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# Cash inflow and trading horizon in asset markets☆

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ABSTRACT

It is conjectured that one of the major ingredients of historic financial bubbles was the inflow of money in various forms. We run 36 laboratory asset markets to investigate the joint effect of cash inflow and trading horizon on price efficiency. We show that markets with cash inflow *and* long trading horizon exhibit bubbles and crashes. We also observe that markets with extended trading horizon but without cash inflow and markets with shorter trading horizon do not trigger bubbles. Finally, we report that beliefs about prices and, importantly, about (constant) fundamentals follow bubble patterns as well.

## 1. Motivation

It is conjectured that one – if not *the* – major ingredient of historic financial bubbles was the inflow of money. This can, for instance, be caused by the expansion of credit by lenders, more frequent trading with leverage, expansive central bank policy, the increase in the monetary base of investors through additional income or the inflow of new investors. Moreover, it is assumed that bubbles in real markets usually formed in long-lived assets (stocks, real estate), not in short-lived ones (options and other derivatives). To gain insights on both conjectured bubble drivers, we investigate the joint effect of cash inflow and trading horizon (i.e., speculation horizon) on price efficiency in laboratory asset markets.

Following the narratives of Galbraith (1994) and Kindleberger and Aliber (2011) the expansion phase of many historic bubbles was fuelled by money inflows after a positive shock in the economy – like the emergence of new technologies or financial deregulation. For instance, it is assumed that the South Sea Bubble 1720 was driven by an increase in the monetary base in the economy, the mania in real estate and asset markets in Japan from 1985 to 1989 was fuelled by huge amounts of cash floating into the markets and the strong price rallies in real estate in the US, Britain, Spain and Iceland around mid 2000 were supported by the expansion of bank credit. Schularick and Taylor (2012) take an empirical macro approach and investigate the development of

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money, credit, and macroeconomic indicators for the time span 1870–2008 for 14 developed countries. They demonstrate that lagged credit growth is a clear predictor of financial crises. They also find support for the notion that financial stability risks increase with the size of the financial sector and that boom-and-bust episodes in stock markets become more problematic in more developed economies.[1] Mian and Sufi (2014) focus on the recent financial crisis in the United States and identify the increase in the debt to GDP ratio as the major driver. Also during the period 2006–2008 the effect of the inflow of new investors has strongly contributed to the Chinese Warrants Bubble (Xiong and Yu, 2011). The most recent example of financial turmoil was the mania in Chinese stock markets in 2014 and 2015 and its subsequent crash in summer 2015. By May 2015 the Shenzhen Composite Index had nearly tripled within one year. At the same time stocks in ChiNext, composed mainly of tech-industry startups, had an average P/E-ratio of 140. Again, it is conjectured that leverage, new money and trader inflows fuelled the bubble substantially.[2]

Turning to our second treatment variable, trading horizon, the literature is much scarcer and nothing is reported on the interplay of cash inflow with trading horizon. Therefore, our study has exploratory character, as we investigate how this combination might affect price formation in asset markets. In the theoretical bubble literature one necessary requirement for ruling out bubbles is the ability and willingness to engage in backward induction (Brunnermeier, 2009; Brunnermeier and Oehmke, 2013). While in infinite horizon settings with rational investors bubbles can emerge which grow at a certain rate ad infinitum (Blanchard and Watson, 1982), in finite horizon models bubbles cannot form under the requirement that rational investors are not restricted from selling the desired number of shares (Tirole, 1982). Since a bubble cannot grow after time T, there cannot be a bubble in T-1, which rules out a bubble for any point earlier in time. However, experimental studies show that individuals in finite horizon settings have difficulties with backward induction (see, for instance, Hirota and Sunder (2007), or Burks et al. (2009) on the Hit-15 game requiring backward induction). McKelvey and Palfrey (1992) show in an experimental study on the centipede game that subjects start playing this game, violating the backward induction principle. This finding questions whether the theoretical assumption of perfect backward induction is a good proxy for human behavior in asset markets with finite horizons. As a long horizon provides scope for speculation and makes the final buyback price (i.e., redemption value) of the asset less salient, we deem the trading horizon a potential driver of bubbles. Therefore, we investigate whether total time until maturity of the asset (defined here as “trading horizon”) has an impact on traders’ ability to backward induct and thus influences markets’ proneness to bubbles. By keeping the cash inflow constant across markets, we expect that longer trading horizons after the final cash inflow might provide traders with more time to engage in speculative activities, rendering backward induction less important and less salient in the beginning of the market. Conversely, shorter trading horizons in combination with the same cash inflows let traders focus more on the end of the market rendering backward induction more salient and letting subjects refrain from engaging in speculative activities. As outlined above, this treatment variation has an exploratory character. In our previous study (Kirchler et al., 2015), we find that steady cash inflows do not trigger bubbles in markets with medium trading horizons of eight periods. Since liquidity was injected gradually, the remaining trading time, once cash inflow has reached a substantial level, might have been too short and thus prevented bubble formation for the aforementioned reasons.

The challenges with identifying the origins of historic bubbles are that i) bubbles can hardly be measured empirically because of the indeterminacy of fundamental values and that ii) different bubble drivers might have contributed simultaneously blurring the exact role of cash inflow and failure of backward induction. In this paper we tackle these problems and investigate the impact of cash inflow and trading horizon on price efficiency. We run a laboratory experiment as it offers the advantages of controlling and isolating the effects of cash inflow and trading horizon and allowing us to investigate speculative behavior in markets. In particular, we formulate the following research questions:

- RQ1: Does the inflow of cash trigger price inefficiencies?
- RQ2: Does the extension of trading horizon increase markets' proneness to price inefficiencies?
- RQ3: Does the joint effect of cash inflow and extended trading horizon trigger price inefficiencies?

To answer these research questions we set up a 2×2 treatment design with the variables “Cash Inflow” (either YES or NO) and “Trading Horizon” (either MEDIUM with 8 periods or LONG with 14 periods). We refrain from running markets with short horizons of one or two periods because, for instance, Plott and SunderSunder, (1982, 1988) and Stöckl (2014) have shown that such markets do not exhibit bubble and crash patterns. The reason for selecting 8 and 14 periods is that we allow for cash inflow at the beginning of periods 3, 5, and 7. Therefore, in markets with 14 periods subjects know that another eight periods follow after the last cash injection into the market, providing more time for engaging in speculative activities compared to markets with 8 periods. In the latter markets substantial cash inflows that could potentially facilitate speculation emerge towards the end of maturity (in periods 5 and 7) and might therefore be too late to affect bubble formation. We use the market design of Kirchler et al. (2015) with a constant fundamental value of the asset and heterogeneous information of traders.

We find a strong interaction between cash inflow and trading horizon. First, markets with medium trading horizon do not show substantial overpricing and price rallies no matter whether there is cash inflow or not. Second, markets with long trading horizon but

[1] In macroeconomics literature it is also conjectured that expansive central bank policy fuels overpricing in asset markets. Because returns on alternative investments such as fixed income decrease, additional inflow of cash and investors into more risky asset classes such as stocks is expected. For instance, Buch et al. (2014) investigate the risk-taking of banks following monetary policy changes. They show that banks increase their exposure to risk following expansive monetary policy shocks.

[2] According to Credit Suisse 6–9% of China's market capitalization was based on leverage, nearly five times the average in the industrialized world. Furthermore, more than 12 million new trading accounts had been opened in April 2015 alone, putting additional money into the market. See http://www.economist.com/news/finance-and-economics/21652337-economic-dangers-chinas-manic-bull-market-goring-concern for further information.