The behavior of stock market prices throughout the episodes of capital inflows

Boubekeur Baba\textsuperscript{a}, Güven Sevil\textsuperscript{b}

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Abstract

This study aims to investigate the behavior of stock prices throughout the episodes of foreign capital flows using data of daily stock prices and quarterly foreign capital flows from 14 EMEs. To this end, the episodes of capital flows are identified using the threshold and the k-means clustering approaches. Next, the stock index changepoints are detected using the Pruned Exact Linear Time (PELT) method. Finally, we combine the results by distributing the detected changepoints over the identified capital flows. The results reveal that the stock indices have been rarely pushed further during the entire surge episodes identified by both approaches, and thus surges of capital flows do not necessarily lead to further appreciation of stock prices. In the meantime, a significant appreciation of stock prices is observed during the normal state of capital flows. On the other hand, it is noticed that the stock prices have not often depreciated during the episodes of foreign capital outflows in all the selected EMEs, which means that stock prices have been less vulnerable to reversals of foreign capital flows.

Keywords: Foreign capital flow episodes, stock prices, threshold approach, k-means clustering, PELT

JEL classifications: E31, F21, F32, F41

\textsuperscript{a} Graduate School of Social Sciences, Anadolu University, Turkey, Email: bb359@anadolu.edu.tr.

\textsuperscript{b} Open Education Faculty, Anadolu University, Turkey, Email: gsevil@anadolu.edu.tr.
1. Introduction

Over the past two decades, international capital inflows to emerging market economies (EMEs henceforth) have been characterized by remarkable fluctuations. Bems and Catao (2016) find short persistency in the capital flows, particularly in recent years. The net capital flows into EMEs have also been more fluctuant compared to advanced economies. Milesi-Ferretti and Tille (2011) attribute these fluctuations to the dominance of hot money in the international capital inflows, especially during the 1990s. The major turnarounds of capital inflows to EMEs are often seen around specific events such as the remarkable surge of international capital flows in the run-up to the global financial crisis (GFC) and the precipitous drop that followed its wake. The most recent event that significantly reshaped the trends of international capital flows is closely related to the US Fed’s announcement on tapering its monetary easing policy in May 2013, this event which has come to be known as “the Taper Tantrum” caused large waves of gross outflows in EMEs amounted at 150$ billion of equity investments.

Throughout the boom-bust cycles of international capital flows, EMEs experienced various implications. During the boom of international capital inflows, the economic growth in EMEs significantly stimulated and the stock market capitalization substantially increased. However, some researchers argue that these progressions have not been without side effects. For instance, Perrault (2002) and King (2001) argue that excessive capital flows were instrumental in sowing the seeds of the economy’s vulnerability to the Asian financial crisis. In addition, there have been serious concerns that the foreign capital inflows might have increased the fluctuations of stock prices in EMEs. However, empirical evidence is somewhat inconclusive about the impact of foreign capital inflows on the fluctuations of stock prices. Nevertheless, it has been clearly noticeable that the boom of international capital flows have coincided with a wide appreciation of stock prices in EME. Kim and Yang (2011) observe a 50% increase in the stock indexes of most emerging Asian economies during the boom of foreign capital inflows from 2000 to 2007. The Bank of International Settlements (BIS) in a report from 2009 stated that the international equity prices were correlated with all three types of capital flows, equity prices of EMEs particularly have sharply increased during the global economic upswing

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1 According to Perrault (2002) the capital flows to EME’s in the 1990s led to real estate bubbles in some countries, overvalued real exchange rates, and inflated financial-asset prices in most of the region, thereby sowing the seeds for the Asian crisis in 1997. King (2001) argues that the lending by Japanese banks to Asian debtors created asset-price bubbles in Thailand, and possibly in other countries, that eventually burst and sparked the Asian crisis.
since 2004. On the other hand, as seen during the GFC and the taper tantrum periods, this upward trend quickly reverses in the event of foreign capital outflows. Many empirical studies on this subject have been primarily concerned with the change of stock return volatility before and after market liberalization events in EMEs. For instance, Levine and Zervos (1998) estimate the structural breaks in stock returns around the dates of financial liberalizations in 16 EMEs. In this study as well, an indirect approach is adopted in which the episodes of foreign capital flows are identified for a number of EMEs, then changepoints of the stock price indices are estimated and designated to the corresponding episode of capital inflows. In addition, we calculate the moving average of the stock index to distinguish the positive changepoints from the negative ones. The intuition behind this approach is based on the argument that asset prices, in general, tend to appreciate as the foreign capital inflows are increasing, but also depreciate as soon as foreign capital begins to flow out.

The remainder of this study is structured as follows, section two briefly discusses the literature of capital flow episodes, section three reviews the literature of foreign capital flows impact on emerging stock markets, section four specifies the empirical methodology. Finally, section five analyses the empirical results.

2. Measuring extreme capital flows

Extreme movements of capital flows such as surges also known as “bonanzas”, sudden stops and capital flight have been extensively studied in the literature. The origin of this literature can be traced to the first study on sudden stops by Calvo (1998). Prior to Calvo (1998) researchers, particularly in the 1980s, were mainly interested in capital flights (see e.g., Cuddington, 1986; Lessard & Williamson 1987; Dooley 1988). Reinhart and Reinhart (2009) later laid the ground for the studies on surge episodes by measuring the abrupt and extremely high movements in the upside of capital flows. Moreover, the studies of capital flow volatility were often concerned with either the slowdown or the surge of capital flows. However, since Reinhart (2009) the literature on this subject has progressed significantly showing interest in analyzing both the downside and the upside of capital flows simultaneously. Another interesting aspect of this literature is the

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2 Calvo (1998) defined sudden stops as sharp slowdown in net capital inflows, later Calvo et al. (2004) and Calvo et al. (2008) broadened the definition by establishing stylized facts such as the concurrence of sudden stop with output contraction and sharp rise in interest rate spreads.

3 Forbes and Warnock (2012) identify episodes of “surge”, “sudden stop”, “flight” and “retrenchment” in the gross inflows and outflows of 58 countries, Forbes (2012) follows Forbes & Warnock’s methodology focusing on Asia, Yesin (2015) also applies Forbes and Warnock’s terminology to analyse waves of capital flows to and from Switzerland, Schmidt & Zwick (2015) analyse the link between uncertainty and episodes of extreme capital flows, Agosin and Ituaita (2012) use the surges in capital flows to predict future sudden stop episodes.
varying approaches and the criteria used to identify the surges and the sudden stops of capital flows, especially regarding surge episodes in which a number of empirical studies use substantially varying methods. Besides the varying criteria and approaches, the literature dealing with extreme capital flows use different inputs, some studies focus on analyzing net capital flows. For instance, Calvo (1998) and Calvo et al. (2004) use net capital flows to gauge sudden stop episodes, Fecuri et al. (2011), Carderelli et al. (2010) and Mendoza and Terrones (2008) also determine the episodes of large capital inflows and sudden stops based on the deviations of net capital flows. In contrast with these studies, Broner et al. (2013); Forbes and Warnock (2012); Rothenberg and Warnock (2011) focus on the behavior of the gross capital flows. According to Forbes and Warnock (2012) the net capital flows, which is the sum of gross inflows and outflows, cannot distinguish the capital movements initiated by foreigners and domestic investors, the differentiation between gross inflows and gross outflows is important because foreign and domestic investors can be motivated by different factors and respond differently to various policies and shocks. Moreover, policy responses to capital flows differ based on whether the extreme capital flow movements are driven by domestic or foreign investors. As a result, net-flows based analysis would miss the dramatic changes that have occurred over the past decade. Forbes and Warnock (2014) further emphasize on using the gross flows stating that the net-flows based analyses, which often ignore the outflows of domestic investors, could misdiagnose the changes in capital flows as being driven by changes in foreign flows. Another reason to use gross flows instead of net flows according to Forbes and Warnock (2014) is that gross capital flows have been more volatile and have grown larger while net flows remained stable over the past years. On the other hand, Ghosh et al. (2014) though did not dismiss the importance of distinguishing between the gross flows of assets and liabilities, they argue that the net capital flows in the case of EMEs still largely reflect the changes in external liabilities. Therefore, they relied on net-flows based analysis to identify surges in capital flows and found that over two-thirds

