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CAPITAL FLOW SURGES AS BUBBLES: BEHAVIORAL FINANCE AND MCKINNON'S OVER-BORROWING SYNDROME EXTENDED*

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This paper explores how behavioral finance and complexity economics, along with imperfect information, faulty mental models and perverse incentive structures can cast light on the factors that generate the international capital flow surges and sudden stops that McKinnon described as the *over-borrowing syndrome*. While there has been a great deal of empirical research on this topic in recent years, there has been much less theoretical analysis of why these flows too often behave in such a volatile manner. Developing a better understanding of the forces driving capital flows should help us identify situations where capital flow surges are particularly likely to end in costly sudden stops and help policy makers decide how best to respond to such flows.

Keywords: Capital flow surges; sudden stops; over-borrowing syndrome; behavioral finance; mental models; bubbles.

JEL Classifications: F3, F4, G01, G02, G15.

1. Introduction

In this paper, we draw on recent contributions in behavioral finance and complexity economics to extend insights from Ron McKinnon's pioneering work on disruptive capital flow surges and reversals that he called the over-borrowing syndrome.

Section 2, written by Willett, offers a personal note of appreciation of his interactions with Ron and a brief summary of Ron's important contribution to international finance in his analysis of the over-borrowing syndrome.

In later sections, we extend Ron's analysis to argue that his over-borrowing syndrome applies to portfolio debt and equity flows in addition to the bank credit flows he emphasized and that the issues of perverse incentives and moral hazard he wrote about go well beyond deposit insurance.

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In Section 3, we discuss the relation between efficient markets, capital flow surges and stock market bubbles. In Section 4, we discuss insights from rational analysis and the role that faulty mental models play in capital flow surges and sudden stops. In Sections 5 and 6 we provide an overview of recent developments in behavioral finance and complexity economics and explore how their interactions with faulty mental models, imperfect information and perverse incentives can be used to analyze capital flow surges and reversals as bubbles and busts and provide explanations for substantial deviations from efficient market behavior and equilibrium values highlighted by Ron (McKinnon and Pill, 1996), and others such as Kindleberger and Aliber (2011) and Minsky (1992). Such market failures can lead not only to instabilities, but can also undermine the ability of financial markets and capital flows to provide discipline to monetary, fiscal, regulatory, and financial policy makers. In Section 7, we provide an overview of recent empirical research on capital flow surges and reversals. In Section 8, we conclude with a summary of the main points of the paper and discussion of policy implications and directions for further research.

2. Personal Note and McKinnon's Over-Borrowing Syndrome by Willett

Ron McKinnon and I grew to be friends over the course of our long running debate on exchange rate issues. While we never managed to reach a common view, Ron was always a model gentleman and I gained a great deal of insight from our discussions. I will miss him greatly.

In approaching exchange rate issues, Ron and I both adopted the optimum currency area (OCA) theoretical framework he pioneered with Bob Mundell. We had very different views, however, about how different countries fit the key assumptions of this framework. Ron and Bob Mundell became the leading advocates of the global monetarist school that saw the whole world, or most of it, as an optimum currency area. They favored a widespread regime of permanently fixed exchange rates with no sterilization of international payments imbalances, thus providing an automatic adjustment mechanism. I was more in the camp of Milton Friedman who favored flexible exchange rates for most countries except those with small and highly open economies.

A key issue separating our views was the degree of international currency substitution, which was to become one of the key issues in discussions of exchange rate policies. On this topic, Ron and I exchanged views in a series of contributions to the *American Economic Review* as well as in personal discussions (McKinnon *et al.*, 1984; McKinnon and Tan, 1983; McKinnon, 1982; Radcliffe *et al.*, 1984). Ron convincingly showed that, in the case where international currencies are perfect substitutes, a fixed exchange rate with no sterilization of international reserve flows was the optimal policy regime no matter the size and openness of economies. Where we differed was in our reading of the evidence on international currency substitution. We agreed that currency substitution was very important for a number of highly dollarized economies, but I did not agree with Ron's view that it was important for most large advanced economies.

There was another set of Ron's contributions that I failed to give sufficient attention when they first appeared, his work on *the over-borrowing syndrome* (McKinnon and Pill,

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1996, 1997; Radcliffe *et al.*, 1984). I now view Ron's articles in this area as some of the most important early contributions to our understanding of why international capital flows so often display dramatic surges followed by rapid reversals, the phenomenon now known as *sudden stops* (Calvo, 1998). At the time, I was working on other issues and was still in my efficient markets, rational expectations phase. My study of the Asian crises in 1997–1998 (Willett *et al.*, 2005) made me confront evidence that was not consistent with these views and through the study of a number of other crises I have come to fully accept Ron's view that international financial markets are frequently plagued by market failures caused by such factors as excessive optimism or pessimism and perverse incentive structures. Ron also argued, persuasively, that such problems were not limited to emerging markets but were likely to occur in advanced economies as well. The recent euro crisis highlights the importance of this insight.

One of the considerations that I have emphasized in recent research is the role of faulty mental models held by both private sector and government actors in generating capital surge and sudden stop behavior (Willett, 2012). Such analysis supports and extends one of Ron's important themes (Willett and Srisorn, 2014). In his work on the over-borrowing syndrome, Ron disagreed with the assumption in standard rational expectations models that all agents know the "true" model of the economy. It has since become abundantly clear that many of the mistakes made by financial market participants, professional economists and government officials result from holding views of the world that turn out to be seriously mistaken. In his analysis, Ron focused on the role of international bank flows and the perverse moral hazard incentives generated by deposit insurance. In hindsight, many of these points were early attempts to address the issues that now comprise behavioral economics and finance.

3. Efficient Markets, Capital Flow Surges and Asset Market Bubbles

There is widespread agreement among international monetary and financial experts that capital flow surges (CFS) and sudden stops (SS) have become a major problem for many emerging market countries and the international financial system as a whole (Agosin and Huaita, 2012; Balakrishnan *et al.*, 2013; Efremidze *et al.*, 2011; Forbes and Warnock, 2012). While there has been a great deal of empirical research in recent years about identifying quantitative aspects of capital surges and sudden stops, so far there has been much less analysis of the theoretical considerations that generate CFS and SS.[1] Three important exceptions are Agosin and Huaita (2012) who apply insights from Minsky (Montiel, 2013), who uses a second generation crisis model approach and De Grauwe *et al.* (1993) on the foreign exchange market.

There has been, however, a great deal of literature on asset market bubbles and crashes that we believe offers important insights into the behavior of international capital flows.[2]

[1] Three important exceptions are Agosin and Huaita (2012) who apply insights from Minsky, Montiel (2013) who uses a second generation crisis model approach and De Grauwe and Grimaldi (2016).

[2] An early contribution is Smith *et al.* (1988). For more recent contributions see Caginalp *et al.* (2000), DeGrauwe and Grimaldi (2006), Shiller (2003, 2014), Sornette (2003) and Vogel (2010).

Much of this literature goes beyond traditional models and focuses on the rapidly growing fields of behavioral economics and complexity economics that use insights from psychology, neurology and physics. This new work is developing to explore a more rigorous basis for analyzing the types of factors emphasized by Kindleberger and Aliber (2011), Minsky (1992), Soros (2008), and others.

