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► To cite this version:

Jinzhao Chen, Xingwang Qian. Measuring the on-going changes in China's capital controls: A de jure and a hybrid index data set. China Economic Review, 2016. hal-03727640

HAL Id: hal-03727640

<https://hal.science/hal-03727640>

Submitted on 19 Jul 2022

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Measuring the on-going changes in China's capital controls: A *de jure* and a hybrid index data set

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This version: November, 2015

Abstract: Liberalizing China's capital account controls may have profound implications for the RMB exchange rate, monetary policy autonomy, and Chinese economy. However, rigorous studies on the importance of China's capital controls are limited, primarily due to the scarcity of proper measurements of China's capital controls. In this paper we create a new data set of indices including *de jure* and hybrid measurements of the changes in China's capital controls. In contrasting to other capital control indices that are compiled in a yes-or-no style, we quantify the intensity of changes in China's capital controls. Our indices reveal a persistent but uneven process of capital account liberalization in China between 1999 and 2012. This paper describes the *de jure* and hybrid indices, including indices for capital controls on individual asset categories, gross flows, inflows and outflows, as well as for residents and nonresidents asset transactions. Understanding that China usually implements policies in a step by step gradualist style, we extract those gradual information from the text in the IMF's *Annual Report on Exchange Arrangement and Exchange Restrictions* (AREAER) and some supplementary material from other sources.

JEL: C82, F15, F21

Keywords: Capital flows, China's Capital Controls, *de jure* index, hybrid index

Acknowledgments: We thank Michel Aglietta, Vincent Bignon, Regis Breton, Yin-Wong Cheung, Menzie Chinn, Virginie Coudert, Xue Liu, Guonan Ma, Fengming Qin, Frank Westermann and participants of seminars at CEPIL, CRIEF of University of Poitiers, HKIMR, MIFN 2015 Osaka conference, Shandong University, and Shandong University of Finance and Economics for their comments and suggestions. Faculty research funds of SUNY Buffalo State are gratefully acknowledged. This paper was written when J. Chen was visiting scholar at SUNY Buffalo State.

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1. Introduction

In globalization eras, cross-border capital flows are widely recognized as an essential ingredient for economic growth and a useful supplement for domestic savings to facilitate greater productive investment and smooth consumption. However, rapid and excessive capital inflows to emerging economies could entail a great risk of devastating financial crisis.

Capital account management (a.k.a capital controls) (IMF, 2011) has long been adopted by many developing countries particularly during periods of rapid short-term capital inflows and disruptive outflows. Chilean type and Malaysian type of capital controls are two notable examples. Indeed, those countries deploying such controls were found among the least hard hit and survived better during recent global financial crises (Ostry et al, 2011; Forbes et al. 2013).

The 2008 global financial crisis opened a new chapter of policy discussion on how to use capital controls to deal with boom-and-bust capital flows – “capital controls are back” (Eichengreen and Rose, 2014). The contagion effect of the 2008 financial crisis and the subsequent US Fed’s quantitative easing (QE) policy caused wild swings of capital flows across the borders of emerging economies. Many emerging economies were affected by volatile capital flows. However, there are a number of economies, such as Brazil, Taiwan, and South Korea, that had a successful experience of managing volatile capital flows with capital controls (Gallagher, 2011; IMF 2011).

Maintaining the primacy of financial liberalization, the IMF started to partially recognize the appropriateness of capital account regulation in 2011; in 2012 the IMF endorsed it (IMF 2012) and recommended a set of guidance notes on the appropriate use of capital account management (CFM) (IMF 2013). The G-20 leaders endorsed these guidelines for the use the capital account management and agreed on a “coherent conclusion” in November 2011 that “there is no ‘one-size fits all’ approach or rigid definition of conditions for the use of capital flow management measures.”

China has a long history of tough regulations on capital flows. Since “open door” in 1978, China has gradually liberalized its restrictions on selected cross-border capital flows, but started with very cautious and small-step liberalization process, resulting in capital account was virtually closed until mid-80’s, despite some progresses in trade related payments regulation.

Starting from early 90's, the liberalization of trade related payment flows and FDIs charged ahead; in particular, the inward FDI exploded, which ascended China to be the largest FDI receiver in the world in 90's. However, the 1997 Asian financial crisis disrupted the entire process. In order to stop as high as \$80 billion (Gunter, 2004; Cheung and Qian, 2010) capital flight in 1998 and shield Chinese economy from East Asian financial turmoil, Chinese government imposed the strictest capital controls, even criminalized certain cross-border capital transactions¹ (Wu and Tang, 2000).

As with the experience of other countries, tight regulations on capital account brought China greater financial stability. It is conceivable that capital controls helped China survived the storm of the 1997 Asian financial crisis. The then US Treasury Secretary Rubin praised China as an “island of stability” in the region. With the help of capital controls, China seemed to manage the risk of possible contagion from the 2008 global financial crisis as well.

However, with greater globalization and associated problems, e.g. global imbalances of payments, a perceived undervaluation of the RMB exchange, and economic growth hitting a bottle neck, China has become more eager to liberalize its capital account to meet these new challenges. The People's Bank of China (PBOC), China's central bank, issued a report in 2012 that outlined a three-stage reform proposal to promote the international use of the RMB and to open up China's capital account within ten years. However, the IMF warned via Wall Street Journal (2013) that speedy liberalization could trigger a massive capital exodus if not properly handled. It was estimated that net outflows from China could be as much as 15% of the country's GDP (Bayoumi and Ohnsorge, 2013) over several years. The domestic banking system may not be resilient enough to withstand such shocks, and could trigger a financial crisis. To minimize the possible danger of liberalization, China's capital controls may remain necessary and effective before the implementation of policies to reform the RMB exchange rate and liberalize interest rates (Prasad et al, 2005).

Before analyzing the policy sequence and the profound implications that capital controls may have on the Chinese economy, it is important to answer the following questions: Are China's capital controls still effective as the Chinese economy becomes increasingly complex? How do capital controls affect capital flows, particularly volatile short-term capital

¹ Appendix A provides detail description of capital control measures.

flows? What effect could liberalizing China's capital controls have on the RMB exchange rate, China's financial stability, and the Chinese economy?

Although there are a plethora of papers that discuss China's capital controls and attempt to answer these questions. However, many of them are narrative and use simple descriptive statistics on key variables to draw conclusions, therefore they lack robust statistical evidence from proper econometric analyses. There are only a handful papers which study China's capital flow regulations using regression analyses², primarily due to the lack of appropriate measures of China's capital controls, particular measures of controls on subcategories of the capital account and inflows versus outflows.

In this paper, hoping to inspire and facilitate a new avenue of studies on China's capital controls and capital flows, we create an index data set measuring changes in China's capital controls by extracting detailed information from the text of IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER). China usually implements policies step by step in a gradual style, and we extract those information about gradual changes from each line of the text in IMF's AREAER and supplementary materials from other sources³. Our goal is to incorporate as detailed and accurate information as possible about China's capital controls. Our monthly indices data are from 1999 to 2012, and comprise two groups of indices, *de jure* and hybrid. Both groups include indices created for selected subcategories of China's capital account, including equities, bonds, money market instruments, commercial credits, financial credits, and FDIs. Additionally, similar indices are generated from controls on inflows and outflows of funds and transactions made by residents and nonresidents. Indices for China's control on trade related capital flows, namely exports proceeds and imports payments, are also created.

To compile the *de jure* index data, we adopt a straightforward coding rule – setting January 1999 as the bench market and assigning it a score of 0, we add 1 to the previous capital control score if there is a tighten-up in capital control and subtract 1 if there is a relaxation on control level in next month. The score will be kept the same if there is no policy change.

² See, e.g., Ma and McCauley (2008), Cheung and Qian (2010), Chen (2013) and Cheung and Herrala (2014).

³ Appendix B provides the list of other information sources.

Hence, a high score of index indicates tighter level of China's capital controls. Aggregated capital control indices, for example, the overall control on China's capital account, is generated by unweighted average of indices from its asset subcategories capital flows (Schindler, 2009). Further, we create a unique hybrid index data set by weighted averaging the *de jure* indices with the share of an asset subcategory in the total value of China's capital account as the weight.

In comparison to other indices, for instance, the Chinn-Ito index, the Quinn (1997) index, and the Schindler (2009) index, our indices possess several advantages, in particular, they 1) properly capture the overall liberalization trend of China's capital controls during 1999 and 2012, while other indices suggest unchanged or even tighten-up on China's capital controls; 2) numerically measure the intensity of changes in capital controls over time; 3) relative to other indices, display substantially more variation, implying uneven and complicated liberalization of China's capital controls during the sample period; 4) contain less subjective judgment as we code policy changes by simply adding (subtracting) if there is a tightening (relaxing) of controls without incorporating judgement about the magnitude of the change;⁴ 5) are monthly frequency and so can be used to study high frequency short-term capital flows.

