Kleine Maerkerstrasse 8

D-06108 Halle (Saale), Germany

Postal Adress: P.O. Box 11 03 61

D-06017 Halle (Saale), Germany

Tel +49 345 7753 60

Fax +49 345 7753 820

www.iwh-halle.de

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