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4 Crystallin (2015) finds substantial differences in the number of surge episodes identified by seven different methods.

5 In the literature, the term of gross inflows refers to net foreign purchases of domestic assets, whereas the term of gross outflows refers to the net purchases of foreign assets by domestic investors.

6 Other studies that have stressed on the importance of distinguishing the association that global and domestic factors have with gross capital flows, from the association they have with net capital flows (see e.g; Rey, 2013; Calderon and Kubota, 2013; Broner et al., 2013).

7 A study by Pagliari and Hannan (2017) on the volatility of capital flows to AEs and EMEs supports this argument. The study finds that the gross outflows tend to dampen the effect of gross inflows on net flows in AEs but not in EMEs, meaning that net flows of EMEs are more related to gross inflows than gross outflows.
of surges in capital flows to EMEs are driven by increase in residents’ liabilities rather than by a decline in their foreign assets.

3. **Foreign capital flows and stock market**

The relaxation of capital controls to attract foreign capital flows has been an integral part of the development strategy of many EMEs. In this respect, substantial studies have discussed the developments attained by EMEs in terms of economic growth, industrial sector and firms’ profitability in the post-liberalization period (e.g. Errunza, 2001; Chari & Henry, 2004; Bekaert et al., 2005; Mitton, 2006; Gupta & Yuan, 2009; O’Connor, 2013). However, since the tumultuous events in EMEs such as the Mexican, the Russian and the Asian crises, the short-term capital inflows have become frequently linked to destabilization effects. Errunza (2001) states that the resulting large portfolio equity flows after stock market liberalization have been held as the primary culprit in precipitating the Asian crisis. Of particular relevance to the destabilization effects is the potentials of capital inflows to increase the stock prices and stock market volatility. Predominantly, the large foreign purchases of local equities are highly likely to drive the stock prices up and away from the fundamentals, while a sell-off by foreign investors can cause the stock prices to plunge sharply.

In the literature, the empirical analysis of the impact of capital flows on the stock market is carried out in several ways. Some of the early studies such as Bekaert and Harvey (1997), DeSantis and Imrohoroglu (1997) and Levine and Servos (1998) examine the effects of capital inflows on stock volatility by considering the event of equity market liberalization, other studies do not include the events of stock market openness, but rather directly deal with the actual involvement of foreign investors in the stock markets (e.g. Umutlu et al., 2013). In addition, the empirical evidence presented by these studies appears to be inconclusive. With different empirical models and data samples being employed, these studies show that the emerging market volatility can either increase, decrease or remain unchanged over the post-liberalization period. The developments of market size, liquidity, and volatility with respect to international capital inflows have been the main focus of this strand of literature. However, the dynamic changes in stock market volatility in response to foreign capital flows occupied the attention of most of the researchers in this area. Among the latter, Nguyen and Bellalah (2008), Umutlu and Shackleton (2015), Umutlu et al. (2013) and Bae et al. (2004) find a significant positive impact of foreign capital inflows on stock market volatility in EMEs. On the other hand, the proposition that the volatility of emerging stock markets have been negatively affected
by foreign capital inflows is supported in many other studies (see e.g. Bekaert and Harvey, 1997; Bekaert and Harvey, 2000; Kim and Singal, 2000; Holmes and Wong, 2001; Hargis, 2002; Umutlu et al., 2010; Li et al., 2011).

The nexus between capital inflows and stock prices, although anecdotally established in many theoretical works such as Caballero and Kirshnamurthy (2006) and Aoki et al. (2009), has rarely been empirically investigated. Among the few studies that did address the impact of capital flows on stock prices, Kim and Yang (2009) find that the capital inflows have indeed contributed to the increase of stock prices in South Korea. Kim and Yang (2011) extended his previous work to other EMEs in the region but find that capital inflow shocks explain a relatively small portion of asset price fluctuations. Similarly, Tillmann (2013) estimate the impact of capital inflows on asset prices in a set of Asian emerging markets. The findings of this study show that capital inflows have significantly pushed up asset prices. Ling et al. (2011) also find a significant impact of FDI and hot money on stock prices in China.

4. Research Methodology

To investigate the behaviors of stock prices throughout the episodes of capital flows we follow Ghosh et al. (2014) approach to identify extreme capital flows using the threshold and the k-means clustering methods. Then, The Pruned Exact Linear Time (PELT) approach presented by Killick et al. (2012) is applied to the daily stock indices of 14 EMEs to detect the variance changepoints in the index, the period of the daily stock indices starts from January 3, 2000 through April 31, 2017. In addition, the moving average with a window of length \( n = 25 \) is used to distinguish the positive changepoints from the negative ones. The positive changepoints denote to price appreciation while the negative ones indicate price depreciation. Finally, the results of the measurements of capital flow episodes and the PELT method are together combined by distributing the detected index changepoints over the capital flow episodes identified by the threshold and the clustering approaches.

4.1 Changepoint detection

The changepoint detection methods perform a segmentation analysis to obtain intervals in which the time series behaves as approximately stationary, then uses this information in order to identify the moment of change and determine the pattern in the nonstationary time series. These methods are applied in several disciplines, like neurology, cardiology, speech recognition, finance, and others. In many cases of time series, the statistical properties do not remain the same throughout the series. One of the possible ways to deal
with this is to identify a set of changepoints, between which the statistical properties of the series remain constant. A range of different test statistics can be used to identify specific types of changes, such as changes in mean or variance.

To simplify the procedure of setting the changepoints, let us assume we have an ordered sequence of data, \( y_{1:n} = (y_1, ..., y_n) \). The model will have a number of changepoints, \( m \), together with their positions, \( \tau = (\tau_1, ..., \tau_m) \). Each changepoint position is an integer between 1 and \( n - 1 \) inclusive. The positions are defined as \( \tau_0 = 0 \) and \( \tau_{m+1} = n \), and it is assumed that the changepoints follow an order such that \( \tau_i < \tau_j \) if and only if, \( i < j \).

Consequently, the \( m \) changepoints will split the data into \( m + 1 \) segments, with the \( i \)th segment containing \( y(\tau_{i-1} + 1):\tau_i \).