Our indices show an overall liberalization of capital controls in China since 2000. The liberalization process is persistent over time, albeit the trend was altered a few times when Chinese government need stricter capital controls to deal with financial stability threats, e.g. the spillover from 2008 financial crisis⁵. Moreover, China's capital control liberalization is uneven across different aspects. For example, capital controls are kept stricter on capital inflows than outflows. While China opens up swiftly to long term capitals movement, it remains fairly tight level of controls on short term capitals, particularly short term financial credits, including bank loans.

⁴ This approach may ignore information that may affect the accuracy of intensity measure, because we treat every policy change equally without differentiating a big policy change versus a small policy change. For example, we consider a policy change that allows a Chinese citizen to bring \$5000 from \$0 per crossing border to be the same as a policy that a Chinese citizen is allowed to bring \$10000 from \$0 per border cross.

⁵ Appendix A provides some capital control measures that were imposed by Chinese government during the 2008 financial crisis period.

We outline the methodology for constructing our indices in the next section. Section 3 compares our indices to other indices, and Schindler's (2009) in particular. We provide some observations of our indices in Section 4. Section 5 concludes.

2. The approach of index construction

We focus on China's case only aiming to extract as detailed and accurate information as possible. As the domestic and global economy became more complicated, China's capital controls appear to be increasingly sophisticated and individual-transaction oriented. In addition, China usually implements reforms step by step – gradualism. Without carefully searching for detailed information on those steps, we may omit some important information and consequently understate the significance of policy changes.

2.1 De jure indices

This data set covers monthly data from 1999 to 2012 for changes in China's capital controls. Similar to other *de jure* indices of capital controls, we primarily rely on the information in the IMF's AREAER, but supplement and cross-check these data with information from other sources such as Chinese government directives and reports, primary news sources, and academic papers on China's capital controls.

As with Schindler (2009), our data set contains a group of indices for asset subcategories as categorized in AREAER, which are however slightly different from the standard presentation of IMF and OECD Balance of Payment (BOP5) assets and liabilities categories; nevertheless, they are compatible after some adjustments. Those subcategories include portfolio equities investment, debt securities investment, FDIs, financial credits, and commercial credits, etc. Further, we compile the data from the perspective of capital controls on gross capital flows, inflows and outflows, as well as on resident and nonresident transactions. Apart from the indices of capital account controls, we also create indices of controls on China's imports and exports payment flows. Given the fact that China's total imports and exports account for more than 50% of GDP, investors could easily move capital in and out via, for example, trade mis-invoicing (Cheung and Qian, 2010; Cheung et al, 2015). Thus, it is likely that controls on trade payment

flows are one of the key parts of overall capital control policy. The indices for controls on China's capital account and trade in our data set are listed below.⁶ Due to the limited importance of some asset categories in China's capital account, we code and compile 6 major asset categories in AREAER, which account for more than 82% of gross value of China's capital account.

eq: Shares or other securities of a participating nature

eq_plbn: Purchase locally by nonresidents

eq_silbn: Sale or issue locally by nonresidents

eq_pabr: Purchase abroad by residents

eq_siabr: Sale or issue abroad by residents

bo: Bonds or other debt securities

bo_plbn: Purchase locally by nonresidents

bo_silbn: Sale or issue locally by nonresidents

bo_pabr: Purchase abroad by residents

bo_siabr: Sale or issue abroad by residents

mm: Money market instruments

mm_plbn: Purchase locally by nonresidents

mm_silbn: Sale or issue locally by nonresidents

mm_pabr: Purchase abroad by residents

mm_siabr: Sale or issue abroad by residents

cc: Commercial credits (trade credits)

cco: By residents to nonresidents

cci: To residents from nonresidents

fc: Financial credits (mainly bank loans)

fco: By residents to nonresidents

fci: To residents from nonresidents

di: Controls on direct investment

dio: Outward direct investment

dii: Inward direct investment

ldi: Controls on liquidation of direct investment

im: Imports and Import Payments

ex: Exports and Export Proceeds

The names for each index are in *italic* font. For example, *eq* is the index measuring China's overall controls on equity investment flows, both inflows and outflows; *eq_plbn* measures the control on equities purchased locally by nonresidents in China. Given that we measure the change in intensity of capital controls, we set the level of capital controls at January

⁶ As Schindler (2009) we drop financial derivatives, real estate transactions, and personal capital transactions. In addition, we also drop the collective investment, due that we cannot identify the corresponding asset or liability categories from China's BOP report.

1999 as the benchmark⁷ and give a score of 0.⁸ Whenever there is a policy change that tightens controls on an individual transaction, e.g. bonds and other debt securities purchased locally by nonresidents (bond investment inflows), we add a value of 1 to the existing score. If there is a control-relaxing policy change, we subtract 1 from the existing score. Otherwise, we keep the score unchanged. In this way, a higher score indicates tighter controls. We do not set an upper or lower boundary for our indices – as long as the Chinese government keeps tightening capital controls, the index will rise⁹. No-boundary setting is rationalized by the fact that China’s gradual liberalization of its capital account is still in process and it is therefore hard to anticipate the number of steps that China will need to take to fully liberalize its capital account.

Since capital controls are coded at an individual asset transaction level, we follow Schindler (2009)’s method to compile an aggregate index by taking the unweighted average of the appropriate asset subcategories. Let us take aggregate controls on the gross flows of “shares or other securities of a participating nature (equity investments)” as an example. The following five formulae describe how to compute the aggregate index for controls on gross equity flows (inflows plus outflow), inflows, outflows, nonresident, and resident equity capital investments, respectively.

$$eq = [eq_plbn + eq_silbn + eq_pabr + eq_siabr]/4 \quad (1)$$

$$eqi = [eq_plbn + eq_siabr]/2 \quad (2)$$

$$eqo = [eq_silbn + eq_pabr]/2 \quad (3)$$

$$eq_nr = [eq_plbn + eq_silbn]/2 \quad (4)$$

$$eq_r = [eq_pabr + eq_siabr]/2 \quad (5)$$

where eq , eqi , eqo , eq_nr , and eq_r notate the index of aggregate controls on gross capital flows, inflows, outflows, flows generated by nonresidents, and by residents, respectively. By applying a simple average method, we do not differentiate the relative importance or effectiveness of capital controls that are imposed on each individual asset subcategories, inflows

⁷ Setting January 1999 as the bench market is due to data availability.

⁸ Alternatively, we can set the benchmark to be 100, resembling the construction of CPI. Although sitting the benchmark in different values, both approaches keep the essence of our indices that measure the intensity changes in China’s capital.

⁹ Although we do not have score boundaries, the highest and lowest score are 5 for commercial credits and -8 for outward FDI, respectively.

or outflows, and resident or nonresident capital flows. For instance, in formula (1), we assume that controls on *eq_plbn* are equally as important as those on *eq_silbn*, *eq_pabr*, and *eq_siabr*. In section 2.2, we discuss this issue in more depth.

As these formulae show, in addition to aggregating sub-indices along asset categories, we also bundle up sub-indices according to the direction of capital flows. For example, when we bundle up the equity inflow sub-indices, we calculate the simple average of “*eq_plbn*: Purchase locally by nonresidents” and “*bo_siabr*: Sale or issue abroad by residents” as the index of control on China’s equity inflows. Similarly, controls on equity outflows are computed as a simple average of *eq_pabr* and *eq_siabr*. For direct investment, commercial credit, and financial credit, no aggregation is necessary, if we assume inflows are equal to the transaction made by nonresidents to residents, whereas outflows are transactions made by residents to nonresidents¹⁰.

It is intuitive to consider both “Purchase locally by nonresidents” and “Sale or issue abroad by residents” as capital inflows, and “Sale or issue locally by nonresidents” and “Purchase abroad by residents” as capital outflows. Hence, the restrictions on the former two are deemed as capital controls on inflows, whereas the restrictions on the latter two are capital controls on outflows. However, some restrictions on nonresidents’ sale of domestic asset (outflows) may be considered a measure of capital controls that is designated to discourage nonresidents’ purchase of domestic assets (inflows). For example, China’s imposition of lock-up periods on the repatriation of sales of domestic assets by nonresidents (outflows) can be interpreted as a restriction on nonresidents’ purchase of domestic assets (inflows) in that the lock-up may discourage the initial purchase of domestic assets. Without subjectively judging the orientation of government policy, we create a control index for “Purchase locally by nonresidents”, “Sale or issue abroad by residents”, “Sale or issue locally by nonresidents”, and “Purchase abroad by residents” of each asset category, respectively. Figure 7 shows the evolution of these indices over time.

Regarding controls on the flow of funds from imports and exports, since resident exporters get payments from nonresident importers, the proceeds of exports are capital inflows; by the same logic, the payments made by resident importers to foreign exporters are capital outflows. Therefore, the control index on exports is essentially the control index of capital

¹⁰ Schindler (2009) applies the same assumption.

inflows, computed as $ex = [ex1 + ex2 + ex3 + ex4... + exn]/n$, where $ex1, ex2, \dots, exn$ are sub-items representing various aspects of export controls, e.g. repatriation requirement, documentation requirement, and exports license, etc. To save space, we do not list the sub-items of the exports control index.¹¹ Using a similar approach, we also generate an index of controls on imports payment flows.