The major purpose of this paper is to explore the extent to which these new approaches can cast light on the factors that generate international CFS and SS. This may, in turn, help us to identify the situations where CFS are particularly likely to end in costly SS. In general, international monetary economics suggests that it is best to allow economies to fully adjust to "permanent" or longer term capital flows driven by changes in fundamentals but that there is a case for offsetting some of the potentially disruptive effects of "temporary," or shorter term, capital flows through measures such as sterilized intervention in the foreign exchange market (Cavallo *et al.*, 2013). Thus, developing a better understanding of the forces driving capital flows should help policy makers decide when to take actions to limit such flows or to offset their effects on important national variables such as money and credit growth and current account deficits.

In recent decades, a great deal of international financial analysis by academic researchers has made use of models that assume a highly intelligent representative agent, complete information, long decision horizons, efficient decision-making, and equilibrium, the standard assumptions of rational expectations and efficient markets models. These models imply that adjustment to disturbances is smooth and that markets are efficient. In such models, capital surges are often generated by improved economic and financial prospects in recipient countries. The resulting improvement in domestic returns relative to foreign returns will cause investors to rebalance their portfolios in favor of the recipient country leading to a one-time capital flow. Once the new equilibrium has been reached, further flows or price changes would come to a halt. Large capital flow reversals and stock market busts would require a new negative shock.

The experience of recent decades, with repeated capital flow surges and sudden stops and asset bubbles and financial busts calls into question the general applicability of these models. In fact, it appears that in practice after the initial process has begun international capital flows and asset price increases sometimes take on a life of their own and continue well past what could be justified by improved fundamentals. In such cases, subsequent reversals and price drops often seem far out of proportion to the actual worsening of fundamentals. We believe that it is important to consider alternatives to efficient market theory, not to replace standard models, but to augment them in important situations that standard models are not meant to address and to alert us to danger ahead with respect to both capital flow and asset price booms.

For many years, most economic theorists relegated views that markets are often inefficient to a sort of academic underworld, although such views held considerable sway with practitioners, policy makers, and economic historians. The 1987 stock market crash, the 2001 dot-com boom and bust and the 2008 subprime mortgage crisis, however, have led a growing number of economists to question the usefulness of mainstream models and pushed dissenting views more into the mainstream of economics as evidenced by the rise

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of behavioral economics and finance.[3] Similarly, we believe that some of the new tools can improve our understanding of the large number of capital flow surges that have ended in disruptive reversals in recent decades.

In rejecting the general applicability of efficient market theory some critics hold the extreme view that financial markets, swamped by waves of irrational optimism and pessimism, seldom get things right. We believe such views go too far. We advocate a middle road between these extremes and suggest several directions to better understanding of how markets behave and to identify signals that particular markets are beginning to deviate substantially from equilibrium based on fundamentals. Drawing on recent developments in behavioral finance and complexity, we argue that markets can behave differently in different situations. In some situations, when markets are near equilibrium and disturbances are relatively small, markets adjust quickly and smoothly to a new equilibrium as assumed in standard rational expectations and efficient markets analysis. In other situations, when markets are far from equilibrium and disturbances are large, adjustments can be abrupt, discontinuous, and chaotic and markets can remain far from fundamental equilibrium for long periods. In this view, standard academic models can be quite useful in explaining market behavior during "normal" periods but have a little value during periods of economic and financial crisis.

Recent studies of stock returns have reported a long list of anomalies including the January effect, the weekend effect, and the month end effect. In each case, time series of stock returns are shown to be inconsistent with the predictions of the efficient market hypothesis that all available public information is embodied in market prices. Stock returns have been shown to exhibit momentum over horizons of 9–24 months, while exhibiting mean reversion over longer periods of 3–5 years (Hong and Stein, 1999; Lakonishok *et al.*, 1994). Both behavioral and complexity hypotheses have been advanced to explain these anomalies. Applying similar methods to empirical relationships between capital flow surges and sudden stops may produce interesting results. We should note, however, that for dealing with issues of McKinnon's over-borrowing syndrome the types of biases that lead to small deviations from efficiency in stock markets are likely not important for public policies toward capital flows where major deviations such as bubbles are of greater relevance.

Not all economists, however, have been willing to accept the possibility of major failures of efficient market theory such as the existence of asset price bubbles. Fama (2013) in his Nobel lecture argued that there is "no reliable evidence that price declines are predictable… bubble is a treacherous term…at least as commonly used, [it] has no content" (p. 1475). In arguing that there is no evidence that bubbles can be identified *ex ante* Fama overlooks a considerable amount of recent literature that purports to do just that (see, for example, Sornette, 2003, and the work of Shiller discussed below).

Of course, Fama is correct that it is not possible to identify bubbles with 100% confidence, nor are all sudden price increases necessarily followed by dramatic crashes.

[3] Among many international monetary economists, the Asian crisis of 1997–1998 had a similar effect. This was the case for us.

However, recognizing that there is a substantial probability that one is in the early stages of an asset price bubble that will burst or a capital flow surge that will end in a sudden stop has important implications for both private behavior and public policy. Shiller (2003) suggests a measure called CAPE (Cyclically Adjusted Price Earnings ratio) that can be used to spot stock price bubbles using historical fundamental factors — trailing averages of 10-year earnings. Although it is widely cited by analysts and financial market commentators and has some value in identifying bubbles, this indicator may signal overvaluation for a number of years before stock prices decline, thus making it difficult to predict the timing of a crash.

Both capital flow surges and stock market booms often last for several years, with substantial impacts on rates of economic growth. Table 1 offers a few metrics of six well-publicized international financial crises, focusing on timing, duration and amplitudes of capital flow and stock market booms. In some cases, capital flows and stock markets peaks are separated by less than one-year (see Table 1), which may suggest a two way feedback between capital flows and bubbles. Much more research is needed on this question.

At this point, we should distinguish between two different concepts of market efficiency. The first is that one cannot consistently beat the market. The second is that prices observed in financial markets do not differ substantially from fundamental equilibrium prices. Contrary to what is sometimes assumed, the first proposition does not logically imply the second. As an example, Malkiel (2012) argues that limits to arbitrage allow asset prices to sometimes diverge substantially from fundamental values, i.e., bubbles happen. He is skeptical, however, that knowledge that a bubble is in process gives investors easy opportunities to earn high risk-adjusted profits, allowing bubbles to continue long after many market participants recognize that prices are far above sustainable levels. For the stock market, a bubble reflects a situation where prices have temporarily risen to levels substantially above fundamental, or equilibrium, values. The equivalent concept in international finance is capital flows that have gone too far, i.e., past equilibrium levels that

Table 1. Historical Examples of Capital Flow Surges and Stock Market Booms

Country	Peak Year of Capital Flows	Peak Year of Stock Market	Duration of Capital Flow Surge (Years)	Duration of Stock Market Boom (Years)	Amplitude of Capital Flows	Amplitude of Stock Market
Argentina	1997	1997	3	2	3.4%	205%
Mexico	1993	1994	5	2	7.7%	147%
Thailand	1995	1994	9	2	16.5%	183%
South Korea	1996	1994	7	2	7.8%	97%
Indonesia	1996	1997	7	2	3.6%	64%
Turkey	2000	2000	2	1	3.3%	420%

Notes: Duration of stock market booms is calculated as the number of years between the previous troughs to the peak. Duration for capital flow surges is the number of years from the first positive gross capital flow after the previous trough to the peak. Amplitude for stock markets is the percent change in stock prices from trough to peak. Amplitude for capital flows is the change as a percent of GDP from the first year with positive gross capital flows after the previous trough to the peak level.

reflect fundamentals and hence are likely to be reversed. Of course, neither sudden drops in stock prices nor capital flow reversals necessarily imply that there was a preceding bubble. Major unanticipated shocks can cause either case.