### 4.2 Pruned Exact Linear Time (PELT)

This search method was introduced by Killick et al. (2012), a key feature of this method is its ability to balance the competing computational cost and accuracy properties. The PELT method considers the data sequentially and searches the solution space exhaustively. Computational efficiency is achieved by removing solution paths that are known not to lead to optimality. The assumptions and theorems which allow removal of solution paths are further explained in Killick et al. (2012). A key assumption is that of a penalty, \( C \), linear in the number of changepoints \( m \). As such the optimal segmentation is \( F(n) \) where,

\[
F(n) = \min_{\tau} \left\{ \sum_{i=1}^{m+1} [C(y(\tau_{i+1}):\tau_i) + \beta] \right\}
\]  

(1)

Conditioning on the last point of change, \( \tau_m \) and calculating the optimal segmentation of the data up to that changepoint gives,

\[
F(n) = \min_{\tau_m} \left\{ \min_{\tau|\tau_m} \sum_{i=1}^{m} [C(y(\tau_{i+1}):\tau_i) + \beta] + C(y(\tau_{m+1}):n) \right\}
\]  

(2)

This could equally be repeated for the second to last, third to last, . . . , changepoints. The recursive nature of this conditioning becomes clearer as one notes that the inner minimization is reminiscent of equation (1). In fact, the inner minimization is equal to \( F(\tau_m) \) and as such (1) can be re-written as

\[
F(n) = \min_{\tau_m} \left\{ F(\tau_m) + C(y(\tau_{m+1}):n) \right\}
\]  

(3)

The function starts by calculating \( F(1) \) and then recursively calculate \( F(2), . . . , F(n) \). At each step, the optimal segmentation is stored up to \( \tau_{m+1} \). When \( F(n) \) is reached, the
optimal segmentation for the entire data has been identified and the number and location of changepoints have been recorded. This procedure can be applied to the mean and the variance of the time series or to both of them simultaneously. However, the mean changepoint is highly sensitive. Therefore, this study follows variance changepoint detection.

5. Analysis of the empirical results

5.1 Identifying episodes of extreme capital flows

This section focuses on the analyses of extreme episodes of foreign capital flows in the selected EMEs, the country sample includes 14 EMEs. The period of the study spans over 69 quarters from 2000Q1 to 2017Q1. Data on the net capital flows are collected through two steps. Firstly, data of direct investment, portfolio investment, and other investment flows are obtained from IMF’s balance of payment statistics. Secondly, the net incurrence of liabilities in each category is subtracted from its net acquisition of assets.

Note: The volatility calculations are based on the conditional variances of GARCH (1, 1) model.

Fig. 1. Aggregate capital flows volatility in selected EMEs.
We begin the empirical analysis by studying the volatility of aggregate capital flows of the selected EMEs using the GARCH (1.1) model. As it is shown in Fig. 1, clearly the aggregate capital flows of the selected EMEs have been extremely volatile after the GFC. During the year 2007, the decline of capital inflows in many EMEs was highly sharp amounting to 50% from the previous period. During the year 2009, capital inflows in most of the EMEs showed signs of recovery and reached its highest level since the GFC in the Q3 of 2010. However, another systemic decline of capital flows to the selected EMEs is noticed in the period between 2010 Q3 and 2011 Q3. In the subsequent period, capital inflows continued to slowdown despite its overall slight increase in Q2 of 2014 for most of the countries. Bems and Catao (2016) document this slowdown in 45 EMEs, their findings indicate that the slow economic growths in these countries played a major part in the slowdown of capital flows. According to Broner and Ventura (2016) the volatility of capital flows is an outcome of the financial globalization in EMEs, which as well brought capital inflows and higher investments and growth to the region. Fig. 1 also exhibits an increase in the volatility of gross capital inflows around the taper tantrum episode while it decreases in the case of net capital flows, Pagliari and Hannan (2017) observe the same volatility spikes around this period in all the EMEs and the developing economies as well, at least in the case of net flows, however their sample looked far smoother because of the inclusion of developing countries in their study.

As previously mentioned, the measures of surge episodes in capital flows vary considerably in the literature, in studies such as Reinhart and Reinhart (2009), Ghosh et al. (2014) and Qureshi and Sugawara (2018) the thresholds for surges and outflows are determined by dividing the distribution of net flows into percentiles. Cardarelli et al. (2009) and Fecuri et al. (2011) use the trend smoothing approach of Hodrick-Prescott filter, in this method the net inflow observation is coded as surge if it is above the HP-filtered trend by at least one standard deviation. In this study, surge and outflow episodes are identified using two methods. In the first method, we apply a threshold approach following Ghosh et al. (2014) and Qureshi and Sugawara (2018) in which the thresholds are set at the top and the bottom 30th percentile of the distribution of the quarterly net capital flows (in percent of GDP), net flow observations that fall in the top 30th percentile are coded as surges and those that fall in the bottom 30th percentile are coded as outflows.

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8 Reinhart and Reinhart (2009) set the cut-off for surges at the top 20th percentile, whereas in Ghosh et al. (2014) the threshold is set at the top 30th percentile.
9 Balakrishnan et al. (2013) apply criteria combined of both approaches. Firstly, they identify surges as one standard deviation above the HP-filtered trend, then add all the inflow observations that fall in the 75th percentile.
the remaining observations are considered as normal flows. In the second method, the actual net flows of each country are divided into three groups using a statistical clustering technique known as k-means clustering, the k-means clustering technique classifies observations into a set of k groups (i.e. k clusters) such that the observations within the same group are as similar as possible. The first step is to define the number of groups which in our case is three groups, after defining the number of the groups, the k-means clustering technique selects random means from the data set in which around each mean the within-cluster sum of squared distances are minimized while the between-cluster distances are maximized, in this way, the observations are assigned to their closest mean. This process is iterated until the cluster assignments stop changing or the maximum number of iterations is reached. The k-means clustering technique employs different algorithms but the Hartigan-Wong (1979) algorithm is the most commonly used in this technique (more details available in Appendix A). In both approaches, only two and more than two consecutive surge or outflow quarters are considered as an episode, in other words, the surges and outflows must be continuous to the next quarters and not interrupted by other observations.

![Fig. 2. Surges and outflows in Chile’s net flows by the threshold approach.](image-url)
Under both approaches, the results show that the surge episodes were more persistent before the GFC. Taking Chile as an example as it is shown in Fig. 2 and 3, the longest surge episode indicated by the threshold approach took place in the period 2006Q1-2008Q1, this pattern is noticed in most of the countries except South Korea, Indonesia, India, and Romania. The clustering approach, however, shows that the longest surge episodes occurring after the GFC in most of the countries. The number of surge episodes yielded by both approaches is close as shown in table 01, and the length of episode is not significantly different. The results also show that the number of surge episodes slightly decreased after the GFC, the threshold approach recorded 30 surge episodes before the GFC and 24 episodes after it. On the other hand, the clustering approach captured 32 surge episodes before GFC and 26 episodes after it. The three Latin American countries in the sample namely Brazil, Chile and Columbia experienced most of its surge episodes before the GFC. Moreover, the longest outflow episodes in the three countries are seen after the GFC. Surges in South Africa are almost similar to Latin American countries. The opposite is observed in the three European emerging countries i.e. Hungary, Poland and Romania where most of the surge episodes occurred after the GFC. The rest of the countries from emerging Asia have heterogeneous dynamics of capital flows, the capital flows in countries such as South Korea and Thailand have become frequently surging after the GFC. In contrast, the surges of capital flows were more frequent before the GFC in India, Indonesia, Philippine, and Turkey. The number and the timing of the identified surge episodes may differ between the two approaches, which is generally the norm in the measuring methods of surge episodes. However, the number of identified surge episodes is not widely different between the two approaches. Except in Chile’s case, in
which the threshold approach has identified five surge episodes, while only two surge episodes were identified by the clustering approach. In total, the surge episodes span over 222 and 236 quarters as shown by the threshold and the clustering approach respectively. On the other hand, the difference in the outflow episodes identified by both approaches is comparatively remarkable. The outflow episodes identified by calculations of the threshold approach totally spread out on 226 quarters, while the clustering approach shows a total of 153 quarters of outflow episodes. By both approaches, we observe that the outflow episodes have more frequently taken place before the year 2013 in all the 14 emerging markets. Beyond this date, we document less incidence of outflow episodes. In addition, it should be noted that considerable amount of outflow episodes has been seen around the crisis periods (the full results are reported in appendix B).