Regarding the control indices applying to residency, as shown in formula (4) and (5), we take the average of “sales or issue aboard by residents” and “purchase aboard by residents” to yield a control index for residents; the control index for nonresidents is the average of “purchase locally by nonresident” and “sale or issue locally by nonresident”. As in Schindler (2009), we interpret controls on direct investment inflows as nonresident restrictions, and those on direct investment outflows as resident restrictions.

These newly created indices for asset categories can be used to create more aggregate capital control indices. For example, we can construct an index of capital controls on China’s overall capital account inflows by taking an average of all inflow indices in the capital account categories, including inflows of equities, bonds, money market instruments, commercial credits, financial credits, and FDIs. Further, we create an aggregate index of China’s capital controls that accounts for the controls on both capital account and current account.

2.2 Hybrid indices

As we discussed in the previous section, we generate aggregate *de jure* indices by simply averaging the sub-indices of an asset category without differentiating the relative importance of each asset subcategory of capital controls, which might cause some measurement bias. To pin down this issue, one of the strategies is to add a weight to each asset subcategories. Ideally, that weight can properly represent the importance of each asset sub-category. One weight that we investigate in this paper is the share of a subcategory asset value in the total value of all asset categories in China’s capital account. For example, equity investment is a subcategory asset and the weight for controls on gross equity investment flows is the value of gross equity investments divided by the total value of gross capital flows of six aforementioned categories in China’s

¹¹ We coded the index for each of those sub-items, which are available from the authors upon request.

capital account. Conceivably, larger flows point to more opportunities for investors to evade capital controls (Ma and McCauley, 2008). In order to be more effective in its capital controls, it is important for China to control an asset that accounts for a large share of its total assets. Thus, the higher the weight, the more important an asset subcategory is in evaluating capital control intensity or effectiveness.

Given that the indices we obtained in Section 2.1 are *de jure* measures and the weights we employed are *de facto* measures, we consider our indices hybrid ones. The weights data are based on the BOP data extracted from the State Administration of Foreign Exchange of China (SAFE), which has quarterly data for each asset subcategory, disaggregated into inflows and outflows and residents and nonresidents¹². To avoid introducing excess variation from using *de facto* BOP data, we use a four-year average moving window to create the weights¹³. The moving windows are applied in retrospective style, for example we use the average of year 1995, 1996, 1997, and 1998 to weight the 1999 index. The rationale is that policy makers usually evaluate the importance of an asset category from its existing status. If we include the current year or the forward years in the four-year moving window, it introduces an endogeneity issue, because current or forward years' capital flows might be the result of current capital controls policy. Listed below are the formulae for the individual capital account control hybrid indices, again using equity capital flow indices as an example:

$$heq = eq_plbn * w_1 + eq_silbn * w_2 + eq_pabr * w_3 + eq_siabr * w_4 \quad (6)$$

$$heqi = eq_plbn * w_1 + eq_siabr * w_4 \quad (7)$$

$$heqo = eq_silbn * w_2 + eq_pabr * w_3 \quad (8)$$

$$heq_nr = eq_plbn * w_1 + eq_silbn * w_2 \quad (9)$$

$$heq_r = eq_pabr * w_3 + eq_siabr * w_4 \quad (10)$$

¹² The BOP uses different terminology. For example, debiting equity asset represents that resident invests overseas stock markets, while crediting equity asset refers resident's sale or issue of stock abroad.

¹³ Using a four-year average moving window is based on our understanding to the development of Chinese economy. From 1995 to 1998, Chinese economy raised the level of openness to the world. 1999 – 2002 is a period that China recovers from the impact of 1997 Asian financial crisis; 2003-2007 is a take-off period for the globalization of Chinese economy, including ballooning international trade and a jumping-up inward and outward FDI; and in 2008 – 2012, as all other emerging economies, China dealt with the global financial crisis and liquidity issues.

where “*heq*” denotes a hybrid index for the overall control on equity investments; w_1 equals the value of “*eq_plbn*: equity purchase locally by nonresident” divided by “the total value of China’s equity investment gross flows”; w_2 to w_4 are obtained in a similar fashion.¹⁴

Using more aggregate BOP data to compute the weights, we are able to create three hybrid indices for China’s overall capital controls on its capital account – the gross capital account control index, capital inflows control index, and capital outflows control index, as well as a hybrid index for overall controls on Chinese trade payment flows using Chinese foreign trade data.

$$hka = eq * w_{g1} + bo * w_{g2} + mm * w_{g3} + cc * w_{g4} + fc * w_{g5} + di * w_{g6} \quad (11)$$

$$hkai = eqi * w_{i1} + boi * w_{i2} + mmi * w_{i3} + cci * w_{i4} + fci * w_{i5} + dii * w_{i6} \quad (12)$$

$$hkao = eqo * w_{o1} + boo * w_{o2} + mmo * w_{o3} + cco * w_{o4} + fco * w_{o5} + dio * w_{o6} \quad (13)$$

$$hca = im * w_{im} + ex * w_{ex} \quad (14)$$

where each weight is the share of an asset in the sum of all six assets and w_{im} and w_{ex} are the weights of imports and exports in total Chinese trade, respectively.

In some ways, hybrid indices have advantages over both *de jure* and *de facto* indices when applied to empirical research. On the one hand, many *de jure* indices are limited in that they do not measure the importance of various capital controls; on the other, *de facto* measures may encounter measurement errors and endogeneity issues (Quinn et al, 2011). The hybrid indices that we generated seem to be able to mitigate issues of lack of importance measures and endogeneity by introducing weights in the coding mechanism and by using a retrospective style moving average window to weight the *de jure* indices.

3. Comparison to other indices

As discussed in Chinn and Ito (2008) and Quinn et al. (2011), there are numerous capital control indices in the literature, including *de jure*, *de facto*, and hybrid indices. Most *de jure* indices use the IMF’s AREAER and convert text information of capital controls to a binary 0/1 code. Before 1997, AREAER provided a summary table that enumerates the presence of

¹⁴ For FDI, the subcategory “liquidation of direct investment” is not taken into account to create the hybrid index since the corresponding gross flows data are not available in BOP to compute the weight.

restrictions for each country. Epstein and Schor (1992) is among the first papers to develop a binary index¹⁵ for 16 OECD countries over the period of 1967 – 1986. The post-1997 AREAER enriches the dimensional structure of the reporting system to 13 separate aspects of capital account restrictions, which spurred a second wave of capital control index construction. For example, Abiad and Mody (2005), Chinn and Ito (2008), Johnston and Tamirisa (1998), Miniane (2004), Mody and Murshid (2005), and Tamirisa (1999) use AREAER information and idiosyncratic methods to create different capital control indices that have different country coverage and time spans. Although they may be generated in different ways and have different strengths and drawbacks, since they primarily rely on AREAER, the correlation between these indices is high (Chinn and Ito, 2008).

Note that almost all of those existing indices data are panel data, covering as many countries (with or without China) and time periods as possible, whereas we work on China as an experimental lab and focus on the critical time period (1999 – 2012) when China gradually liberalized its capital account.

Methodology wise, our indices are close to Schindler (2009). Both of our indices are based on AREAER, cover several subcategories of capital account transactions, and average the subcategories control indices to form more aggregate control indices. Moreover, both papers create control indices for inflows and outflows and resident and nonresident restrictions. However, our indices are different from Schindler (2009) in several ways. First, rather than measure the capital control level in a yes-or-no style, we measure the monthly intensity of changes in China's capital controls. We deviate from the traditional binary coding to numerically measuring the changes in capital account restrictions over time. Due to a different coding mechanism, our indices reveal the evolution of China's policy on capital control and have more variation than Schindler's. Table 1 and 2 provide summary statistics of our indices and Figure 1 shows that our gross index has significantly more variation compared to those of Chinn and Ito (2008), Quinn (1997), and Schindler (2009).¹⁶ Third, we include some subcategory indices that are essential to China in our data set. For example, we add commercial credit indices and control

¹⁵ Other papers include Alesina, Grilli, and Milesi-Ferretti (1994), Grilli and Milesi-Ferretti (1995), Edison et al (2004), and Klein (2003)

¹⁶ We convert Quinn (1997)'s index into 0-1 scale.

indices for China's imports and exports payment flows to accommodate the large amount of Chinese foreign trade activities.

Another *de jure* indices database that is close to ours is Forbes et al (2013), in which the authors create a new capital flow management index (CFMs) to identify any change, increase or decrease in restrictions, at a weekly frequency for 2009, 2010, and 2011 and 60 countries. Similar to Schindler's and our index, they generate the data set by type of capital flow: inflows and outflows, residents and nonresidents. One difference is that, although Forbes et al (2013) count the number of policy changes, albeit differentiating between a tightening and relaxation of controls, the authors do not measure their intensity over time. One advantage of our indices is that we have more disaggregate indices for various types of financial assets and the indices for controls on the current account, which is arguably a very important aspect of effective capital controls in some major current-account-convertible emerging countries such as China.

