North American Journal of Economics and Finance xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

North American Journal of Economics and Finance

journal homepage: www.elsevier.com/locate/najef

# Modeling dynamics of short-term international capital flows in China: A Markov regime switching approach

Ye Ning[a], Lingxiang Zhang[b,*]

[a] School of Economics, Peking University, Yiheyuan Road, Haidian District, Beijing 100871, PR China
[b] School of Management and Economics, Beijing Institute of Technology, Zhongguancun South Street, Haidian District, Beijing 100081, PR China

ARTICLE INFO

*Keywords:*
Short-term international capital flows
Time-varying transition probability
Markov switching models

*JEL:*
F21
F31
R21

ABSTRACT

In this paper, we analyze the dynamics of short-term international capital flows in China using time-varying transition probability Markov switching models. We provide empirical evidence that exchange rates may prove to be useful information variables for detecting the states of inflow or outflow. Moreover, the short-term international capital of "currency arbitrage" has high speculations. In addition, the results show that inflows and outflows last about 25 months and 4 months, respectively, and after 2007, inflows dominate the dynamics of short-term international capital.

## 1. Introduction

International capital flows due to investors' needs to allocate capital worldwide and to pursue higher returns (Devereux & Sutherland, 2007; Feldstein, 1983; Kouri & Porter, 1974). The main feature of international capital flows in recent years is that they are becoming increasingly short term. Charles P. Kindleberger in his book *International Short-term Capital Movements* (Kindleberger, 1937) defined and classified short-term international capital flows. In his definition, short-term international capital flows are defined as the kind of international flows where investors intend to change or twist the directions in a short time.

However, international capital flows can be a double-edged sword for developing countries. On the one hand, international capital flows offer access to international capital with lower costs for developing countries. On the other hand, international capital flows bring shocks to immature financial markets in developing countries, which would raise the vulnerability of their domestic financial systems and undermine the independency of their macroeconomic policies. Prasad and Wei (2007) investigated the structure of China's international capital flows in 2001–2005 and found that the rapid accumulation of foreign exchange reserve was not caused by FDI inflows and current account surplus but by short-term international capital inflows, for example, "hot money" inflows. After the global financial crisis in 2008, with lower demand from the developed world and the "quantitative easing" policy in the U.S., short-term international capital flows flooded into emerging countries to pursue profits (Korinek, 2010), which would bring shocks to their macroeconomic and financial stability. However, during economic recessions, the "Sudden Stops" and rapid outflows of short-term international capital can trigger severe regional financial crisis.

As the second largest economy in the world, China not only receives economic shocks from other major countries passively, but its development also exerts increasingly important influence on other countries in the world. The fluctuation of China's short-term international capital flows has become an unneglectable factor that affects China's economic development and stability and will bring higher requirements and serious challenges to China's macroeconomic policies. In the face of complicated international economic

* Corresponding author.
*E-mail address:* zhanglingxiang@bit.edu.cn (L. Zhang).

https://doi.org/10.1016/j.najef.2018.01.002
Received 28 March 2017; Received in revised form 24 December 2017; Accepted 4 January 2018

situations and huge active short-term international capital in the global capital market, the measurements in capital control and foreign exchange control that China has relied on in the old days became insufficient for further effective supervision.

Most of existing studies focus on the measurement of short-term international capital flows, such as Cuddington (1986), Dooley (1988), and Kant (1996) among others, or discuss the determinants of short-term international capital flows, such as Ohlin (1929), Reinhart, Leiderman, and Calvo (1993). With the deepening of research, more economic-political and financial factors are taken into consideration to explain the mechanism of international capital flows. For instance, Fedderke and Liu (2002) looked into the large inflow of international capital in South Africa since 1994 and pointed out that political risk is the main determinant for international capital flows. Barroso, da Silva, and Sales (2016) empirically analyzed the short-term international capital flows of Brazil and found that the U.S. "quantitative easing" monetary policy triggered capital inflow, which led to currency appreciation, rising stock prices, and enlarged domestic credit. Since the global financial crisis in 2008, China's economy is inevitably exposed to the global economic situation and macroeconomic policy of the U.S. Cheung, Sven, and Frank (2016) pointed out that in the post crisis period, China's short-term international capital flows are affected by the "quantitative easing" policy in the U.S., as well as exchange rate fluctuation, capital control policies, and trade friction. However, there is a lack of literature analyzing the dynamic characteristics of China's short-term international capital flows.