Capital flows express quantity rather than price adjustments so dynamics may be different from stock market returns. In both capital flow surges and stock price bubbles, however, hubris, over optimism, and confirmation bias keep investors from paying sufficient attention to early warning signs that prices or flows are unsustainably far from equilibrium. When markets reach a stage where herding develops, even "informed" investors are likely to give more weight to information that tends to confirm their previous decisions than to signs of excess as the crises in Asia and Mexico illustrate.

Most scholars define capital flow surges as situations where capital inflows are substantially larger than historical levels, suggesting that such large flows may not be sustainable.[4] Stock-flow relationships, however, can make it difficult to discriminate between a capital flow surges and a large one-time stock adjustment to a new equilibrium. An increase in the attractiveness of investing in a country, for example, may lead to a one-time rebalancing of desired portfolios that can generate large, one-time capital flows that are entirely consistent with equilibrium. Slow diffusion of information and behavioral biases, however, can make stock adjustments take place slowly, producing apparent momentum in capital flows over time. Tapering of such inflows over time is entirely consistent with equilibrium and should be distinguished from capital flow reversals triggered by, say, loss of confidence. We believe this helps explain why only about half of capital flow surges end in sudden stops (Efremidze *et al.*, 2015).

More attention needs to be given to attempting to distinguish capital flow surges and sudden stops from benign equilibrium adjustments and to the measures used to identify them. Furthermore, as recent literature has emphasized, focusing only on net capital flows, as has been common, can fail to distinguish important differences between the behavior of foreign and domestic agents. For example, we often find that both capital inflows and outflows increase after major financial liberalizations, with much smaller changes in net flows. We discuss recent empirical research on these issues in Section 6.

4. Insights from Rational Analysis

4.1. *Booms*

Before turning to discussion of behavioral finance and complexity economics we want to stress that imperfections in the operation of markets are perfectly consistent with rational efficient behavior by individual agents in the face of perverse incentive structures such as the case of moral hazard from government guarantees discussed by McKinnon and in cases where information is imperfect.

In discussions of excessive market behavior, the herding by agents frequently plays a prominent role. While such herding or bandwagon effects can be caused by behavioral biases, they can also have a rational basis. We live in a complex world where it is difficult

[4]The measurement of such surges is discussed in Section 6.

to know either the true model of market behavior or what developments will occur in the future. In such situations, rational agents will recognize the limitations of their knowledge. Asymmetric information models of rational herding have been developed based on the idea that investors have limited information and thus find it rational to follow the lead of actors they believe to be better-informed (Calvo and Mendoza, 2000; Nofsinger and Sais, 1999).

This process is augmented with a second type of herding behavior where investors adopt fashionable mental models, e.g., that East Asian countries are a place for "smart money" to invest or that joining the euro zone substantially reduces the risks associated with the entrants. As stock prices climb higher, investors justify expectations of further gains by a mental model known as the "this time it's different" syndrome highlighted by Reinhart and Rogoff (2009). This behavior can apply to CFS as well. Prior to the 1997 East Asian crises, although some of these countries were showing current account deficits, most investors did not worry as inflation was low and fiscal balances were strong. In other words, the model that current account deficits are not a problem as long as there is no fiscal deficit was defective. Thailand turned out to have other financial weaknesses in the private sector to which investors did not pay timely attention.[5]

4.2. *Busts*

Stock market bubbles often end in *busts,* with sharp price declines and forced selling. Likewise, many CFS end in SS rather than in gradual ebbing of inflows. In rational speculative bubble models no specific shock is needed to trigger a bust (as discussed in Section 6, this is also a property of models of complexity economics). As prices get pushed further above long run equilibrium levels, both the probability of a bust in the next period and the size of the likely drop increase. For prices to keep rising, such risks must be offset by accelerating expected price increases to keep a "rational" speculator in the market. During crashes, the same factors that generated the boom operate in reverse. Credit ease turns to tightness, fear and pessimism replace greed and optimism, and falling collateral values and margin selling reinforce price declines. In other words, just as markets can overshoot on the upside during booms they can overshoot fundamental values on the downside.

In second and third generation currency crisis models, such situations where optimism gives way to pessimism only occur in countries where economic and financial fundamentals have entered a vulnerable zone. Such models do not focus on what causes a shift in investor expectations. Any negative shift can become self-fulfilling and lead to a financial or currency crisis. In such models, countries could be innocent victims of an arbitrary outbreak of investor pessimism. In all crises that we have studied, however, there have been identifiable events that triggered the abrupt shift in expectations. For example, in the 1998 Russian crisis the decisive event was the failure of the legislature to pass fiscal measures that had been agreed between the government and the IMF.

[5] Of course we may sometimes believe that agents sometimes irrationally adopt oversimplified or even fundamentally wrong mental models but this is not an issue that we know how to rigorously analyze.

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A substantial literature has developed on fundamental factors that make countries vulnerable to currency crises and SS, including large fiscal and current account deficits, rapid rates of credit growth and balance sheet affects. Any country or financial institution, with a mismatched balanced sheet with either more short-term liabilities than short-term assets or assets primarily denominated in domestic currency and liabilities primarily denominated in foreign currencies, is always in a vulnerable zone, poised for a self-fulfilling crisis.[6] This is a major reason behind the development of lender of last resort type facilities through the IMF programs.

Of course, external events can trigger sharp price declines as well and declines can be intensified by internal factors including shrinking collateral values and margin requirements. Crashes can even be triggered by the widespread adoption of investment strategies like the October 1987 crash where price drops were substantially amplified by algorithm-driven selling triggered by *portfolio insurance* strategies.

The literature on experimental asset bubbles also documents factors behind crashes (Efremidze *et al.*, 2011). One such factor is the ratio of total cash holdings to stock price. During a bubble phase cash to price ratio declines, stocks become unaffordable and investors cannot maintain the pace of stock purchases. Without external infusion of additional liquidity, prices crash (Caginalp *et al.*, 2000). Similarly, when there is a domestic asset bubble while there is a surge in capital flows, at some point pace of returns to foreign capital flows decline or turn more volatile. This interaction between CFS and domestic asset bubbles could amplify booms and busts and lead to more severe consequences. More research is needed in this area to investigate the interactions between capital flows and bubbles.[7]

Furthermore, sharp declines in prices or capital flows could be explained by chaos theory. One of the lessons of chaos theory, known as the *butterfly effect*, is that in complex systems small changes in initial conditions can result in surprisingly large changes in outcomes (Lorenz, 1963). In these situations, catastrophic system events occur without any external triggering mechanism at all, unavoidable consequences of complexity (Bak, 1996). When a bubble pushes prices far above fundamental values almost any piece of bad news or the market's own complex internal dynamics can send prices sharply lower. In such situations relationships become nonlinear. We discuss complex systems in more detail later in Section 6. Thus, there are several plausible models with various definitions of rationality that allow for bubbles and crashes to occur in asset markets. These models could also offer insights on the behavior of international capital flows.

4.3. *Perverse incentive structures and agency problems*

The incentive structures facing investment managers and other agents can provide additional rationales for herding behavior and can contribute to the formation of bubbles in

[6] Montiel (2013) presents a model in which problems of moral hazard and the maturity and currency composition of domestic balance sheets interact with the level of international reserves and threat of currency depreciation to generate possibilities for rational panics, i.e. self-fulfilling speculative attacks, that lead to banking crises.