Unlike for *de jure* indices, there are only a few hybrid indices of capital controls. Edison and Warnock (2003) create a monthly measure of capital account openness proxied by the share of domestic equities available to foreign investors. Dreher (2006) and Dreher, Gaston, and Martens (2008) create and update a broad measure of economic globalization, which is an aggregated of a group of sub-indices based on weights derived from a principal components analysis. Those sub-indices include *de facto* variables (trade, FDI, portfolio equity, tariff rate, hidden import barriers, and taxes on international trade) and a *de jure* index is constructed by counting the number of restrictions in 13 binary coded categories of AREAER. While it is appropriate to generate weights from principle component analysis (PCA) when there are several sub-components that measure different aspects of a principle component, it is hard to say that those weights reveal relevant information about the relative importance of each component. Moreover, the PCA weights are fixed throughout the sample period. This might be a deficiency in accounting for capital controls that have significant heterogeneity across countries and time periods.

In our hybrid index we choose a weight computed as the value share of a certain asset subcategory in the total value of all assets in China's capital account. A larger weight represents a more important asset subcategory for our capital controls measures. For example, it is more important to regulate the financial credits category (65% of total value of capital account gross flows considered for the period 2008-2011) versus bond and other debt security category (4%).

In addition, we rely on a four-year-average moving window to account for the evolvement of the relative importance of each asset category from 1999 to 2012. Using the four-year moving window is also intended to harness the excessive variation associated with the weight and possible endogeneity issue. Arguably, differentiating the relative importance of each asset may enable our indices to better measure developments in China's capital controls.

4. Indices description and some observations

Overall, our indices reflect a persistent process of liberalizing China's capital account since 2000. As shown in Figure 2, there is a clear downward trend (a lower index represents a more liberalized capital account) in the gross capital account control index (*ka*). Although there is a structural shift around the 2008 global financial crisis, the downward trend continued after the crisis – China kept loosening the controls on its capital account although there was a temporary reversal of this trend reflecting concerns about spillovers of the global financial crisis. The control index for gross flows of current account (*ca*) also indicates a liberalizing trend, but with a much slower pace than the capital account. Particularly during the period from 2005 to 2008 before the global financial crisis, rather than liberalizing, China tightened up trade payments controls. It is probably due to the fact that China was using policy tools to rein the booming trade surplus to ease the political pressure from its major trade partners. In general, the control indices of both the current account and capital account move in tandem, revealing that the Chinese government coordinates capital control in the current account and capital account. In addition, our indices may well reflect how the government implements capital control policies in response to major economic events and shocks. For instance, in responding to 2008 financial crisis (pinpointed at the collapse of Lehman Brother in Sept. 2008) when capitals “flight to quality” from emerging economies, the Chinese government encouraged capital inflows by raising the QFII cap from \$800 million to \$1 billion and reducing the lock-up period for certain medium and long-term capital to 3-month from six-month to 1 year; and allowed foreign investors to participate in the interbank foreign exchange market. At the same time, China tightened capital outflow measures to strictly enforce the QDII cap on the net amount of funds remitted abroad.

In two panels of Figure 3, we show the indices of the intensity changes in capital controls on inflows versus outflows and on resident versus nonresident transactions, respectively. Although the controls on both inflows and outflows were generally becoming looser, the process was uneven. While outflow controls were persistently liberalized, inflow controls rotated with tightening and loosening, but generally were kept the overall control intensity higher than that of the outflows. The capital controls on residents and nonresidents transactions appear to follow a similar pattern as those on inflows and outflows. China kept loosening controls on residents, while retaining relatively tighter controls on nonresidents.

Figure 4 illustrates the control intensity of 6 different asset subcategories of China's capital account. There is an overall trend of liberalization, but at an uneven pace for different assets. For example, equity investments and FDIs liberalization are put in the fast lane, whereas financial credits and money market instruments have a bumpier ride. Interestingly, controls on commercial credits were substantial tightened after 2005. Checking further by reviewing the index of commercial credits inflows and outflows separately, we find that this is attributable to stricter control on inflows relating to the repatriation of Chinese exports proceeds ("Inflows by assets" panel of Figure 4). In fact, at the same time China encouraged outflows of commercial credits (payments for imports). This suggests that China intended to contain the runaway trade surplus in response to mounting political pressure from the US government. Comparing "Inflows by assets" with "Outflows by assets" panel of Figure 4, it is noteworthy that China liberalized capital controls on outflows faster than on inflows. Outward FDI is the outstanding example: to support the "going global" policy initiative of 2002, China drastically opened up outward FDI and encouraged Chinese enterprises to invest and raise capital overseas.

Figure 5 compares the controls on inflows and outflows of six asset subcategories individually. Again, in general, controls on inflows and outflows were liberalized, except for commercial credits. The liberalization pace for outflows is faster than that for inflows. There are two exceptions though – China opened up controls on inflows more than on outflows for bond securities and money market instruments. This may reflect China's policy intention of developing its domestic bond markets and money markets by introducing foreign competition.

Figure 6 compares the *de jure* and hybrid indices for gross capital flows, inflows, and outflows. Both the *de jure* and hybrid indices suggest a trend of liberalization of China's capital

account controls. Though they are highly correlated, the hybrid gross flows control index deviated from the *de jure* index after 2007, showing a measure of tighter control than the *de jure* index.

The *de jure* and hybrid inflow control index seem to head in the same direction but follow different paths after 2002 – the hybrid index suggests a higher intensity of inflows control than the *de jure* index does. Due to investors’ one-way bet on the revaluation of RMB, China has experienced an episode of hot money influx since 2003. The Chinese government consequently tightened capital controls to restrain hot money inflows (as seen in the “Financial credit” panel of Figure 5). The influx of hot money drastically raised the share of financial credits (*fc*), which jumped from 30% to about 60% and subsequently reduced the share of FDI inflows from 60% to 25%. The increased weights of financial credit (*fc*) substantially amplified the *de jure* measure of inflows capital controls, resulting in a higher hybrid control index than the *de jure* index.

Regarding the *de jure* and hybrid index on capital outflows, both trend downwards, except for a tightening spike during the 2008 financial crisis. But the hybrid index shows a higher level of controls than the *de jure* one. The reason primarily is due to the high share of financial credit (*fc*), which on average account for more than 70% of total outflows from capital account asset categories after 2007. Such heavy weights amplify policy shifts in 2008 to restrict capital outflows during the “flight to quality” episode, and consequently keep the hybrid index of capital outflows away from the *de jure* index.

5. Conclusion

We create a capital control index data set to measure the on-going liberalization of China’s capital account. The data set contains two groups of indices - *de jure* and hybrid indices measuring the intensity changes in China’s capital controls. Similar to Schindler (2009), we compile control indices of different asset categories in gross capital flows, capital inflows, and outflows, as well as controls on residents and nonresidents, respectively.

The *de jure* indices are quantitatively coded according to information extracted from the IMF’s *Annual Report on Exchange Arrangement and Exchange Restrictions* (AREAER) and supplementary materials from other sources. In addition, we contribute to the literature by constructing new hybrid indices of China’s capital controls, compiled by a weighted-average of

the *de jure* indices with the share of an asset subcategory in the total value of China's capital account categories.

Both the *de jure* and hybrid indices capture the overall liberalization of China's capital account restrictions after 2000, albeit at an uneven pace for inflows versus outflows and short-term versus long-term capital flows. In contrast to other indices that show little variation in China's capital controls, our indices reflect China's overall capital account liberalization process and show reasonable variation of intensity changes in China's capital controls. In addition, our indices contain less subjective judgment in that we code policy changes by adding (subtracting) 1 if there is a tightening (relaxation) of controls without trying to judge the magnitude of the change.

Our index data set is based on the foundation laid by many papers in the literature, including Chinn and Ito (2008), Quinn (1997) and Schindler (2009) in particular. We strive to integrate their strength and mitigate their drawbacks when creating our indices. However, some caveats are inevitable. Listed below are three drawbacks associated with our indices. First, as other indices measuring the intensity of capital controls, our coding approach ignores the information that differentiates the magnitude of policy changes. Second, for our *de jure* indices, we do not differentiate the relative importance of each asset category when we aggregate the sub-indices. We do however create the hybrid indices to tackle this issue. Third, when we create the hybrid indices, our choice of a four-year window is arguably arbitrary¹⁷.

Our indices are on a monthly frequency. Due to the availability of the AREAER data, the data set is relatively limited in its time span of 1999-2012; and we only cover China's case. However, data updating and research projects to create indices for other countries would be easy to carry out as our coding mechanism and compilation approach are compatible with all other countries.