| Country          | Threshold approach | Clustering approach |
|------------------|--------------------|---------------------|
|                  | Number of surge episodes | Number of outflow episodes | Number of surge episodes | Number of outflow episodes |
| Brazil           | 4                  | 5                   | 6                   | 3                   |
| Chile            | 5                  | 6                   | 2                   | 3                   |
| Columbia         | 5                  | 3                   | 6                   | 3                   |
| Hungary          | 5                  | 3                   | 4                   | 5                   |
| Korea, Rep.      | 3                  | 9                   | 3                   | 9                   |
| Malaysia         | 4                  | 6                   | 3                   | 5                   |
| India            | 4                  | 6                   | 5                   | 1                   |
| Indonesia        | 5                  | 7                   | 5                   | 1                   |
| Philippine       | 5                  | 4                   | 4                   | 5                   |
| Poland           | 5                  | 3                   | 5                   | 3                   |
| Romania          | 3                  | 4                   | 3                   | 3                   |
| South Africa     | 4                  | 6                   | 4                   | 4                   |
| Thailand         | 5                  | 3                   | 6                   | 2                   |
| Turkey           | 5                  | 7                   | 5                   | 3                   |
| Total            | 62                 | 72                  | 61                  | 50                  |

5.2 Stock index changepoints and capital flows episodes

As shown in tables 2 and 3, the PELT approach has detected a total of 190 changepoints in the stock indices of the 15 EMEs. The number of changepoints across all the selected emerging countries ranges between 10 and 20 index changepoints, the least changepoints are documented in Chile and Columbia, whereas the stock index in Romania displays the largest numbers of index changepoints. We followed the post-changepoint trend to distinguish between the positive and the negative changepoints. After distributing the
detected index changepoints over the identified capital flow episodes, we noticed that most of the index changepoints whether positive or negative occur during the episodes of normal inflows. However, stock indices in Chile and Hungary have displayed most of its changepoints during the capital flow surge episodes. For the other countries, the stock indices are rarely pushed to new heights during the surge of capital inflows. In fact, in countries such as South Korea and Thailand, the stock indices never showed any response over the entire capital surge episodes, the stock indices in the rest of the countries have barely responded to surges of capital flows. For instance, four surge episodes of foreign capital flows were identified in Brazil lasted for 16 quarters combined, yet stock prices picked up only twice during the surge episodes. In some cases, we find one increase in stock prices during the entire surge episodes. Broadly speaking, the stock indexes of the selected EMEs have displayed only 25 increases over the 62 surge episodes identified by the threshold approach and have ascended just 22 times over the 61 surge episodes identified by the clustering approach. It is also noticed that even when the foreign investments are at extremely high level, the stock prices have not been held from turning down in many EMEs. Meaning that the additional demand created by foreign investors does not necessarily lead to the rise of stock prices. Likewise, on the downside of foreign capital flows, it is found that foreign capital reversals are not often affecting the stock indexes in EMEs. Except for Chile’s case, stock indices in all the other emerging markets have experienced positive changepoints more than negative change points. Indeed, in some emerging countries such as Hungary, Malaysia, Indonesia, and Thailand, the stock prices were never negatively affected by the outflow of foreign capital. In this respect, Kim and Yang (2011) state that in terms of portfolio investments in debt and equity markets, the direct impact of reversals is less likely to severely affect the economy because asset equity price adjustments will quickly reduce the balance of payments impact of sudden large outflows. Another explanation could be that these countries are somehow able to fill the void left by the migration of foreign capital with the local investors, or even through the repatriation of its investments abroad. Additionally, some EMEs have imposed some capital control policies or barriers to the exit of foreign investments, Other EMEs were not largely opened up to hot money in the first place, rendering their markets less vulnerable to foreign capital reversals. Overall, the positive

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10 The index changepoints that neither fall under surge episodes nor under outflow episodes were designated to the episodes of normal capital flows. The distribution of index changepoints over the episodes of capital flows is done through the date references to each index changepoints (See appendix C)
index changepoints have notably overwhelmed the negative ones even during the outflow episodes, most of which are displayed during the normal flow episodes. This may suggest that stock indexes in emerging markets grow steadily as the foreign capital is regularly flowing into the market.

**Fig. 4.** Changepoints in Chile’s stock price index. The index is represented by the blue line. The red line represents the index moving average. Black dashed vertical lines represent the index changepoints. The shaded areas represent the flow episodes, episodes of the threshold approach in the graph on the left, while episodes of the clustering approach in the graph on the right, surges in light blue and outflows in grey.

**Table 2**

| Country        | Surge Positive | Surge Negative | Normal Positive | Normal Negative | Outflow Positive | Outflow Negative | Change points by country |
|----------------|----------------|----------------|-----------------|-----------------|------------------|-------------------|-------------------------|
| Brazil         | 2              | 3              | 5               | 2               | 2                | 1                 | 15                      |
| Chile          | 6              | -              | 2               | -               | -                | 2                 | 10                      |
| Columbia       | 2              | -              | 5               | 1               | 1                | 1                 | 10                      |
| Hungary        | 4              | 4              | 3               | 1               | 4                | -                 | 16                      |
| Korea, Rep.    | -              | -              | 3               | 3               | 6                | 1                 | 13                      |
| Malaysia       | 3              | 2              | 3               | 1               | 3                | -                 | 12                      |
| India          | 1              | -              | 3               | 1               | 8                | 2                 | 15                      |
| Indonesia      | 1              | -              | 4               | 2               | 4                | -                 | 11                      |
| Philippine     | 1              | -              | 6               | 3               | 2                | -                 | 12                      |
| Poland         | 1              | 1              | 7               | 2               | 3                | 2                 | 16                      |
| Romania        | 2              | 1              | 9               | 1               | 4                | 3                 | 20                      |
| South Africa   | 1              | -              | 4               | 2               | 6                | 1                 | 14                      |
| Thailand       | -              | -              | 3               | 2               | 4                | -                 | 9                       |
| Turkey         | 1              | 1              | 7               | 3               | 4                | 1                 | 17                      |
| Total          | 25             | 12             | 64              | 24              | 51               | 14                | 190                     |
Table 3
Stock index changepoints distributed on capital flow episodes identified by clustering approach