[7] For a recent analysis of the US case (Gjerstad and Smith, 2014).

periods of low yields and easy credit. When managers incomes are closely tied to short-term returns, they have target returns or benchmarks to meet, and measures of longer-term risk are unreliable it is almost inevitable that agent-managers will impose greater risks on principals than the principals would be willing to assume on their own. The resulting increase in risk may go undetected by clients for some time, however, due to reporting lags, because it is difficult to get accurate measures of the incremental risk and managers often claim they have found ways to generate returns without taking on more risk (Willett, 2012). Post mortems of the US subprime crisis suggests that this behavior occurred in a number of large financial institutions where top management often had little idea how much risk mid-level managers were taking on.

Incentive structures that base compensation and job tenure on how managers perform relative to common benchmarks can also lead to herding behavior where a manager may not want to deviate too far from what other managers are doing. As we will discuss in Section 5, a number of the biases pointed out in the cognitive psychology and cognitive science literature reinforce these "rational" incentives.

But, while such analysis explains why actors may act in ways that deviate from the expected wealth maximizing assumption of standard models we must address why other agents not suffering from these biases do not offset their effects.

4.4. *Limits to arbitrage*

Traditional efficient markets theory has always accepted that many investors may be irrational. It assumes, however, that the effects of such "noise" investors will be offset by rational investors whose actions will drive expected returns to levels at which prices reflect all available information. This assumption is buttressed by the argument, made famous by Friedman (1966) that speculators whose behavior moves prices towards equilibrium will generally earn higher returns than destabilizing speculators. Over time, the resulting concentration of wealth in the hands of stabilizing speculators should lead to a more stable and efficient market.

This argument may not hold, however, for markets where there are practical limits to the arbitrage activities needed to drive prices to equilibrium levels. Indeed, true arbitrage opportunities, where investors are able to profit from the existence of different prices for the same asset, are rare. In most cases, investors are actually making risky and speculative bets that prices of "similar" assets deviating from observed statistical relationships will return to 'normal' within a reasonable period. This is frequently called risk arbitrage which taken literally is a contradiction in terms. Under the existence of some irrational traders, transaction costs and a wide range of fundamental valuation model estimates one can never be sure exactly what the "true" equilibrium price of an asset is or how long price deviations may last. Restrictions on short selling, limits to borrowing, commissions and nonzero bid-ask spreads can also prevent arbitrage from driving prices to fundamental levels.

Such barriers to arbitrage are typically even stronger for the cross-border investments associated with CFS. Information tends to be more costly, capital flow restrictions are often present, and institutions such as banks, insurance companies and pension funds face

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regulatory restrictions on the amounts they can invest in foreign securities. Despite the frequency with which economists' models assume perfect capital mobility, the empirical evidence shows that for many countries this is not the case.[8]

The realization that bubbles can go on for a considerable time can also limit the extent to which rational investors are willing to bet against momentum traders—the problem of Gambler's Ruin. Investment managers that fail to initially participate in a bubble will have below-average returns until the bubble pops. If their investor-clients focus on short run return targets, a manager betting against a bubble can lose clients. Investor behavior during the tech and recent housing bubble suggests that this is not just a theoretical curiosity. In this case, as in models of so-called rational speculative bubbles, the full market does not behave rationally. They are rather examples of limits to arbitrage where rational agents do not have the incentives or opportunity to fully offset the behavior of the non-rational agents.

Furthermore, even sophisticated fundamental investors may choose to ride the bubble in the optimistic belief that they will be able to identify the turning point before others and hence sell at the right time. It appears that a number of hedge funds behaved in this way during both the tech bubble and the subprime mortgage crisis (Khandani and Lo, 2007). The prevalence of investment managers who believe they have above-average capabilities is consistent with evidence from cognitive science that people often over-estimate their own abilities, thus suffering with overconfidence bias. As Sharot (2012) argues, this may once have been a valuable trait for survival, but can be deadly in modern financial markets.

Eventually, of course, as the market becomes increasingly overvalued new entrants into the market will slow and almost any kind of adverse development can trigger a massive sell off. To some degree this coincides with a switch from optimism to pessimism, but such optimism and pessimism are often heavily conditioned by agents' understanding of the situation. In summary, rational speculation may not always prevent bubbles.

4.5. *Facilitators: Easy credit and regulatory failures*

Many analysts of asset bubbles maintain that prices can only become greatly overvalued in conditions of easy credit. Indeed, we can consider credit booms as a necessary, though not sufficient condition, for bubbles to take place. It is often argued that international financial flows are themselves a major cause of credit booms in emerging markets and thus help create the conditions that lead to crises and large capital account reversals. See, for example, Kindleberger and Aliber (2011) and Reinhart and Rogoff (2009). Effects on appreciation of the real exchange rate that create unsustainable current account deficits could be another endogenous mechanism.[9] These could be examples of Soros' reflexivity approach where financial behavior affects the fundamentals that in turn affect financial behavior. There are collective action problems here as individual uncoordinated agents would not typically be sufficiently large to substantially affect total flows so they would not

[8] See the recent survey paper by Clark *et al.* (2012).

[9] Such possible mechanisms are discussed in Agosin and Huaita (2011).

have private incentives to end capital flows before such endogenous instabilities were created.

For capital flow surges, easy credit takes the form of increases in the willingness of foreign banks to lend to domestic borrowers and their demands to borrow. As Minsky (1992) stressed, during these episodes overly optimistic views of investors are often shared by bankers, who willingly extend credit used to buy assets. Recent research, however, in Amri *et al.* (2015) suggests that governments and central banks have a good deal of capacity through exchange rate flexibility, sterilized intervention, and macro prudential policies to break the links between large capital inflows and rapid credit creation.[10]

Likewise, capital surges are typically associated not only with attractive innovations in the receiving countries but also with easy credit in capital exporting countries. A prime example is the surge of capital flows to emerging market countries associated with the massive financial easing in advanced economies in the wake of the global financial crisis.[11] Recent analyses of credit booms and financial crises finds that virtually all financial crises were preceded by major credit booms but that roughly half of credit booms are not followed by crises, roughly similar to the proportion of CFS that end in SS (Amri *et al.*, 2015; Reinhart and Rogoff, 2009; Sula, 2010).

Increases in international lending, of course, can simply represent rational, efficient responses to improved business prospects in borrowing countries. Alternatively, international lenders may be caught up in waves of optimism, especially when interest rates are low and liquidity is plentiful at home. Lenders extending loans in their home currencies may believe they have less reason to be concerned with exchange rate risk. Borrowers may believe that domestic authorities would not allow major depreciations, which would discourage them from hedging foreign currency liabilities and increase the vulnerability of borrowing country balance sheets to sudden outflows.

Even though it is a primary function of central banks and governments to avoid easy money and excessive credit, they often fail in this task for a number of reasons. Our argument is not that large capital inflows do not make credit booms more likely but rather that this is far from an automatic relationship. While the authorities typically have the technical capability to largely offset the effects of capital inflows on credit growth they often fail to do so. Just like stock market booms, it is not easy to tell when credit expansions cross the line to become excessive. Same types of psychological factors that lead private investors to adopt overly optimistic views often convince financial regulators that this time it is different and high rates of financial expansion are not dangerous.