China's liberalization process on capital account is still ongoing and numerous steps of policy and regulation changes that designated to further open up capital account and promote renminbi internationalization are kept emerging after 2012. For example, the establishment of Shanghai Free Trade Zone (FTZ) in September 2013 and the similar FTZs in Guangdong,

¹⁷ In addition to 4-year window, we tried 3, 5, and 6-year moving average windows. These indices are similar to the ones in the paper.

Tianjin, and Fujian in April 2015 experiment on virtually full capital account convertibility economic environment in these controlled region. China also made a trial run to deepen openness of domestic financial market by creating Shanghai-Hong Kong stock market link that allows Hong Kong and mainland China investors to invest each other's stock market. Other major liberalization measures includes QDFII2, Mutual Funds Connect, and further development of offshore renminbi market (CHN) and dim sum bonds market. Had we update our capital control index data set in the future, we shall count in those policy steps in the index data.

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Appendix A

List of capital control measures imposed by Chinese government during

1) 1997 Asian financial crisis

- Regulation to stricter procedure on inspection, verification and the settlement of foreign exchange for payments of Chinese imports (June, 1998).
- Detail measures on exports inspection, value verification, and collection of foreign exchange proceeds from exports (June, 1998).
- Government directives on organize government personal to fight illegal foreign exchange purchases (July, 1998).
- Detailed regulation code on punishing illegal purchasing and selling foreign exchange (August, 1998).
- Reinstated foreign debt management policies and prohibited purchase foreign exchange from SAFE for early repayment of foreign loans (August, 1998).
- Prohibited certain renminbi loan to Chinese enterprises with the intention to purchase foreign exchange for early repayment of foreign loans (August, 1998).
- The Supreme People's court outline law code for trials related to illegal foreign exchange dealings (August, 1998).
- Administration directive to address new situations and problems related to strengthening the administration of foreign exchange under capital account (September 1998).
- Force close unregistered currency swap centers and directly administrate 35 registered currency swap centers by SAFE (October, 1998).
- Amended criminal code to including illegal foreign exchange purchasing as punishable economic crimes (October, 1998).
- Regulation on banning bank transfer of foreign exchange between enterprise and individual and individual to individual (November, 1998).
- In addition to measures listed above, Chinese government also tighten up the re-enforcement some existing control measures that I were there but lightly or sporadically enforced before the financial crisis.

2) 2008 global financial crisis

- Notice of SAFE on implementation of online system of inspection to examine the collection and settlement of companies' foreign exchange export receipts (July, 2008)
- Notice of SAFE on related issues concerning foreign exchange settlement or transfer of advanced receipt of some export enterprises (July, 2008)
- **Notice of the SAFE, the Ministry of Commerce, and the General Administration of Customs on the Printing and Distribution of Measures for Online Inspection of Export Foreign Exchange Collection and Settlement, in order to reinforce the verification of authenticity and coherence for export and foreign exchange collection and settlement (July, 2008)**
- **Notice of SAFE Concerning Issues Related to the Implementation of Measures for Online Inspection of Export Foreign Exchange Collection and Settlement (July, 2008)**
- Circular of SAFE on relevant business operations issues in order to improve the foreign exchange administration of foreign-funded enterprises, to facilitate the verification,

payment, and settlement of foreign exchange capital of the foreign-funded enterprises, and to standardize the relevant business operations of the designated foreign-exchange banks and accounting firms (August, 2008)

- **Notice of SAFE on Operating Procedure for Online Inspection of Export Foreign Exchange Collection and Settlement (September, 2008)**
- Circular of the SAFE on relevant issues concerning in the administration of registration of deferred payments of import enterprises (September, 2008)
- Notice of SAFE on related issues concerning registration management of foreign debts under the account of goods trade of Enterprises, in order to establish a complete system of supervision and management for foreign debt assets, to regulate the cross-border trade flows and to facilitate the balance of payments (October, 2008)
- Notice of SAFE on operating instruction concerning registration and management system of trade credit (advanced payment of import), in order to in order to establish a complete system of statistical supervision and management for foreign obligatory right, to regulate the cross-border trade flows (November, 2008).
- Notice of SAFE on related issues operating instruction concerning registration and management system of trade credit (deferred receipt of export), in order to improve the statistical supervision of foreign asset, to regulate the registration management of foreign obligatory right under the account of goods trade of domestic enterprises, to protect the legal right of export enterprises, to assure the authenticity and coherence of cross-border trade and related trade flows (November, 2008).
- Notice of SAFE on related issues concerning the improvement of registration management of foreign debts under the account of goods trade of Enterprises, in order to face the negative impact of global financial crisis and to boost rapid and stable economic growth (December, 2008)
- **Currency swaps based on the RMB between the PBoC and Bank of Korea (December 2008) and other emerging economies, to make the RMB a global currency when the value of the USD tumbled, which put at risk Chinese assets worth USD1.8trn.**

Appendix B

Listed below are samples of China's rules, regulations and government website that we referred and cross-checked when compiling the *de jure* data.

- Foreign Exchange Regulations of the PBC (State Council Decree No. 193).
- Foreign Exchange Regulations of the PBC (State Council Decree No. 532).
- Border Trade Foreign Exchange Administration Procedures (Hui Fa [2003] No. 113).
- PBC Notice on Issues Related to the Conducting of Personal Renminbi Business by China Mainland Banks with Hong Kong and Macao Banks (Yin Fa [2004] No. 254).
- Interim Measures for the Administration of Foreign Currency Cash Taken into and out of the Customs Territory (Hui Fa [2003] No. 102).

- Administrative Measures for the Renminbi Settlement of Cross-Border Trade Pilot Project (People's Bank of China Announcement [2009] No. 10).
- Implementing Rules of the Administrative Measures for the Renminbi Settlement of Cross-Border Trade Pilot Project (Yin Fa [2009] No. 212).
- Administrative Measures for the Renminbi Settlement of Outward Foreign Direct Investment Pilot Project (People's Bank of China Announcement [2011] No. 1).
- Administrative Measures for the Renminbi Settlement of Inward Foreign Direct Investment (People's Bank of China Announcement [2011] No. 23).
- Notice Concerning Matters Relating to Utilization if to Invest Renminbi in the Interbank Bond Market by the Three Types of Offshore Renminbi Clearing Bank Institutions (Yin Fa [2010] No. 217).
- Measures on the Pilot Domestic Securities Investment by Fund Management Company and Securities Company RMB Qualified Institutional Investors (CSRC, PBC, SAFE Decree No. 76).
- The People's Bank of China (PBoC), www.pbc.gov.cn
- The State Administration of Foreign Exchange of China (SAFE), www.safe.gov.cn
- National Development and Reform Commission of China, www.sdpc.gov.cn/
- Ministry of Commerce of China, www.mofcom.gov.cn

Figure 1: Comparison to other *de jure* indices

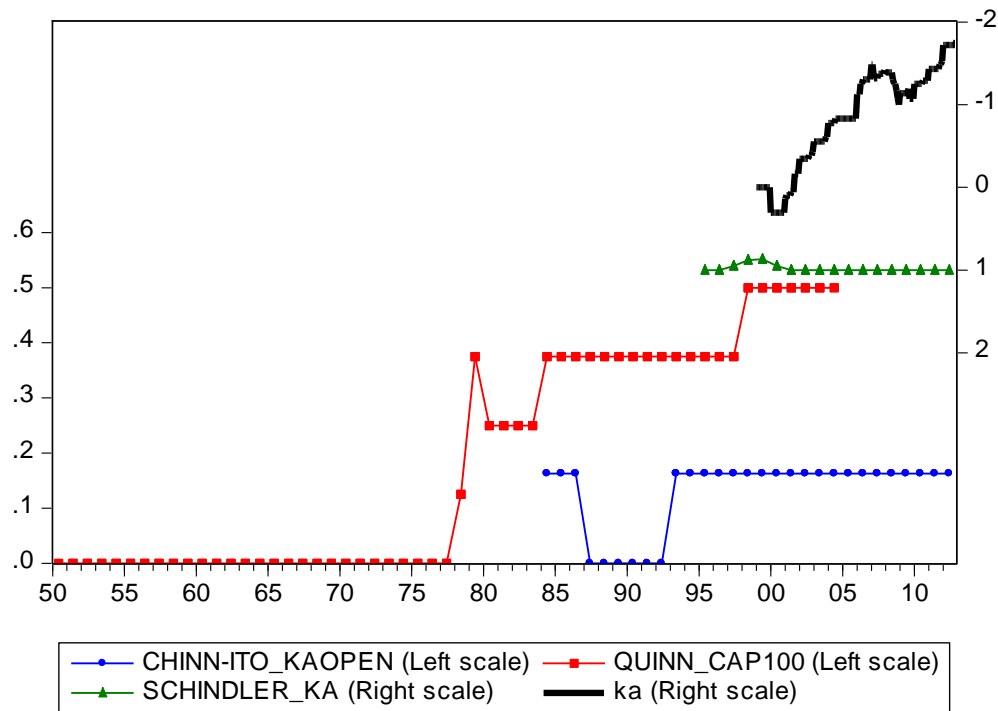


Figure 2: Index of controls on capital account (*ka*) and current account (*ca*)

