



Speculative capital inflows, adaptive expectations, and the optimal renminbi appreciation policy[☆]



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ABSTRACT

This paper examines empirical evidence of the adaptive learning behavior of speculators in the 2005–2008 renminbi appreciation episode, and establishes a theoretical model to explore appreciation policy implications of such a behavior. In our model, speculators form their expectations about the future appreciation premium adaptively by extrapolating past appreciation returns into the future. We find that a rapid appreciation may attract more capital inflows, and the central bank may prefer a slow appreciation to discourage capital inflows. Simulated results can generate hump-shaped paths of the appreciation speed, expected appreciation premium, and capital inflows. In addition, changes in the appreciation speed precede changes in the expected appreciation premium and capital inflows. These results are consistent with empirical evidence in the 2005–2008 renminbi appreciation episode.

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1. Introduction

China experienced a rapid accumulation of international reserves during the 2005–2008 renminbi appreciation episode. Speculative capital inflows due to the appreciation anticipation are believed to account for a considerable amount of the increase in the international reserves.¹ This caused concerns about the potential unfavorable outcomes associated with speculative capital inflows, such as high money growth, asset bubbles, and the capital loss that the central bank incurs due to the appreciation premium that speculators earn. As a result, how to use appreciation policy to discourage speculative capital inflows became an important policy issue.

There was a heated debate with two opposite opinions over this issue. One opinion argued that a rapid appreciation should be used to discourage future capital inflows. After all, if the appreciation were finished over night, there would be no further capital inflows. The other advocated a slow appreciation, arguing that a rapid appreciation may actually attract more capital inflows, because speculators may invest by following the past trend in appreciation. As we will explain more clearly later, the first opinion implicitly assumes that speculators have good knowledge of the appreciation target. A rapid appreciation, by reducing the remaining appreciation size, will reduce the return that speculators expect to earn from future appreciation and, consequently, will lower capital inflows. The second opinion implicitly assumes that speculators use the recent trend in appreciation to predict the appreciation premium in the near future, and determine capital inflows accordingly.

Thus, the question of how speculators form their expectations on appreciation returns lies at the heart of the debate, and has important policy implications. This motivates us to examine empirical evidence on this issue. Empirical analysis in [Section 2](#)

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¹ The size of speculative capital inflows during this period is estimated by various methods in [Section 2](#).

reveals that during the 2005–2008 renminbi appreciation episode, speculators may have formed their expectations adaptively. A high appreciation speed tends to lead to a high expected appreciation premium of speculators and, consequently, high capital inflows. Inspired by the empirical evidence, we establish a theoretical model to study the optimal renminbi appreciation policy when speculators have adaptive expectations. More specifically, we assume that speculators extrapolate past appreciation returns into the future to form their expectations on the short-term appreciation return, and determine capital inflows accordingly. As we will show later, this assumption allows us to produce results consistent with the data.

Our model is extended from Li and Qiu (2009, 2011), who build a model to analyze the central bank's appreciation policy when speculators are perfectly rational and have perfect knowledge of the appreciation target.² In their model, the central bank faces three costs: (i) the misalignment cost caused by resource misallocation due to the undervalued exchange rate; (ii) the short-term adjustment cost due to resource reallocation, and (iii) the capital loss caused by the appreciation premium earned by speculative capital inflows. One key result of their model is that if speculators have a long-term investment horizon and can stay until the end of the appreciation, then the policy that minimizes the capital loss will be to appreciate as fast as possible. This is because in this case speculators care only about the long-run return until the end of the appreciation, which depends not on the appreciation speed, but on the total remaining size of appreciation. As a result, a faster appreciation will reduce capital inflows, which supports the first opinion in the debate mentioned previously.

This paper essentially evaluates the second opinion of the debate that a rapid appreciation may attract more capital inflows. By adopting the assumption of adaptive learning, our model produces the result consistent with the second opinion. In our model, a more rapid appreciation will indeed attract more capital inflows, instead of discouraging capital inflows. We then use our model to examine whether the central bank should indeed optimally take a slower appreciation or not. The main findings of our model are the following.

First, it is optimal for the central bank to appreciate more slowly when speculators use a larger number of past observations to form expectations. This is because in this case, a lower appreciation speed in one period can help reduce speculators' expected appreciation premium in a larger number of future periods.

Second, it is optimal for the central bank to appreciate more slowly when speculators extrapolate the trend into a larger number of future periods, because in this case, a slow appreciation will have a higher impact on speculators' expected appreciation premium.

Third, we also consider the case where speculators have a prior belief about the appreciation speed before the appreciation actually starts. We find that a higher prior belief will lead to higher capital inflows, forcing the central bank to appreciate more quickly so as to reduce the capital loss. Moreover, a higher weight on the prior belief will also increase the optimal appreciation speed, because reducing the appreciation speed now has a weaker effect on reducing speculators' expected appreciation premium and, consequently, the benefit of a slower appreciation is smaller.

Finally, simulated results show that our model can generate hump-shaped paths for the appreciation speed, the expected appreciation premium, and capital inflows. That is, under the optimal appreciation policy, the appreciation speed, the expected appreciation premium, and capital inflows all exhibit the pattern of “slow–fast–slow”. This result matches empirical data better than that in Li and Qiu's (2009, 2011) model with complete information. In their model, the appreciation speed and capital inflows are constantly decreasing over time. While as shown in Section 2, during the 2005–2008 renminbi appreciation episode, the appreciation speed, the expected appreciation premium, and capital inflows were all roughly hump-shaped: all of them increased initially, and then started to decrease after reaching the peak in early 2008. In addition, simulated results reveal that changes in the appreciation speed precede changes in the expected appreciation premium and capital inflows, which is also consistent with empirical evidence.

Our paper is related to the literature on speculative capital and currency crises.³ Different from this literature that studies capital *outflows* when a central bank faces a pressure of currency *depreciation*, our paper studies the case where a central bank tries to deter capital *inflows*, when facing a pressure of currency *appreciation*. To our knowledge, formal theoretical research on this topic is still at its infancy, and very few theoretical works study capital inflows in an economy under the appreciation pressure.

Our paper is also related to the literature on behavioral finance, or more particularly on the trend-chasing behavior in financial markets. In our model, investors are assumed to extrapolate past trends into the future. This behavior is widely observed in financial markets. Kindleberger and Aliber (2005) document numerous stories in history where speculators buy assets when the price is rising and sell when the price is falling. For example, facing the surge in the gold price in the 1970s, “Investors were extrapolating from the increase in the market price from Monday to Tuesday to project the market price on Friday; they purchased gold on Wednesday in anticipation that they could sell at a higher price on Friday” (Kindleberger & Aliber, 2005, p. 43). De Long et al. (1990) establish a formal model to study this type of positive feedback investment strategy, followed by Cutler et al. (1990), Hong and Stein (1999), and Temin and Voth (2004) among many others.

Finally, our paper is in line with the literature on adaptive expectations. Kindleberger and Aliber (2005) define adaptive expectations as the “assumption that the values of certain variables in the future are extensions of these values in the recent past. Thus the cliché that ‘the trend is your friend,’ reflecting the view that if prices have been increasing they will continue to increase”

² In reality, exchange rate policy may not be conducted by a central bank. Here we use “central bank” to denote any government agency in charge of exchange rate policy.

³ Works in this literature include Krugman (1979), Flood and Garber (1984), Obstfeld (1986), Morris and Shin (1998), Chang and Velasco (2001), and Chari and Kehoe (2003) among many others.

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