| Country       | Surge | Normal | Outflow | Changepoints by country |
|---------------|-------|--------|---------|-------------------------|
|               | Positive | Negative | Positive | Negative | Positive | Negative |          |
| Brazil        | 2     | 3       | 5       | 2         | 2       | 1         | 15       |
| Chile         | 2     | -       | 6       | 1         | -       | 1         | 10       |
| Columbia      | 4     | -       | 3       | 1         | 1       | 1         | 10       |
| Hungary       | 4     | 4       | 2       | 1         | 5       | -         | 16       |
| Korea, Rep.   | -     | -       | 3       | 3         | 6       | 1         | 13       |
| Malaysia      | -     | 2       | 7       | 1         | 2       | -         | 12       |
| India         | 2     | 1       | 9       | 1         | 1       | 1         | 15       |
| Indonesia     | -     | 2       | 8       | -         | 1       | -         | 11       |
| Philippine    | 2     | -       | 6       | 2         | 1       | 1         | 12       |
| Poland        | 1     | 1       | 9       | 1         | 2       | 2         | 16       |
| Romania       | 4     | 1       | 8       | 4         | 3       | -         | 20       |
| South Africa  | -     | -       | 9       | 3         | 2       | -         | 14       |
| Thailand      | -     | -       | 5       | 2         | 2       | -         | 9        |
| Turkey        | 1     | 1       | 9       | 4         | 2       | -         | 17       |
| Total         | 22    | 15      | 89      | 26        | 30      | 8         | 190      |

6. Conclusion

The foreign capital flows to EMEs have been on a roller-coaster ride since the liberalization of these markets at the end of 1980s and early of 1990s. This study pursues the behavior of stock prices throughout the episodes of foreign capital flows in 14 EMEs. To this end, a three-stage empirical analysis is followed. In the first step, the episodes of foreign capital flows in the selected EMEs are identified using two methods, the threshold method suggested by Ghosh et al. (2014) and Qureshi and Sugawara (2018) and the k-means clustering approach. In the second step, we first employ the PELT method developed by Killick et al. (2012) to detect the changepoints in the stock indexes of the selected EMEs, then the post-changepoint trend is followed by calculating the index moving average to distinguish between the positive and the negative changepoints. Last but not least, the detected index changepoints with reference to its dates are distributed over the identified episodes of foreign capital flows.

The difference in the timing and the number of surge episodes has been generally the norm in the capital surge measuring methods followed in the literature. In this study, we find a slight difference between the number of capital surge episodes identified by the threshold and the clustering approach. Meanwhile, the difference has been comparatively
remarkable in terms of the capital outflow episodes identified by the two approaches. As for the stock prices, the PELT method has detected a total of 190 index changepoints in the stock indices of the 14 EMEs. Romania’s stock index displayed the largest index changepoints, whereas the least index changepoints are found in the stock indices of Columbia and Chile.

After distributing the detected index changepoints over the identified capital flow episodes, it is observed that surges of capital flows do not necessarily lead to further appreciation of stock prices. In most of the selected EMEs, the stock indices have been rarely pushed further during the entire surge episodes identified by both approaches. However, there have been few exceptions such as Chile and Hungary where stock indexes have indeed more frequently increased during the surge episodes. In the meantime, we observe a significant appreciation of stock prices during the normal state of capital flows. Meaning that the steady capital flows which last longer can effectively push up stock prices. For the policymakers, it means that they should care less about the effect of the temporarily surging foreign capital inflows, but rather should regulate and control the steady foreign capital inflows because it may have an accumulative effect on the stock prices. On the other hand, it is noticed that the stock prices have not often depreciated during the episodes of foreign capital outflows in all the selected EMEs, which means that stock prices have been less vulnerable to the reversals of foreign capital flows.
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Appendix A. K-means basic ideas

The basic idea behind k-means clustering consists of defining clusters so that the total intra-cluster variation (known as the total within-cluster variation) is minimized. There are several k-means algorithms available. The standard algorithm is the Hartigan-Wong algorithm (1979), which defines the total within-cluster variation as the sum of squared distances Euclidean distances between items and the corresponding centroid:

\[ W(C_k) = \sum_{x_i \in C_k} (x_i - \mu_k)^2 \]

- \( x_i \) design a data point belonging to the cluster \( C_k \).
- \( \mu_k \) is the mean value of the points assigned to the cluster \( C_k \).

Each observation \( (x_i) \) is assigned to a given cluster such that the sum of squares (SS) distance of the observation to their assigned cluster centers \( \mu_k \) is a minimum.

the total within-cluster variation is defined as follow:

\[ \text{tot.withins} = \sum_{k=1}^{k} W(C_k) = \sum_{k=1}^{k} \sum_{x_i \in C_k} (x_i - \mu_k)^2 \]

The total within-cluster sum of the square measures the compactness (i.e. goodness) of the clustering and we want it to be as small as possible.
## Appendix B

### Table B1

The results of the threshold approach:

| Country      | Surge episodes | Outflow episodes |
|--------------|----------------|------------------|
|              | Start          | End   | Quarters | Start  | End   | Quarters |
| Brazil       |                |       |          |        |       |          |
|              | 2002Q3         | 2002Q4| 2        | 2000Q3 | 2000Q4| 2        |
|              | 2003Q3         | 2004Q4| 6        | 2006Q4 | 2007Q2| 3        |
|              | 2005Q2         | 2005Q4| 3        | 2008Q1 | 2008Q2| 2        |
|              | 2015Q3         | 2016Q3| 5        | 2010Q1 | 2011Q3| 7        |
|              |                |       |          |        |       |          |
| Chile        |                |       |          |        |       |          |
|              | 2004Q1         | 2004Q2| 2        | 2003Q3 | 2003Q4| 2        |
|              | 2004Q4         | 2005Q1| 2        | 2008Q2 | 2008Q4| 3        |
|              | 2006Q1         | 2008Q1| 9        | 2011Q2 | 2011Q4| 3        |
|              | 2009Q1         | 2009Q2| 2        | 2012Q2 | 2012Q4| 3        |
|              | 2009Q4         | 2010Q1| 2        | 2013Q2 | 2013Q3| 2        |
|              |                |       |          |        |       |          |
| Columbia     |                |       |          |        |       |          |
|              | 2000Q1         | 2000Q4| 4        | 2007Q1 | 2007Q2| 2        |
|              | 2001Q2         | 2001Q3| 2        | 2010Q3 | 2010Q4| 2        |
|              | 2002Q1         | 2003Q4| 8        | 2012Q2 | 2015Q3| 14       |
|              | 2004Q2         | 2004Q3| 2        |        |       |          |
|              | 2009Q1         | 2009Q2| 2        |        |       |          |
|              |                |       |          |        |       |          |
| Hungary      |                |       |          |        |       |          |
|              | 2010Q2         | 2010Q3| 2        | 2004Q1 | 2006Q1| 6        |
|              | 2011Q4         | 2012Q4| 5        | 2008Q3 | 2009Q3| 5        |
|              | 2013Q2         | 2013Q3| 2        |        |       |          |
|              | 2014Q2         | 2014Q4| 3        |        |       |          |
|              | 2015Q2         | 2016Q3| 5        |        |       |          |
| Korea, Rep   |                |       |          |        |       |          |
|              | 2012Q3         | 2012Q4| 2        | 2000Q1 | 2000Q2| 2        |
|              | 2013Q2         | 2013Q4| 3        | 2001Q4 | 2002Q1| 2        |
|              | 2014Q2         | 2017Q1| 12       | 2003Q2 | 2004Q1| 4        |
|              |                |       |          |        |       |          |
| Malaysia     |                |       |          |        |       |          |
|              | 2000Q3         | 2001Q1| 3        | 2001Q4 | 2002Q1| 2        |
|              | 2006Q3         | 2006Q4| 2        | 2004Q4 | 2005Q1| 2        |
|              | 2007Q3         | 2007Q4| 2        | 2010Q1 | 2010Q2| 2        |
|              | 2008Q2         | 2009Q4| 7        | 2010Q4 | 2011Q2| 3        |
|              |                |       |          |        |       |          |
| India        |                |       |          |        |       |          |
|              | 2000Q2         | 2000Q3| 2        | 2004Q4 | 2005Q1| 2        |
|              | 2001Q2         | 2001Q3| 2        | 2006Q1 | 2008Q1| 6        |
|              | 2008Q4         | 2009Q2| 3        | 2009Q3 | 2009Q4| 2        |
|              | 2015Q3         | 2017Q1| 7        | 2010Q2 | 2010Q3| 2        |
|              |                |       |          | 2011Q2 | 2011Q3| 2        |
|              |                |       |          | 2012Q3 | 2012Q4| 2        |
| Indonesia    |                |       |          |        |       |          |
|              | 2000Q2         | 2000Q3| 2        | 2004Q4 | 2005Q1| 2        |
|              | 2001Q2         | 2001Q3| 2        | 2006Q1 | 2006Q2| 2        |
|              | 2008Q4         | 2009Q2| 3        | 2006Q4 | 2008Q1| 6        |
|              | 2013Q3         | 2014Q1| 3        | 2009Q3 | 2009Q4| 2        |
|              | 2015Q3         | 2017Q1| 7        | 2010Q2 | 2010Q4| 3        |
|              |                |       |          | 2011Q2 | 2011Q3| 2        |
|              |                |       |          | 2012Q3 | 2012Q4| 2        |
| Philippine   |                |       |          |        |       |          |
|              | 2002Q2         | 2002Q3| 2        | 2001Q4 | 2002Q1| 2        |
|              | 2004Q3         | 2005Q1| 3        | 2008Q2 | 2008Q3| 2        |
|              | 2006Q2         | 2006Q3| 2        | 2010Q2 | 2011Q1| 4        |
|              | 2008Q4         | 2009Q2| 3        | 2012Q3 | 2013Q1| 3        |
|              | 2013Q4         | 2014Q1| 2        |        |       |          |
| Poland       |                |       |          |        |       |          |
|              | 2001Q2         | 2001Q4| 3        | 2005Q1 | 2005Q2| 2        |
|              | 2004Q3         | 2004Q4| 2        | 2007Q1 | 2008Q2| 6        |
|              | 2013Q2         | 2014Q2| 5        | 2009Q3 | 2011Q2| 8        |
|              | 2014Q4         | 2015Q1| 2        |        |       |          |
|              | 2015Q3         | 2016Q1| 3        |        |       |          |
## The threshold approach results (continued…)

| Country     | Surge episodes | Outflow episodes |
|-------------|----------------|------------------|
|             | Start | End | Quarters | Start | End | Quarters |
| Romania     |       |     |          |       |     |          |
|             | 2011Q3 | 2011Q4 | 2 | 2004Q2 | 2004Q3 | 2 |
|             | 2013Q2 | 2015Q3 | 10 | 2005Q1 | 2005Q3 | 3 |
|             | 2016Q1 | 2016Q3 | 3 | 2006Q1 | 2006Q2 | 2 |
|             |       |       |          | 2006Q4 | 2008Q3 | 8 |
| South Africa|       |     |          |       |     |          |
|             | 2000Q4 | 2002Q4 | 9 | 2004Q4 | 2005Q2 | 3 |
|             | 2003Q3 | 2003Q4 | 2 | 2006Q1 | 2006Q2 | 2 |
|             | 2008Q4 | 2009Q1 | 2 | 2006Q4 | 2008Q2 | 7 |
|             | 2016Q4 | 2017Q1 | 2 | 2009Q2 | 2009Q4 | 3 |
|             |       |       |          | 2010Q2 | 2010Q3 | 2 |
|             |       |       |          | 2012Q3 | 2012Q4 | 2 |
| Thailand    |       |     |          |       |     |          |
|             | 2000Q1 | 2001Q1 | 5 | 2005Q2 | 2006Q2 | 5 |
|             | 2013Q3 | 2014Q1 | 3 | 2009Q3 | 2011Q1 | 7 |
|             | 2014Q4 | 2015Q1 | 2 | 2012Q3 | 2013Q1 | 3 |
|             | 2015Q3 | 2015Q4 | 2 |       |       |     |
|             | 2016Q3 | 2017Q1 | 3 |       |       |     |
| Turkey      |       |     |          |       |     |          |
|             | 2001Q1 | 2001Q2 | 2 | 2000Q1 | 2000Q3 | 3 |
|             | 2002Q2 | 2002Q4 | 3 | 2005Q4 | 2006Q1 | 2 |
|             | 2008Q4 | 2009Q2 | 3 | 2006Q4 | 2007Q1 | 2 |
|             | 2015Q1 | 2016Q1 | 5 | 2007Q3 | 2007Q4 | 2 |
|             | 2016Q3 | 2017Q1 | 3 | 2008Q2 | 2008Q3 | 2 |
|             |       |       |          | 2010Q4 | 2011Q2 | 3 |
|             |       |       |          | 2013Q1 | 2013Q2 | 2 |
Table B2
The results of the clustering approach