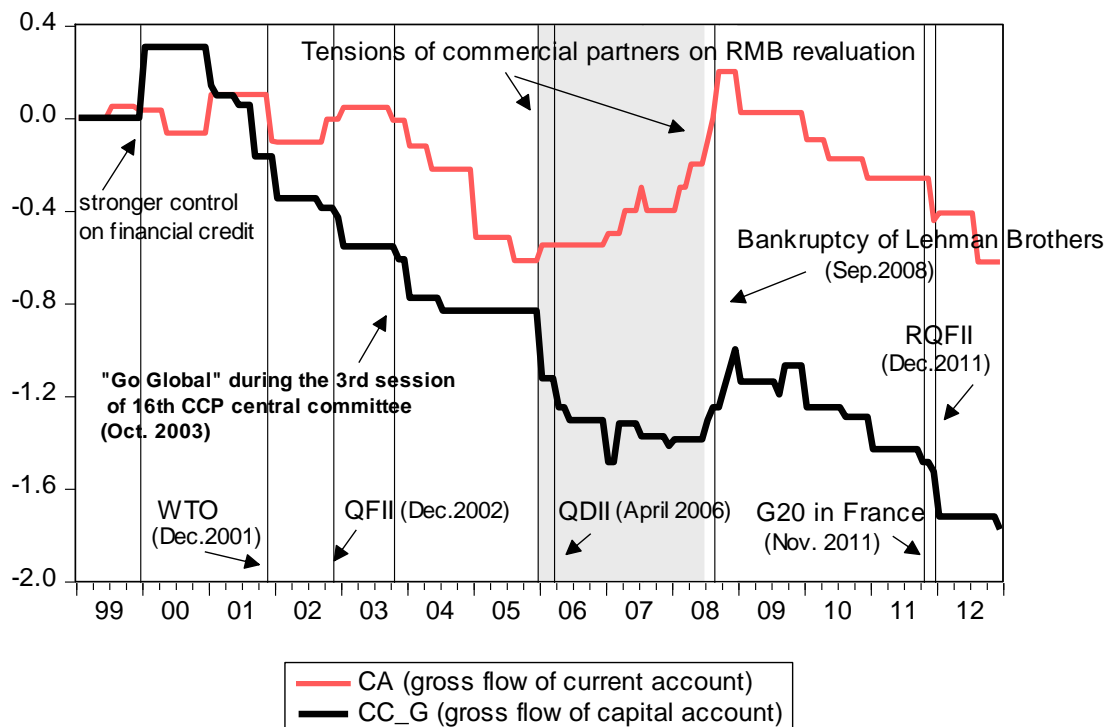


Figure 3: *De jure* indices by direction of flows and residency

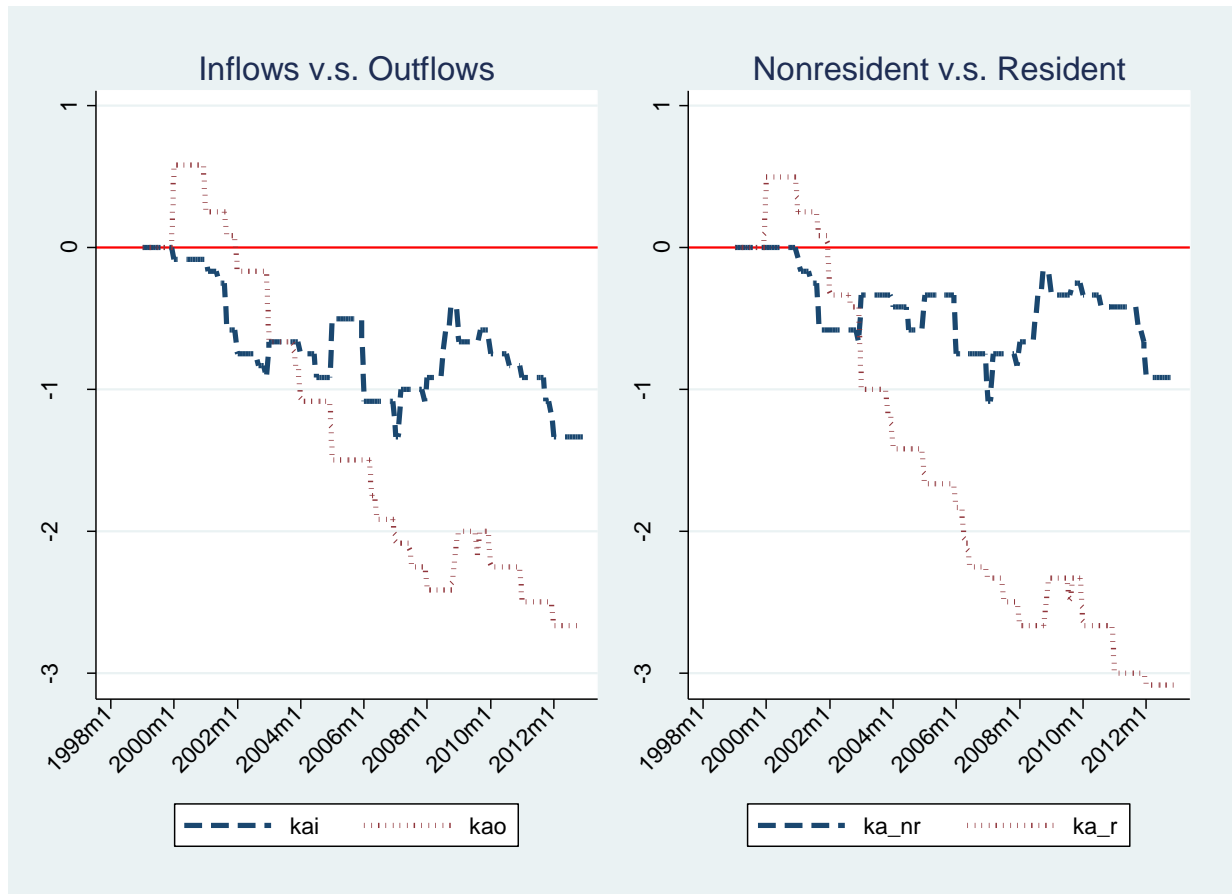


Figure 4: Capital account controls *de jure* indices by assets

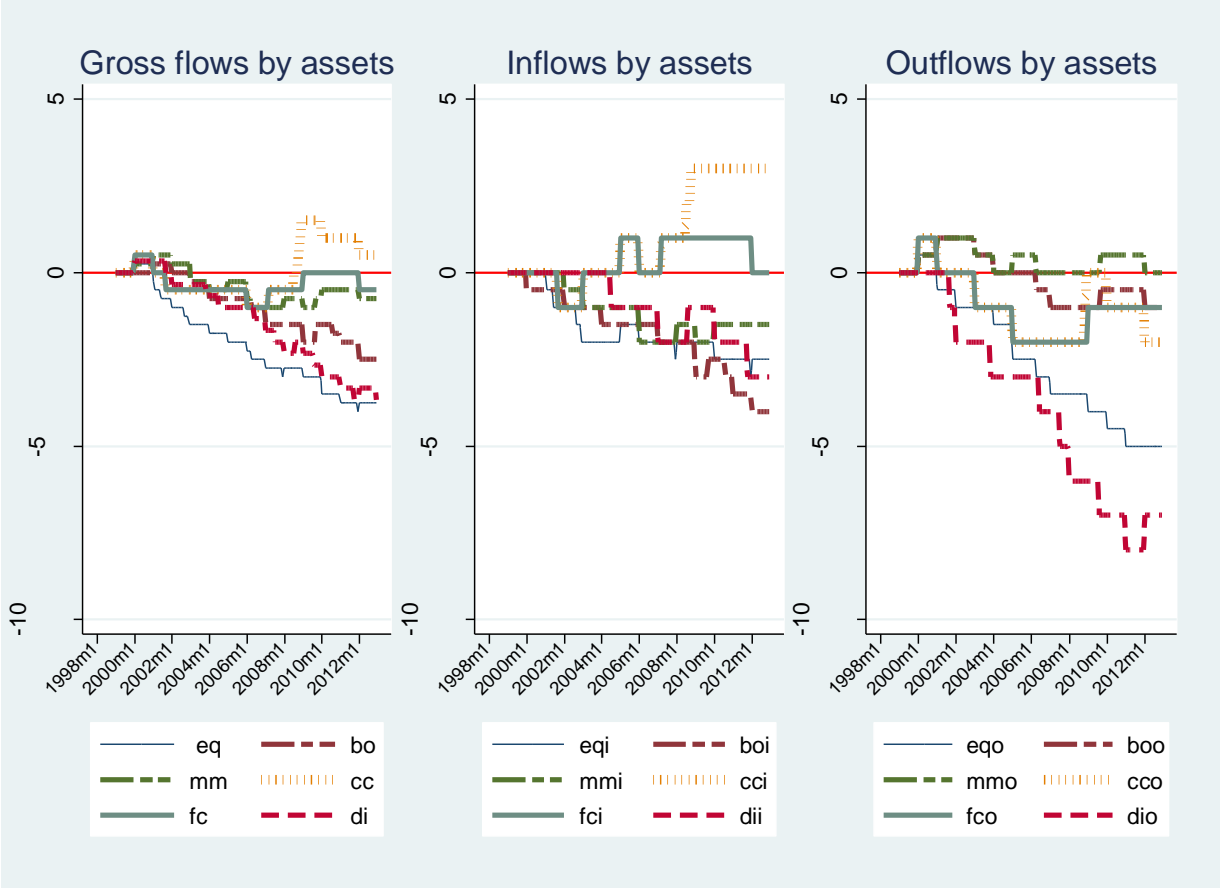


Figure 5: De jure indices by assets and by flow types