[10] To date there has been less research on the links between capital inflows and currency appreciation and current account deficits, but we do find that these are major determinants of sudden stops. Recently Rey (2013) has attracted a good deal of attention by arguing that there is a global credit cycle and that as a result flexible exchange rates are not effective in giving countries monetary independence. This is undoubtedly true in the sense that floating rates cannot make countries fully insulated from international developments, but this need not imply that flexible rates cannot give countries scope to offset to a substantial degree the effects of some types of foreign generated financial shocks. On the ability of central banks to sterilize capital inflows see Ouyang *et al.* (2008) and (2010).

[11] The empirical literature on capital flows to emerging markets generally finds that monetary conditions in the advanced economies have strong effects. For recent surveys of this literature, see Crystallin (2015) and Koepke (2015).

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Central bankers also face political pressures from major financial institutions, government officials, the media and the borrowing public to keep the good times rolling. Public pressures on elected officials are particularly important when growth is slow or negative and unemployment is high. Pressures from large financial institutions also come both directly and through elected officials. Regulators tend to adopt the mental models of the financial sector, referred as cognitive capture, as opposed to the bribes and threats usually associated with models of regulatory capture.

Before we turn to discussion of the cognitive biases emphasized in behavioral economics and finance that contribute to booms and busts, we consider an important aspect that falls between simple rational analysis and the behavioral approach.

4.6. *Faulty mental models*

Early analyses in the rational expectations approach generally assumed well informed agents all operating on the basis of the same and correct model of how the economy works. More recently, considerable attention has been paid to issues such as limited information and uncertainty. One type of analysis focuses on the effects of uncertainty that agents take into account. The implication is that the greater the perceived uncertainty the more muted agents actions should become.

A second type of analysis focuses on heterogeneous agents who are sure that their views are correct, while there are other agents who are also confident that their, opposing, views are correct. The implications of genuine differences in views about complex situations clearly comes within a rational framework. Frequently, however, we observe agents who have excessive faith in simple models of complex situations and who pay little attention to evidence which conflicts with their views. This version falls squarely within the realm of behavioral economics and finance with their emphasis on psychological factors such as overconfidence and confirmation bias. In many cases, it is difficult to make judgments about whether clashes in mental models would be best seen in a rational or behavioral framework. We do not attempt to answer this question here but rather focus on a number of examples where mental models that have turned out to be seriously faulty have contributed to capital flow surges and sudden stops and to financial market booms and busts. There is also evidence of herding behavior in the adoption of mental models which can contribute to sustaining capital flow surges and stock price booms to the point where they precipitate crises.

A classic example was the widely held belief by leading advanced economy bankers in the 1970s that sovereign nations do not go bankrupt. A little knowledge of history would have shown this argument to be false. Ignorance of history led to excessive capital flows to emerging markets, and of course to the Latin American debt crisis of the 1980s.

A second destructive mental model, associated with Fed Chairman Greenspan, is that we can count on competitive pressures to provide sufficient discipline to the managers of financial firms so they make decisions in ways that guarantee financial stability. We have seen, however, that principal-agent problems, short time horizons, and the difficulty of measuring financial risk can sometimes lead to managers of financial institutions to take on

excessive risk even in intensely competitive markets. This was made worse by the fact that both bankers and academics relied on risk models built on the benign assumption that returns are distributed normally, i.e., that extreme events rarely happen. These models led investors and managers to underestimate risk and contributed to mistaken beliefs that complex financial products had made financial systems fundamentally safer. Unfortunately, extreme events are not rare in the real world. Excessive faith in faulty mental models substantially worsened the recent financial crises in the US and Europe.[12]

Belief in a third type of faulty mental model has also been widespread among monetary authorities and investors. The belief that a rapid credit expansion is no cause for alarm as long as consumer price inflation remains in check. Examples abound, however, of cases of capital flow surges and asset price bubbles during periods of low CPI inflation including Mexico in 1994, Asia in 1997, and the recent US and euro zone crises. Where goods and asset prices diverge sharply, monetary policy cannot control both, one of the reasons for having sound regulatory policy as a second policy instrument. Taking low inflation as an indicator that the financial sector is in sound shape has contributed importantly to many cases of capital surges which in turn led to large reversals when the weakness of the financial sector became known. The Asian crisis of 1997–1998 is a prime example. Another important contributor to the Asian crisis was the belief that substantial currency depreciations had been effectively ruled out. This led to widespread failure to hedge foreign currency liabilities associated with the capital inflows and in turn contributed to the size of the capital flow reversals once crises broke out.

In complex situations, it can be perfectly rational to adopt views or models which turn out to be wrong *ex post*. As Simon (1982) pointed out with his concept of bounded rationality, when information costs, uncertainty, and the limits on the cognitive abilities of the human brain are taken into account such behavior may, in fact, be rational. Often, however, a faulty model is acquired due to "insufficient attention" to a sufficiently broad range of possibilities, held with excessive confidence by people unwilling to acknowledge contradictory evidence.

The fact that a decision maker has been operating on the basis of an oversimplified theory or mental model does not in itself prove that expectations were formulated in an inefficient manner. We live in a highly complex world where the best scientists are often at odds about which theory to use to explain a particular phenomenon. Still it is often possible for reasonable people to agree that actors in particular cases have adhered too firmly to views that they would not have adopted if they had invested more in information before committing to a particular mental model or given insufficient attention to the possibility that the theory would turn out to be incorrect.

There is an important distinction between theories that are simply incomplete because they do not consider all possible factors and those that turn out to be fundamentally wrong. A good example of the latter is the widespread belief that, while house prices in particular regions may fall, this could never happen at the national level. While many recognized that prices were rising unusually fast, "this time is different" stories held considerable sway,

[12] See, for example, Nelson and Katzenstein (2015), Willett (2012) and Willett and Srisorn (2014).

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thus contributing to the housing bubbles in the United States and a number of other countries that triggered the global financial crises (Willett, 2012).[13]

People may also fail to realize that a theory may work in some situations and not others. An example is the excessive faith placed by both financial institutions and regulators in the financial engineering and risk management models used in option pricing, asset allocation, and risk management that worked well during normal periods but broke down badly in crisis situations (Derman, 2011).

Senior managers at banks and other institutions cannot be expected to understand the full complexities of these models but one can make a strong argument that they should have been aware of some of their limitations or at least have paid attention to warnings from some leading risk officers (Rajan, 2010).

All economic and financial models, of course, must abstract from many features of the real world. Behavioral and neuro finance scholars argue that psychological biases tend to lead agents to carry the simplification process too far and to have excessive confidence in the results. The content of such highly simplified mental models will of necessity focus on variables for which it is easier to get data and information. For example, in East Asia in the 1990s it was easier to obtain information on high rates of investment and economic growth, low inflation and strong fiscal positions than on the weak state of financial institution balance sheets.

This argument does not apply, however, to the international economic weaknesses many of these countries displayed through large current account deficits that forced continued reliance on large financial inflows. Data on these situations was easy to obtain but was ignored or heavily discounted by many international investors, possibly due to the false belief in the model that current account deficits without fiscal deficits were not dangerous. Mexico in the early 1990s is an example where too much emphasis was put on domestic macroeconomic strength and not enough on its fragile external accounts. Likewise, it was easier to identify improved economic policies that justified increased capital inflows than to determine the economy's capacity to productively absorb the inflows.