This study aims to analyze the dynamics of China's short-term international capital flows, to help understand the current situation and forecast the trend of short-term international capital flows in China, and to provide theoretical foundations and empirical evidence to properly guide capital flows, and consequently, reducing shocks of short-term international capital flows to the economy. The speculative and high-risk features of short-term international capital flows lead to asymmetry and nonlinear dynamic features. This means that during the period of economic booms, the large amount of short-term capital inflows may push up capital prices and encourage the expansion of economic bubbles, whereas during the period of economic busts, the rapid withdrawal of short-term capital may trigger "fire sale" of capital and even cause serious financial crisis. Therefore, this paper adopts a nonlinear time-varying transition probability (TVTP) Markov regime switching model to describe the dynamics of China's short-term international capital flows.

From an economic perspective, three reasons make TVTP model particularly appropriate for analyzing short-term international capital flows.

First, the short-term international capital flows are difficult to be measured, and consequently, the states of inflow and outflow of short-term international capital flows are unobservable in essence. Therefore, the TVTP Markov regime switching model is appropriate to be used to capture unobserved regimes.

Second, the speculative and high risky features of short-term international capital flows lead to asymmetry and non-linear dynamic features, and TVTP model is able to capture its non-linear characteristics from the perspective of regime switching behavior.

Third, by adding potential determinants as selected information variables into the TVTP model and compares changes of the results, true determinants can be observed.

The paper is structured as follows. Section 2 estimates the volume of short-term international capital flows in China and based on which describes the stylized facts. Section 3 introduces the specification of TVTP models and their choices of information variables. Section 4 gives the estimated results and interpretations. Section 5 concludes.

## 2. Estimation and stylized facts of short-term international capital flows

Various calculation methods of short-term international capital flows exist in literature due to different definitions of short-term capital flows. Among these, two methods, namely, direct and indirect, are predominant.

The direct method was proposed by Cuddington (1986). It principally considers the net errors and omissions in the balance of payment (BoP) table as a basic item that reflects short-term international capital flows, incorporates other items of BoP that may contain short-term international capital flows, and then calculates short-term international capital flows.

The indirect method, which is also known as the residual method, was proposed by the World Bank (1985). This method regards external debt increments and foreign direct investment net inflow as a state's sources of funding and official reserve increments and the current account deficit as the state's expenditures of funding. Then, short-term capital flows are calculated based on the difference between these two types of funding.

The direct method is generally believed to underestimate the results, whereas the indirect method is believed to overestimate them (Yang & Chen, 2000; Zhang, 2011). However, Shi and Lian (2014) provided simple proof that the estimates of the direct method theoretically approximate those estimated by the indirect method.

Many studies (e.g., Li & Qiu, 2013; Zhang, 2011) have used the indirect method to measure China's short-term international capital flows due to two disadvantages of the direct method. The first disadvantage is that the basic items used in the direct method, such as the net errors and omissions (a balancing item) may be caused by the hidden nature of short-term capital flows or by statistical errors. The second disadvantage of the direct method is that it assumes that an item beyond its computing formula does not contain short-term capital flows, which can easily lead to an underestimation of the calculated results (Shi & Lian, 2014). Moreover, direct estimates are more difficult than indirect estimates because large amounts of monthly data of indicators used in direct method estimates are unavailable. Therefore, in this study, we estimated China's short-term international capital flows by using the indirect method.

Normal flows of foreign currency into a country go in several directions. Some are retained by commercial banks, some are hold by nonbank institutions and individuals, whereas the rest goes to the central bank and becomes foreign reserves. The most popular method of measuring short-term international capital flows is the World Bank residual method (World Bank, 1985). It computes