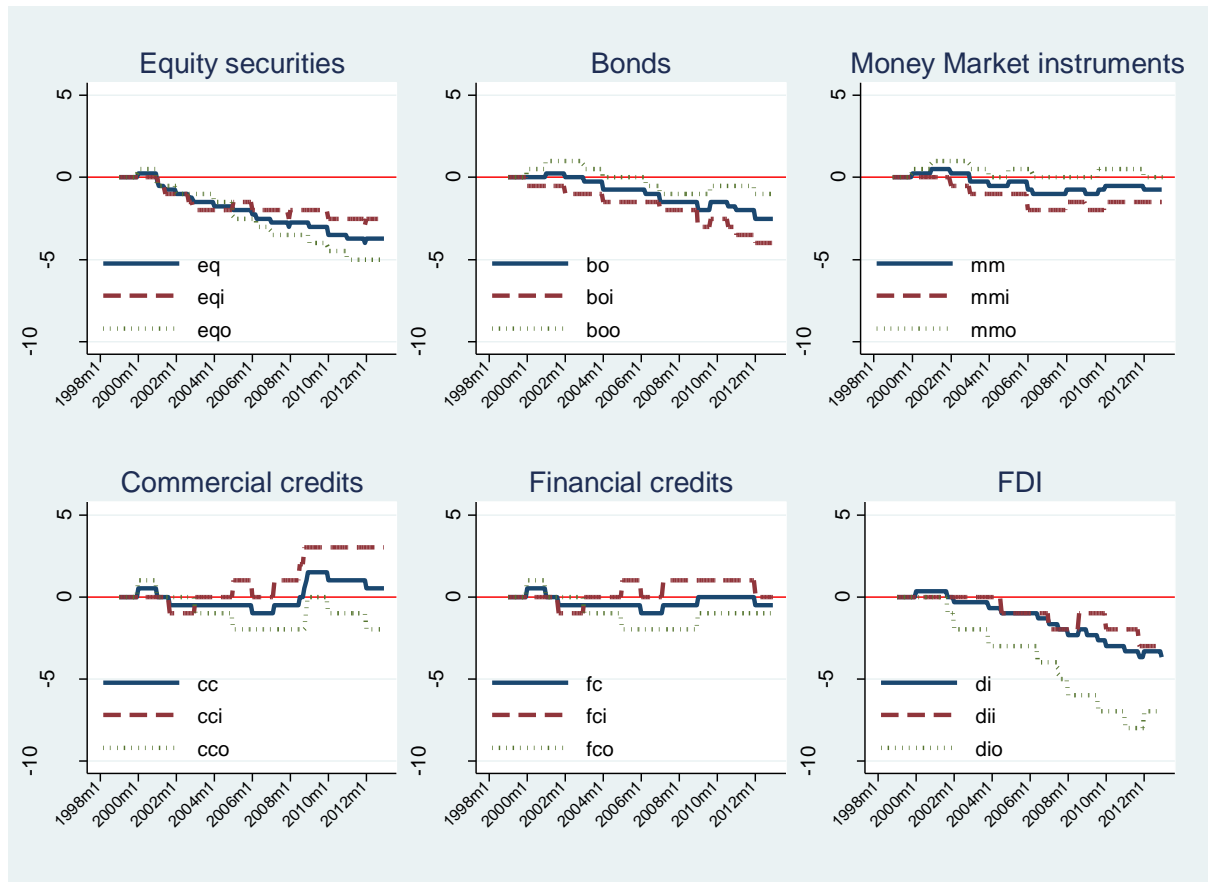


Figure 6: *De jure* and hybrid indices by flow types

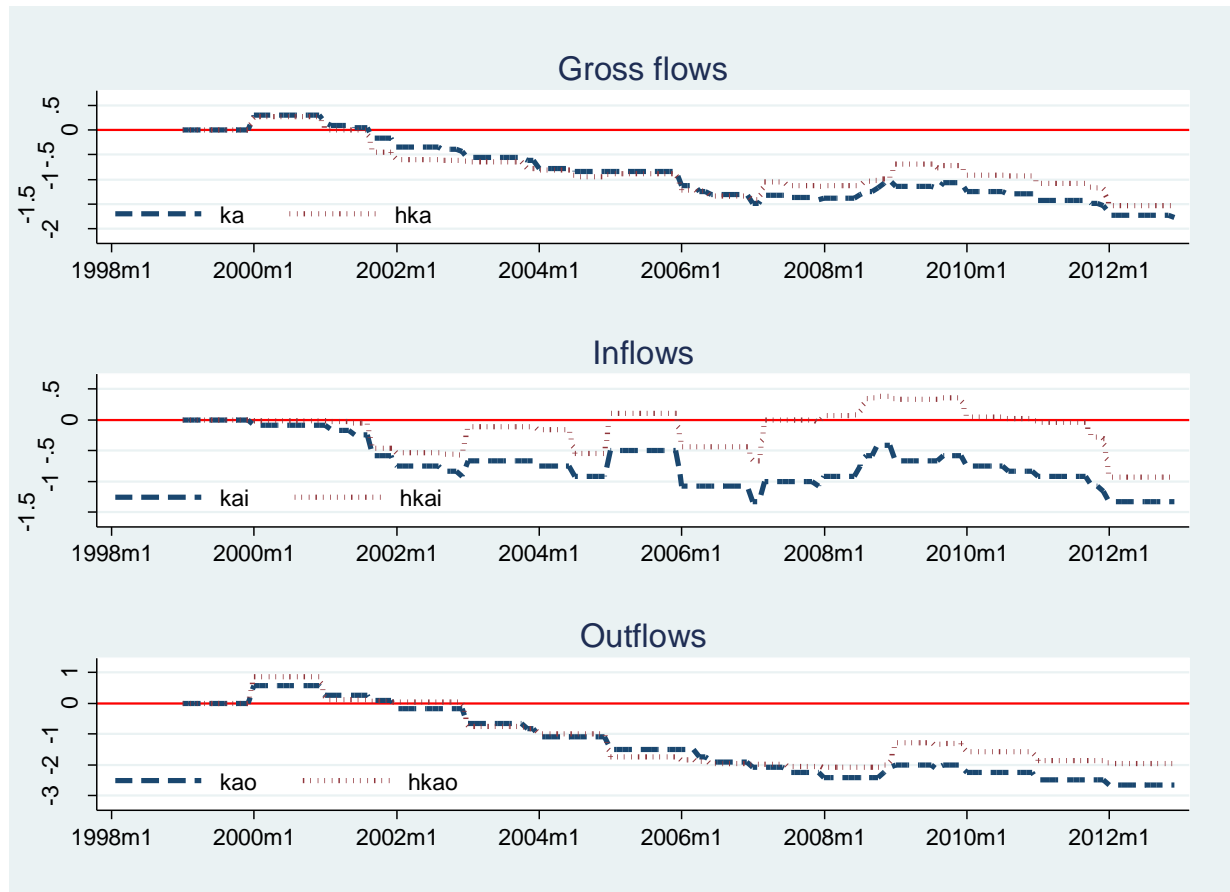


Figure 7: de jure indices for nonresidents purchase and sale of domestic assets and residents purchase and sales of foreign assets