One mistake that foreign investors may have made was to interpret the desire of locals to borrow internationally as evidence that they would productively deploy the capital. A major advantage of the price system is that it takes advantage of local information. In a number of these countries, however, there were strong moral hazard elements that encouraged domestic banks and corporations to engage in both excessive borrowing abroad and excessive lending domestically. Crony capitalism, with privatized profits and expectations that major losses would be socialized, gave politically connected decision makers incentives to take on excessive economic risks.

This tendency toward over-confidence in one's mental models can be reinforced by confirmation bias (from behavioral finance) that leads many, if not most, individuals to overweight economic evidence that supports their prior views and to ignore or heavily discount evidence inconsistent with their views. Thus, financial actors are often slow to

[13] See, Shiller (2003) for an early discussion of the role of popular mental models. For further discussions of mental models in economics and political science (Roy *et al.*, 2005).

pick up on early warning signs, robbing markets of the supposed ability of sophisticated investors to provide discipline by selling when they see growing signs of trouble.

When markets become over extended, it is almost inevitable that some development will pop the bubble. This often leads to what Willett (2000) has called the "breaking of mental models" where investors and borrowers realize that their views of the situation were fundamentally flawed. In such cases, we would expect market behavior to shift much more abruptly than where an event such as an earthquake causes losses but does not force people to fundamentally rethink their mental model.

Many popular discussions of the transition from bubbles to crashes focus on sudden switches in the psychological states of investors from optimism to pessimism. Undoubtedly this view carries some truth but, for the reasons given above, such reversals are not always needed to explain the bursting of bubbles and sudden stops. In some cases growing unease among "sophisticated" investors, that prices have moved too far can reduce the strength of their confirmation bias and cause them to be more receptive to disconfirming information. Some developments, such as the devaluation of the Thai baht in 1997, may be just too large to ignore, resulting in a wakeup call that forces investors to reevaluate previous views. The scramble to sell one's positions once a crisis starts may be a rational response to discovering one's exposed financial position rather than irrational panic or sudden shifts from optimism to pessimism (Willett *et al.*, 2005).

In summary, people often place excessive faith in simple models, only to abandon the models during times of crises. In such circumstances, it is not always easy to judge whether market actors are operating rationally under constraints or inefficiently by not gathering the appropriate information. For policy makers and market actors, however, the existence of such behavior, whatever its cause, is the relevant consideration. The potentially disruptive effects tend to be strongest when combined with the types of biases analyzed in cognitive psychology and applied in behavioral economics and finance.

5. Behavioral Finance

Behavioral models were initially developed and applied to issues in domestic asset markets. Only recently have we begun to have applications to international finance.[14] Behavioral and neuro economics and finance draw on extensive research in cognitive psychology and neuroscience to identify behavioral biases that may cause agents to behave in ways that are inconsistent with the predictions of standard economic models. Some economists argue that we should stick with purely rational analysis because there are an infinite number of ways to be irrational so how can one model this. Behavioral economists argue that, while this may be true, some important behavioral biases have been found to be more prevalent.

Here we focus on a few of these biases that we believe are particularly relevant for understanding capital flow surges and sudden stops. The behavioral approach focuses both on cognitive limitations on the capabilities of decision makers and on biases that effect

[14] Examples are De Grauwe and Grimaldi (2006), Willett *et al.* (2014) and Willett and Srisorn (2014).

many people, some of which may have been helpful for survival in earlier ages but are not suitable for making decisions in today's complex economic and financial systems. Many behavioral models are based on the rules of thumb, or heuristics, of representativeness, availability, and anchoring (Tversky and Kahneman, 1974). Well-documented psychological biases include over-optimism, overconfidence, and confirmation bias that can contribute to excessive belief in "this time it's different" stories when people encounter unusual situations. There is little evidence that behavioral factors by themselves start bubbles or capital flow surges. Rather, they operate to reinforce or augment likely rational initial response to positive economic events leading to the development of momentum that pushes prices beyond fundamental equilibrium levels.

Other behavioral factors that may contribute to such bandwagon effects include myopia and oversimplified mental models. Both lead agents to believe that patterns observed in the recent past will continue into the future. They are compounded by representativeness bias where one or more prominent or recent examples are given disproportionate weight relative to the full body of available evidence. For example, while there is considerable evidence that the return of a mutual fund last period is a poor predictor of return next period there is a strong tendency for retail investors to shift money into mutual funds that have done well in the recent past. This makes it particularly difficult for rational managers to retain investors when betting against a bubble. Contrary to the predictions of efficient markets theory, bubbles can last for a considerable time so that those betting against deviations from fundamental equilibrium can lose money for multiple periods. When investors have short time horizons and extrapolative expectations this can create substantial barriers to arbitrage for informed actors. Even when agents recognize that a bubble is in progress, overconfidence can lead them to believe that they are smarter than average market participants and make them believe they will be able to profit from the bubble while getting out of the market before prices fall. Such behavior tends to interact strongly with the rational causes of market imperfections discussed in Section 4.

Uncertainty and asymmetric information interacts with excessive confidence in faulty mental models. Likewise, behavioral tendencies to underweight the future interact with rational incentives to focus on short term results due to perverse bonus structures to generate disregard for longer run consequences of current actions. Confirmation bias can cause agents to cling to faulty mental models far too long.

The experimental branch of behavioral finance presents extensive evidence to support the idea that asset price bubbles are more likely to form when investors have little trading experience in particular markets (Efremidze *et al.*, 2015b). Similar information processing difficulties would arise for investors with experience in one country who shift assets into foreign markets where they have little or no experience. There is of course some overlap between modern behavioral analysis and traditional critiques of financial markets that they are guided by Keynes's animal spirits and jump between excessive optimism and excessive pessimism. Analysis of rational limits to market efficiency, faulty mental models, behavioral finance and complexity economics can all contribute to better understanding of situations where such extreme behavior tends to occur.

Where markets become overextended small disturbances that cause market participants to reappraise their views of the situation can have much larger effects than if the market had been near equilibrium.[15] Recent research into complexity economics, to be discussed in the following section, offers further insight into such nonlinear behavior.

6. Complexity Economics

In addition to the behavioral and institutional factors that can lead to bubbles, as discussed above, there is a growing body of research in *complexity* that applies tools developed in the physical sciences to understand catastrophic events as diverse as earthquakes, avalanches, volcanic eruptions, tsunamis, hurricanes, and mass extinctions to the study of financial bubbles and busts. There is also another related and recently developed interdisciplinary field called "econophysics", which applies broader range of methods from statistical physics to economic and financial market problems (Rosser, 2006). In this paper, we focus only on the complexity analysis.

Complexity is an interdisciplinary effort to study the behavior of systems in which the *interactions* among a large number of interdependent component parts are strong enough to cause the system to exhibit a set of characteristic complex behaviors, or signatures, including multiple equilibria, self-organization, emergence, and criticality, that lead to extreme sensitivity to initial conditions (Mitchell, 2011). Bak (1996) described complexity as systems that demonstrate alternating periods of gradual change and extreme variability, which he describes as *punctuated equilibria*. International capital flows, with periods of calm interrupted by capital flow surges and sudden stops, fit Bak's definition.