| Country      | Surge episodes | Outflow episodes |
|--------------|----------------|------------------|
|              | Start          | End   | Quarters | Start  | End   | Quarters |
| Brazil       | 2002Q3         | 2002Q4 | 2        | 2006Q4 | 2007Q2 | 3        |
|              | 2003Q3         | 2004Q4 | 6        | 2007Q4 | 2008Q1 | 2        |
|              | 2005Q2         | 2005Q4 | 3        | 2010Q1 | 2011Q1 | 5        |
|              | 2006Q2         | 2006Q3 | 2        |        |        |          |
|              | 2008Q4         | 2009Q1 | 2        |        |        |          |
|              | 2015Q3         | 2017Q1 | 7        |        |        |          |
| Chile        | 2004Q1         | 2004Q2 | 2        | 2008Q2 | 2008Q4 | 3        |
|              | 2006Q3         | 2007Q1 | 3        | 2011Q2 | 2011Q4 | 3        |
|              |                |        |          |        |        |          |
| Columbia     | 2000Q1         | 2004Q4 | 4        | 2010Q3 | 2010Q4 | 2        |
|              | 2001Q2         | 2001Q3 | 2        | 2012Q2 | 2013Q1 | 4        |
|              | 2002Q1         | 2003Q4 | 8        | 2014Q1 | 2015Q1 | 5        |
|              | 2004Q2         | 2004Q3 | 2        |        |        |          |
|              | 2005Q4         | 2006Q3 | 4        |        |        |          |
|              | 2009Q1         | 2009Q2 | 2        |        |        |          |
| Hungary      | 2011Q4         | 2012Q4 | 5        | 2000Q3 | 2000Q4 | 4        |
|              | 2013Q2         | 2013Q3 | 2        | 2004Q1 | 2006Q1 | 9        |
|              | 2014Q3         | 2014Q4 | 2        | 2007Q1 | 2007Q2 | 2        |
|              | 2015Q2         | 2016Q3 | 6        | 2008Q3 | 2009Q1 | 3        |
|              |                |        |          | 2013Q4 | 2014Q1 | 2        |
| India        | 2000Q2         | 2002Q3 | 10       | 2007Q3 | 2008Q1 | 3        |
|              | 2003Q4         | 2004Q3 | 4        |        |        |          |
|              | 2008Q2         | 2009Q2 | 5        |        |        |          |
|              | 2014Q1         | 2014Q3 | 3        |        |        |          |
|              | 2015Q2         | 2017Q1 | 8        |        |        |          |
| Indonesia    | 2012Q3         | 2012Q4 | 2        | 2001Q3 | 2002Q3 | 5        |
|              | 2013Q2         | 2013Q4 | 3        |        |        |          |
|              | 2014Q2         | 2017Q1 | 12       | 2003Q2 | 2004Q1 | 4        |
| Korea, Rep   |                |        |          | 2004Q4 | 2005Q2 | 3        |
|              |                |        |          | 2006Q1 | 2006Q2 | 2        |
|              |                |        |          | 2007Q1 | 2007Q2 | 2        |
|              |                |        |          | 2008Q1 | 2008Q2 | 2        |
|              |                |        |          | 2009Q1 | 2010Q1 | 5        |
|              |                |        |          | 2011Q1 | 2011Q2 | 2        |
| Malaysia     | 2000Q4         | 2001Q1 | 2        | 2001Q3 | 2002Q1 | 3        |
|              | 2008Q3         | 2009Q2 | 4        | 2004Q4 | 2005Q1 | 2        |
|              | 2016Q4         | 2017Q1 | 2        | 2010Q1 | 2010Q2 | 2        |
|              |                |        |          | 2010Q4 | 2011Q2 | 3        |
|              |                |        |          | 2015Q4 | 2016Q2 | 3        |
| Philippine   | 2002Q2         | 2002Q3 | 2        | 2000Q1 | 2000Q3 | 3        |
|              | 2004Q3         | 2005Q1 | 3        | 2001Q4 | 2002Q2 | 2        |
|              | 2006Q2         | 2006Q3 | 2        | 2008Q2 | 2008Q3 | 2        |
|              | 2013Q1         | 2014Q4 | 2        | 2010Q1 | 2011Q1 | 5        |
|              |                |        |          | 2012Q3 | 2013Q1 | 3        |
| Poland       | 2001Q2         | 2001Q4 | 3        | 2007Q4 | 2008Q2 | 3        |
|              | 2004Q3         | 2004Q3 | 3        | 2009Q3 | 2010Q1 | 3        |
|              | 2013Q2         | 2014Q2 | 5        | 2011Q1 | 2011Q2 | 2        |
|              | 2014Q4         | 2015Q1 | 2        |        |        |          |
|              | 2015Q3         | 2016Q1 | 3        |        |        |          |
| Romania      | 2011Q3         | 2011Q4 | 2        | 2004Q2 | 2004Q3 | 2        |
|              | 2012Q2         | 2015Q3 | 14       | 2005Q2 | 2005Q3 | 2        |
|              | 2016Q1         | 2017Q1 | 5        | 2006Q4 | 2007Q4 | 5        |
The results of the clustering approach (continued…)

| Country     | Surge episodes | Outflow episodes |
|-------------|----------------|------------------|
|             | Start | End | Quarters | Start | End | Quarters |
| South Africa| 2000Q4 | 2001Q1 | 2 | 2004Q4 | 2005Q2 | 3 |
|             | 2001Q3 | 2003Q1 | 7 | 2006Q1 | 2006Q2 | 2 |
|             | 2003Q3 | 2003Q4 | 2 | 2007Q1 | 2008Q1 | 5 |
|             | 2008Q4 | 2009Q1 | 2 | 2012Q3 | 2012Q4 | 2 |
| Thailand    | 2000Q1 | 2000Q2 | 2 | 2006Q1 | 2006Q2 | 2 |
|             | 2000Q4 | 2001Q1 | 2 | 2010Q1 | 2011Q1 | 5 |
|             | 2013Q4 | 2014Q1 | 2 |
|             | 2014Q4 | 2015Q1 | 2 |
|             | 2015Q3 | 2015Q4 | 2 |
|             | 2016Q3 | 2017Q1 | 3 |
| Turkey      | 2001Q1 | 2001Q2 | 2 | 2000Q1 | 2000Q3 | 3 |
|             | 2002Q2 | 2002Q4 | 3 | 2005Q4 | 2006Q1 | 2 |
|             | 2008Q4 | 2009Q2 | 3 | 2010Q4 | 2011Q2 | 3 |
|             | 2015Q1 | 2016Q1 | 5 |
|             | 2016Q3 | 2017Q1 | 3 |
### Appendix C