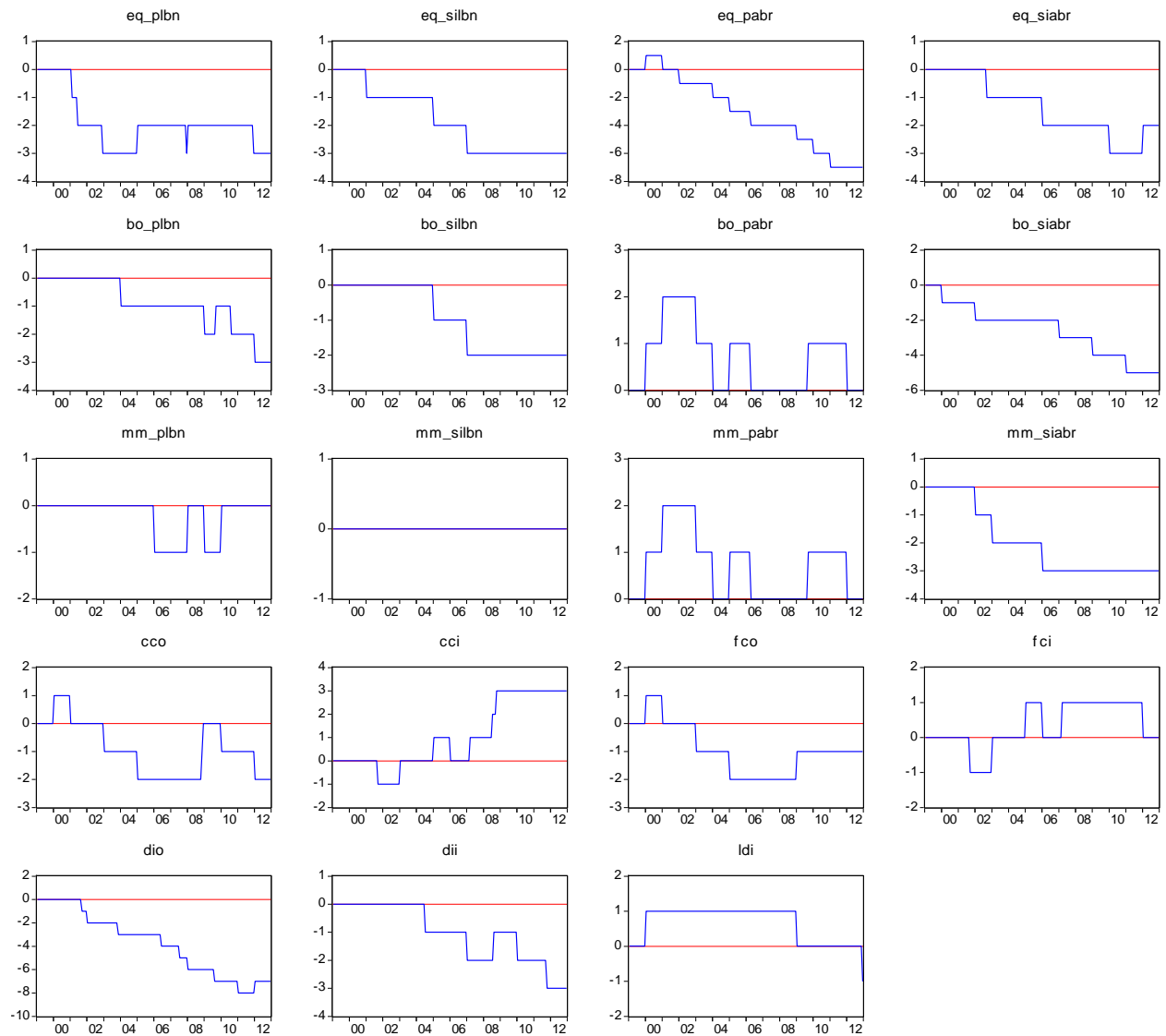


Table 1: Summary statistics (*De jure* indices)

Variable	Obs.	Mean	Std. Dev.	Min	Max
<i>eq</i>	168	-2.051	1.283	-4.000	0.250
<i>eqi</i>	168	-1.646	0.836	-3.000	0.000
<i>eqo</i>	168	-2.455	1.811	-5.000	0.500
<i>eq_nr</i>	168	-1.884	0.892	-3.000	0.000
<i>eq_r</i>	168	-2.217	1.763	-5.000	0.500
<i>bo</i>	168	-0.955	0.853	-2.500	0.250
<i>boi</i>	168	-1.753	1.136	-4.000	0.000
<i>boo</i>	168	-0.158	0.688	-1.000	1.000
<i>bo_nr</i>	168	-0.967	0.860	-2.500	0.000
<i>bo_r</i>	168	-0.943	0.869	-2.500	0.500
<i>mm</i>	168	-0.382	0.470	-1.000	0.500
<i>mmi</i>	168	-1.107	0.714	-2.000	0.000
<i>mmo</i>	168	0.342	0.355	0.000	1.000
<i>mm_nr</i>	168	-0.107	0.206	-0.500	0.000
<i>mm_r</i>	168	-0.658	0.825	-1.500	1.000
<i>cc</i>	168	0.054	0.738	-1.000	1.500
<i>cci</i>	168	1.018	1.429	-1.000	3.000
<i>cco</i>	168	-0.911	0.959	-2.000	1.000
<i>cc_nr</i>	168	1.018	1.429	-1.000	3.000
<i>cc_r</i>	168	-0.911	0.959	-2.000	1.000
<i>fc</i>	168	-0.304	0.371	-1.000	0.500
<i>fci</i>	168	0.321	0.641	-1.000	1.000
<i>fco</i>	168	-0.929	0.886	-2.000	1.000
<i>fc_nr</i>	168	0.321	0.641	-1.000	1.000
<i>fc_r</i>	168	-0.929	0.886	-2.000	1.000
<i>di</i>	168	-1.391	1.283	-3.667	0.333
<i>dii</i>	168	-1.024	0.997	-3.000	0.000
<i>dio</i>	168	-3.786	2.674	-8.000	0.000
<i>di_nr</i>	168	-1.024	0.997	-3.000	0.000
<i>di_r</i>	168	-3.786	2.674	-8.000	0.000
<i>ca</i>	168	-0.838	0.608	-1.778	0.306
<i>kai</i>	168	-0.698	0.375	-1.333	0.000
<i>kao</i>	168	-1.316	1.076	-2.667	0.583
<i>ka_nr</i>	168	-0.440	0.275	-1.083	0.000
<i>ka_r</i>	168	-1.574	1.198	-3.083	0.500
<i>im</i>	168	-0.513	0.436	-1.344	0.100
<i>ex</i>	168	0.131	0.386	-0.500	1.100
<i>ca</i>	168	-0.191	0.234	-0.622	0.200

Table 2: Summary statistics (hybrid indices)

<i>Variable</i>	Obs	Mean	Std. Dev.	Min	Max
<i>heq</i>	168	-2.284	1.249	-4.654	0.000
<i>heqi</i>	168	-1.574	0.780	-2.969	0.000
<i>heqo</i>	168	-0.710	1.031	-2.942	0.000
<i>heq_nr</i>	168	-1.535	0.842	-2.968	0.000
<i>heq_r</i>	168	-0.750	1.187	-3.365	0.000
<i>hbo</i>	168	-0.725	1.252	-3.191	1.142
<i>hboi</i>	168	-1.065	1.001	-3.095	0.000
<i>hboo</i>	168	0.340	0.453	-0.096	1.364
<i>hbo_nr</i>	168	-0.081	0.091	-0.333	0.000
<i>hbo_r</i>	168	-0.648	1.179	-2.858	1.142
<i>hmm</i>	168	-0.157	0.544	-0.901	0.874
<i>hmmi</i>	168	-0.427	0.472	-1.284	0.000
<i>hmmo</i>	168	0.270	0.323	0.000	0.954
<i>hmm_nr</i>	168	-0.003	0.006	-0.017	0.000
<i>hmm_r</i>	168	-0.154	0.543	-0.887	0.874
<i>hcc</i>	168	0.099	0.759	-1.039	1.482
<i>hcci</i>	168	1.018	1.429	-1.000	3.000
<i>hcco</i>	168	-0.911	0.959	-2.000	1.000
<i>hcc_nr</i>	168	1.018	1.429	-1.000	3.000
<i>hcc_r</i>	168	-0.911	0.959	-2.000	1.000
<i>hfc</i>	168	0.189	0.538	-0.820	0.886
<i>hfci</i>	168	0.321	0.641	-1.000	1.000
<i>hfco</i>	168	-0.929	0.886	-2.000	1.000
<i>hfc_nr</i>	168	0.321	0.641	-1.000	1.000
<i>hfc_r</i>	168	-0.929	0.886	-2.000	1.000
<i>hdi</i>	168	-1.394	1.290	-3.945	0.000
<i>hdii</i>	168	-1.024	0.997	-3.000	0.000
<i>hdio</i>	168	-3.786	2.674	-8.000	0.000
<i>hdi_nr</i>	168	-1.024	0.997	-3.000	0.000
<i>hdi_r</i>	168	-3.786	2.674	-8.000	0.000
<i>hka</i>	168	-0.763	0.498	-1.535	0.275
<i>hkai</i>	168	-0.152	0.335	-0.928	0.388
<i>hkao</i>	168	-1.086	0.942	-2.087	0.858
<i>hka_nr</i>	168	0.035	0.414	-0.659	0.674
<i>hka_r</i>	168	-1.288	1.292	-3.526	0.875
<i>him</i>	168	-0.513	0.436	-1.344	0.100
<i>hex</i>	168	0.131	0.386	-0.500	1.100
<i>hca</i>	168	-0.161	0.236	-0.611	0.281