Complexity draws on a body of work known as far-from-equilibrium physics that was developed to explain the fact that many physical processes display different types of behavior in different situations (Prigogine, 1977). Near equilibrium, dynamic adjustments tend to be smooth and gradual. As distance from equilibrium increases, however, a system reaches a critical point — the bifurcation point — beyond which structural change takes place, where change is abrupt and discontinuous to a new state or "regime." This "phase transition" from the equilibrium regime to the new, far from equilibrium regime is characterized by well-known statistical properties known as power laws (Sole, 2011).

As opposed to normal distributions typically assumed in asset pricing models, power law distributions exhibit "fat tails" — historical series contain a larger number of "outliers" with extremely large or extremely small values than would be predicted by normal distributions. The failure to take such considerations into account in many risk management models was a major contributor to the generation of the US subprime crisis. Power law distributions have been shown to be ubiquitous in nature, in self-organizing, social and communications networks, and have been found in many recent empirical studies of economic and financial time series (Gabaix, 2008). Arthur (2013) has argued that markets and economies are best analyzed as out-of-equilibrium complex systems. Other researchers

[15] The formal second generation currency crisis models also allow for large capital flow reversals without the need for major changes in the underlying fundamentals. These occur, however, only when a country's fundamentals have weakened to the point that they now lie in a vulnerable zone, not when fundamentals remain strong.

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have explored the implications of complexity for systemic risk and financial contagion (Chinazzi and Fagiolo, 2013; Haldane and May, 2011). Some physicists doing research in finance have explored the implications of Per Bak's self-organized criticality framework in attempts to identify the onset of the phase transitions we call financial crises (Caccioli *et al.*, 2011; Dai *et al.*, 2012; Kaizoji, 2006; Lewis, 2010; Sornette, 2003).

Bak's principal conclusion is that complex systems naturally evolve to a poised, or critical state, where small disturbances lead to events, called *avalanches*, of all sizes. The size of avalanches is distributed as a power law with fat tails, so extreme events are more common than would be true in a world of normal distributions. While financial markets do not always follow this pattern of stretching to critical states, they do so frequently enough to warrant giving serious attention to such possibilities.

Many studies have shown that as a system approaches the critical point leading to a phase transition it demonstrates certain statistical properties including an increase in variance, the presence of autocorrelation, lengthening of "relaxation time" — the time necessary for a system to return to equilibrium after a disturbance, and a reduction in the power law exponent, i.e., an increase on the "fatness" of the tails (Sole, 2011). Researchers are working to identify these statistical "markers" of the phase transitions we know as financial crises. For example, Efremidze *et al.* (2015) found that using a system complexity measure called *entropy* in the timing of stock market variability improved risk-adjusted returns over buy-and-hold index fund investing.

Applying system complexity methods may be a fruitful area of research for identifying the causes of surges and sudden stops in international capital flows as well. For capital flows it seems worthwhile to study the patterns of capital flow dynamics to see if similar patterns emerge that can serve as useful early warning signals. As with price bubbles, we would not expect to find rigid patterns. Because capital flows often exist with some type of domestic or international asset price bubble, we suspect the patterns in asset bubbles could be partially reflected in capital flow patterns as well. Both in turn may sometimes be related to rapid domestic credit growth. Such analysis has important implications for how we should measure capital flow surges. Many of the most popular measures focus on the behavior of capital flows in only one or two peak quarters or years. Our analysis, however, suggests that more attention should be given to the total size of above average inflows over a period of several years (Crystallin *et al.*, 2015).

7. Some Recent Empirical Research

In recent years, there has been considerable quantitative research on the behavior of international capital flow surges and sudden stops. One important result is the importance of distinguishing between domestic pull factors — rising demand for capital in borrowing countries — from foreign push factors — increasing willingness to provide capital in lending countries — in generating capital flow surges in emerging market economies. McKinnon's analysis focused on innovations in economic policy in borrowing countries as the initiating factor. To the list of examples that he offered we can now add many more such as a number of Asian economies in the early and mid-1990s prior to the 1997 crises,

Argentina in the mid and late-1990s and a number of the Southern European economies after the creation of the euro.

There is also strong empirical evidence that risk and liquidity play important roles. This fits with our discussion, above, that easy credit is an essential condition for the creation of serious bubbles. While McKinnon listed high inflation as one of the signals of severe cases of over-borrowing it has turned out to the surprise of many, including ourselves, that asset bubbles frequently occur even in the absence of substantial goods market inflation. The pre-crisis Asian economies, Argentina, the Euro zone crisis and the US subprime bubble are all examples.

There have been a number of recent investigations of capital flow surges. There is broad agreement among researchers on what is meant qualitatively by capital flow surges—capital inflows much larger than historical averages. There is much less agreement, however, about which quantitative measures best identify capital flow surges. Applying a number of the criteria used in recent studies to a common dataset Crystallin *et al.* (2015) find that popular methods differ by almost a factor of three in the number of capital flow surges episodes that they identify. Clearly, this is an area where further analysis is needed.

Most of the initial studies in this area focused on net financial flows, but more recent analysis has shown the importance of distinguishing between flows of domestic and foreign capital. While reversals in net financial flows were often initially labeled as sudden stops, Efremidze *et al.* (2015) argue that this label should be applied only to cases where large inflows of foreign capital suddenly stop or are reversed. In a nontrivial number of cases, they find that net capital flow reversals have been caused primarily by changes in the behavior of domestic capital owners. While capital flow surges substantially increase the risk of capital flow reversals, a substantial portion of surges are not followed by reversals and a high percentage of large reversals are not preceded by surges. In addition, the correlations between capital flow reversals and currency crises are not nearly as high as has been typically assumed (Efremidze *et al.*, 2011).

An important question then becomes to identify the factors that explain when capital flow surges reverse. The most robust evidence uncovered thus far is that large current account deficits substantially increase the probability that capital flow surges will be reversed. There has also been research on whether some types of capital flows are more likely to be reversible than others. There is considerable evidence that direct investment flows, while sometimes subject to reversals, are much less likely to be reversed than are banking and portfolio flows. There has been disagreement, however, about the volatility of banking versus portfolio flows. Our latest research finds that capital flow surges with higher proportions of bank loans are more likely to reverse than when portfolio flows are more dominant (Efremidze *et al.*, 2015).[16]

McKinnon pointed to the likelihood of a strong association between capital flow surges and domestic credit booms, a view that has now become a part of conventional wisdom (Kindleberger and Aliber, 2011; Reinhart and Rogoff, 2009). Amri *et al.* (2015) find,

[16] See the analysis and references in Efremidze *et al.* (2015). In their study, capital flow surges are more likely to be reversed if the shares of bank loans are high, but not all studies have reached this conclusion.

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however, that this relationship is much weaker than has been commonly assumed. On most of their measures only 20% or fewer capital flow surges are followed by credit booms. The reasons for such weak associations, such as possible sterilization of the monetary effects of inflows, deserve more attention as do the effects of credit booms in contributing to the generation of capital flow reversals. We should note that the popular view that major financial liberalizations in emerging market countries are almost always followed by excessive credit booms and crises is also overstated (Amri *et al.*, 2012).