**Table C1**  
Distribution of changepoint dates throughout the flow episodes (Threshold approach)

| Country     | Surge                          | Capital flow episodes | Outflows          |
|-------------|-------------------------------|-----------------------|-------------------|
| **Brazil**  | 12/17/2004, 8/11/2015, 2/17/2015, 3/2/2016, 7/13/2016 | 1/2/2006, 9/20/2007, 9/3/2008, 12/5/2008, 4/28/2009, 9/10/2009, 6/6/2013 | 10/12/2006, 4/2/2007, 8/1/2011 |
| **Chile**   | 10/25/2004, 10/31/2006, 1/23/2007, 6/1/2007, 2/4/2008, 12/11/2009 | 7/13/2010, 10/14/2016 | 9/19/2008, 8/9/2013 |
| **Columbia**| 5/6/2009, 6/10/2009             | 2/3/2005, 11/7/2005, 8/2/2006, 7/11/2007, 10/6/2008, 9/14/2009 | 5/12/2010, 12/10/2014 |
| **Hungary** | 6/8/2011, 5/29/2012, 7/10/2012, 9/20/2012, 10/30/2012, 5/8/2014, 10/15/2014, 1/6/2016 | 2/13/2007, 11/21/2007, 10/29/2009, 1/23/2015 | 6/17/2004, 12/7/2004, 5/13/2005, 3/18/2009 |
| **Korea, Rep.** | 11/22/2005, 11/1/2006, 7/1/2008, 8/25/2008, 10/3/2008, 9/1/2010 | 11/22/2005, 11/1/2006, 7/1/2008, 8/25/2008, 10/3/2008, 9/1/2010 | 2/3/2005, 4/13/2006, 5/12/2006, 4/10/2007, 5/25/2007, 4/9/2009, 7/30/2009 |
| **Malaysia** | 11/20/2006, 7/1/2008, 9/10/2008, 7/17/2009, 5/2/2013 | 1/19/2007, 4/6/2007, 3/4/2008, 8/19/2015 | 3/9/2006, 10/12/2006, 4/19/2007, 6/28/2007, 9/18/2007, 2/29/2008, 8/24/2009, 8/17/2010, 8/4/2011, 9/13/2012 |
| **India**   | 5/15/2009                      | 7/20/2005, 6/3/2008, 9/26/2008, 5/8/2014 | 4/13/2007, 9/18/2007, 7/11/2008, 9/9/2008, 3/8/2010, 2/11/2013 |
| **Indonesia** | 5/6/2009                      | 4/6/2007, 3/4/2008, 8/19/2015 | 4/11/2006, 7/29/2009, 9/14/2009, 9/3/2010 |
| **Philippine** | 5/1/2006                      | 1/12/2007, 3/31/2007, 7/27/2007, 9/25/2007, 1/15/2008, 6/9/2008, 7/24/2009, 4/5/2011, 1/10/2012 | 4/2/2010, 1/2/2013 |
| **Poland**  | 8/12/2013, 12/4/2015           | 4/1/2004, 7/27/2005, 12/1/2005, 3/29/2006, 10/12/2006, 10/9/2008, 8/4/2011, 9/5/2012 | 1/11/2008, 6/26/2008, 7/29/2009, 11/6/2009, 9/7/2010 |
| **Romania** | 7/15/2011, 12/3/2013, 6/27/2014 | 2/9/2004, 10/21/2004, 10/17/2008, 7/29/2009, 10/13/2009, 9/2/17/2010, 5/4/2010, 12/31/2010, 7/30/2012, 12/20/2012 | 4/14/2015, 7/11/2005, 9/12/2005, 1/6/2006, 6/26/2007, 1/18/2008, 7/2/2008, 4/14/2015, 7/11/2005, 9/12/2005, 1/6/2006, 6/26/2007, 1/18/2008, 7/2/2008, 4/14/2015, 7/11/2005, 9/12/2005, 1/6/2006, 6/26/2007, 1/18/2008, 7/2/2008 |
| **South Africa** | 10/31/2005 | 10/4/2006, 7/7/2008, 9/4/2008, 3/5/2010, 1/18/2012, 7/1/2014 | 1/11/2007, 9/18/2007, 7/20/2009, 10/13/2009, 5/3/2010, 9/17/2010, 12/14/2012, |
| **Thailand** | 10/16/2003, 6/29/2007, 6/12/2008, 9/15/2008, 2/6/2012 | 10/5/2008, 6/29/2007, 6/12/2008, 9/15/2008, 2/6/2012 | 8/21/2009, 6/18/2010, 9/21/2010, 12/31/2012 |
| **Turkey**  | 10/3/2008, 5/15/2009           | 1/7/2008, 5/11/2008, 6/29/2007, 7/30/2009, 9/22/2009, 12/18/2009, 7/23/2010, 8/4/2011, 7/26/2012 | 11/22/2005, 1/13/2006, 1/19/2007, 3/28/2007, 5/21/2008, 11/22/2005, 1/13/2006, 1/19/2007, 3/28/2007, 5/21/2008 |
| Country       | Surge                                      | Capital flow episodes | Outflows                   |
|--------------|--------------------------------------------|-----------------------|----------------------------|
| Brazil       | 12/17/2004, 8/11/2015, 12/17/2015, 3/2/2016, 7/13/2016 | 1/2/2006, 9/20/2007, 9/3/2008, 8/5/2008, 4/28/2009, 9/10/2009, 6/6/2013 | 10/12/2006, 4/2/2007, 8/1/2011 |
| Chile        | 10/31/2006, 1/23/2007                          | 10/25/2004, 6/1/2007, 2/4/2008, 12/11/2009, 7/13/2010, 8/9/2013, 10/14/2016 | 9/19/2008                     |
| Columbia     | 11/7/2005, 8/2/2006, 5/6/2009, 6/10/2009 | 2/3/2005, 7/11/2007, 10/6/2008, 9/14/2009 | 7/20/2010, 12/10/2014         |
| Hungary      | 5/29/2012, 7/10/2012, 9/20/2012, 10/30/2012, 10/15/2014, 1/6/2016 | 11/21/2007, 10/29/2009, 6/8/2011, 5/8/2014, 1/23/2015 | 6/17/2004, 12/7/2004, 5/13/2005, 2/13/2007, 3/18/2009,                     |
| Korea, Rep.  | 11/22/2005, 11/1/2006, 7/1/2008, 8/25/2008, 10/3/2008, 9/1/2010 | 2/23/2005, 4/13/2006, 5/12/2006, 4/10/2007, 5/25/2007, 4/9/2009, 7/30/2009,                     |
| Malaysia     | 7/1/2008, 9/10/2008                         | 11/20/2006, 1/19/2007, 4/6/2007, 3/4/2008, 7/17/2009, 8/19/2010, 5/2/2013, 8/19/2015, 1/10/2005, 3/4/2010 |
| India        | 6/3/2008, 9/26/2008, 5/8/2014               | 7/20/2005, 3/9/2006, 10/12/2006, 4/19/2007, 6/28/2007, 5/15/2009, 8/24/2009, 8/17/2010, 8/4/2011, 9/13/2012, 9/18/2007, 2/29/2008 |
| Indonesia    | 7/11/2008, 9/9/2008                         | 4/11/2006, 4/13/2007, 5/6/2009, 7/29/2009, 9/14/2009, 3/8/2010, 9/3/2010, 2/11/2013, 9/18/2007 |
| Philippine   | 5/1/2006, 1/2/2013                           | 1/12/2007, 5/31/2007, 7/27/2007, 9/25/2007, 1/15/2008, 7/24/2009, 4/5/2011, 1/10/2012, 6/9/2008, 4/2/2010 |
| Poland       | 8/12/2013, 12/4/2015                         | 4/1/2004, 7/27/2005, 12/1/2005, 3/29/2006, 10/12/2006, 10/9/2008, 9/7/2010, 8/4/2011, 9/5/2012, 12/27/2016, 1/11/2008, 6/26/2008, 7/29/2009, 11/6/2009 |
| Romania      | 7/15/2011, 7/30/2012, 12/20/2012, 8/12/2013, 6/27/2014 | 2/9/2004, 10/21/2004, 4/14/2005, 1/6/2006, 1/18/2008, 7/2/2008, 10/17/2008, 7/29/2009, 10/13/2009, 2/17/2010, 5/4/2010, 12/31/2010, 7/11/2005, 9/12/2005, 6/26/2007 |
| South Africa | 10/31/2005, 10/4/2006, 9/18/2007, 7/7/2008, 9/4/2008, 7/20/2009, 10/13/2009, 3/5/2010, 5/3/2010, 9/17/2010, 1/18/2012, 7/1/2014, 1/11/2007, 12/14/2012 |
| Thailand     | 10/16/2003, 6/29/2007, 6/12/2008, 9/15/2008, 8/21/2009, 2/6/2012, 12/31/2012, 6/18/2010, 9/21/2010, 11/18/2003, 1/13/2006 |
| Turkey       | 10/3/2008, 5/15/2009                         | 1/7/2005, 5/11/2006, 1/19/2007, 3/28/2007, 6/29/2007, 1/15/2008, 5/21/2008, 7/30/2009, 9/22/2009, 12/18/2009, 7/23/2010, 8/4/2011, 7/26/2012, 11/22/2005, 1/13/2006 |