A good deal of recent empirical research on the behavior of international capital flows is consistent with the view that while economic and financial fundamentals play a major role in both capital flow surges and reversals[17] the types of factors emphasized in the literature on behavioral finance and complexity economics can also be quite important. Research also finds that global financial conditions have a major impact so that receiving countries are often affected by capital flows responding to developments outside of their economies. The effects of the recent global financial crisis on capital flows to emerging markets is a prime example and while quantitatively less important, the even more recent taper tantrum seems a clear example of overreaction by the market to the policy statement of Chairman Bernanke.[18] Capital flows both to and from emerging markets show a considerable degree of correlation across countries and with the growth of international capital mobility the frequency of surges had increased over time. A good bit of synchronization is explained by the general influence of monetary and financial conditions in the advanced economies. After controlling for this, Crystallin (2015) still finds a considerable degree of contagion in capital flows surges and reversals, which is consistent with, but of course does not in itself prove, the importance of behavioral factors. The highest degree of synchronization and contagion in capital surges was found to be before the Asian and global financial crises, which is consistent with there being considerable over-optimism during these periods. Interestingly Crystallin (2015) finds more contagion of capital inflow surges than of large capital outflows.

8. Concluding Comments

The central focus of this paper is to extend McKinnon's over-borrowing syndrome to show how recent developments in the analysis of domestic asset market booms and busts can provide useful insights into the causes of capital flow surges and sudden stops. Some capital flow surges are undoubtedly consistent with standard economic models based on rational expectations and efficient markets. Examination of historical episodes such as the boom and then bust in capital flows to East Asia in the 1990s and within the euro zone during the last decade, however, suggest that many important episodes cannot be fully explained in terms of adjustments within standard equilibrium models. Nor do we believe that these capital flows behaved in the wildly irrational manner that is alleged by many critics of globalization. We have sketched elements of an intermediate view that suggests

[17] See for example the recent survey by Koepke (2015).

[18] For recent analysis of the taper tantrum (Eichengreen and Gupta, 2013).

that financial markets can behave differently at different times. Not only are there rational arguments such as costly information and principal-agent problems for imperfect market behavior but cognitive biases and the adoption of faulty mental models can also generate internal market dynamics that lead to booms and busts, as can the complexity of financial markets itself.

In closing we would like to highlight several directions for further research that we believe are of particular importance. One is to undertake detailed case studies of specific capital flow events to develop a better idea of the types of factors that have driven them.[19] Several recent empirical studies document useful economic variables such as the rate of monetary expansion and various measures of risk such as expected stock price volatility that have had important influences on capital flows from advanced to emerging market economies (Koepke, 2015). However, these cannot pick up many of the types of behavioral influences that we have discussed. Thus we believe that it is important to have a number of analytical case studies to complement empirical research and devise sets of behavioral and complexity indicators. We believe that such studies may give helpful clues to policy makers and investment managers about the likelihood of various capital flows leading to disruptive sudden stops.

A second topic is investigation of the effects of capital flow surges on conditions in the host countries that may generate large reversals. These include worsening of current account balances and increases in monetary and credit growth. Investigation of such patterns may give important clues to policy officials about helpful and unhelpful ways to respond to capital surges. For example, pro-cyclical fiscal responses are likely to increase the probability of sudden stops.[20]

A third important area for further research is to pay greater attention to the stock-flow interactions that underlie international capital movements. In equilibrium models, events such as improved economic policies that increase the expected profitability of investments in a particular country or set of countries should lead primarily to a one-time reallocation of portfolios, not to continued large flows over time. Of course, many types of international capital flows do not adjust as quickly as is assumed in standard efficient market models and stock reallocations may take some time. It would be extremely useful for us to develop a better idea of the dynamic adjustment patterns of different types of financial flows. The stock adjustment process implied by rational portfolio allocation may underlie many of the cases where capital flow surges are not followed by sudden stops. The surges in such cases could primarily reflect desired stock adjustments spread out over time.

Some economists argue that behavioral finance will not be taken seriously by mainstream economists until it develops a consistent general theory. This criticism is fundamentally misplaced. An essential key to understanding financial market bubbles, crashes, capital flow surges and sudden stops is recognizing that markets can behave in different ways at different times. At one level this is obvious. Markets sometimes boom, sometimes

[19] For a recent example, see Gjerstad and Smith (2014).

[20] Agosin and Huaita (2011) posit the importance of such dynamics but do not investigate them empirically. We have research underway on such issues at the Claremont Institute for Economic Policy Studies.

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bust, and often exhibit "normal" behavior. What we need to understand much better is how to identify when phase transitions between these "states" are likely to take place. Thus, rather than focusing only on trying to develop a general theory, it is likely to be more productive to concentrate on developing analyses that offer insight into how market participants are likely to behave under different types of circumstances and identify what are the likely empirical characteristics.

Although the newly developing field of complexity is making important contributions to our understanding of financial behavior some of its advocates may go too far to assume there is a uniform general theory of market behavior (Vogel, 2010). We believe that due to the wide array of factors that we have discussed, the dynamics of stock market bubbles and capital flow surges are not likely to follow fixed patterns and will not conform to one simple model.

For policy formulations regarding capital flows, we do believe that analysis should encompass all three broad categories of models we discussed — rational, behavioral and complexity considerations. To identify situations where markets are likely to undergo phase transitions from one state to another or that bubbles and unstable capital flow surges are taking place indicators from all three categories of models need to be tracked. More research is needed of course to refine the list of indicators, models and optimal policy reactions. Nevertheless, there are several important findings that recent research has documented.

Large, rapid inflows of financial capital do substantially increase the probability of capital flow reversals especially when they are accompanied by unhealthy fundamentals such as large current account deficits and credit booms. The probability of reversals also rises substantially when surges continue beyond one year. Composition of capital surges matters as well, as high proportions of bank loans in surges appear to increase the probability of reversals (Efremidze *et al.*, 2015). Having sufficient foreign reserves is useful to mitigate the impact on exchange rates, but even huge amounts of accumulated reserves have not prevented capital flow reversals during the Global Financial Crisis in 2008–2009.

There are clearly enough differences among situations to make it difficult to state with a high degree of confidence that a market is in disequilibrium, much less when a bubble will pop. But few things in life are certain. Recent research offers considerable promise of our being able to identify situations where the odds are well above 50–50 that a market is deviating substantially from fundamental equilibrium. How agents should adjust the estimates of the probability that the market is in a bubble or surge will depend on the relative costs of type I and type II errors and these are likely to differ substantially in different situations and among private agents and those concerned with public policy.

Finally, there is much more work that needs to be done on policies to deal with reducing the incentives for large disruptive capital flows without unduly impeding the benefits of financial market integration. In general, economic analysis suggests that economies should adjust to large continuing capital flows, but that it can be useful to dampen the effects of temporary flows. Of course a key question then becomes can one identify whether large capital flows will be temporary or continuing. The prevalence of capital flow surges and sudden stops clearly indicate that all large capital flows should not be treated as permanent.

It is unrealistic to expect that we will ever develop a method of precisely determining whether particular flows will be temporary or permanent but we believe that the types of research strategies outlined above can make important contributions toward gaining a better idea of what types of flows are more likely to be temporary. In such cases, some degree of sterilized exchange market intervention may be called for in the face of large inflows of financial capital. In some cases, even capital controls may be justified but the costs of such measures are well known. In general, including international financial flows in discussions of macro prudential financial policies makes sense. For example, placing limits on banks' unhedged foreign currency liabilities may be a prudent strategy. Such issues are now appropriately high on the agendas of policy makers in emerging market economies, international institutions such as the International Monetary Fund, and many researchers. Ron would be pleased.

In conclusion, we would once again like to pay tribute to the important contributions made by Ron McKinnon to the analysis of imperfections in the behavior of international financial flows and of the damaging effects that these can sometimes bring. His early warnings have become all too true.

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