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Interactions between stock, bond and housing markets

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ABSTRACT

We develop a model in which investors can participate in stock, bond and housing markets. Investors' market entry decisions are subject to herding effects and depend on the markets' price trends and on their mispricings. The dynamics of our model is governed by a four-dimensional nonlinear map and its unique inner steady state is characterized by standard present-value relations between dividends, rents and the bond rate. Amongst other things, we show that endogenous stock and housing market dynamics emerge, countercyclical to each other, if investors react strongly to the markets' price trends. Such a cross feedback reflects investors' tendency to transfer their enthusiasm from one speculative market to another.

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1. Introduction

Stock and housing markets have produced significant boom-and-bust dynamics in the past. Since these turbulences have had dramatic effects on the real economy, it is crucial to improve our understanding of what may cause them. In this respect, it appears worrying to us that the intricate interplay between stock and housing markets is still not well understood. Notably, [Shiller \(2015\)](#) stresses that stock market booms display an increasing tendency to alternate with housing market booms and fears that a growing negative cross feedback between stock and housing markets may amplify their boom-and-bust nature. While it may not be very surprising that a home price boom may begin a few years after a stock market boom – people may feel wealthier and spend more on their homes, thus driving up home prices – [Shiller \(2015, p. 95\)](#) writes that “*But it is challenging to envision a feedback model that has home prices rising rapidly even after stock prices are sharply falling. It may seem unlikely that we will ever understand such a phenomenon.*” For this reason, the goal of our paper is to develop a simple behavioral feedback model that takes the countercyclical boom-and-bust nature of stock and housing markets into account. In doing so, we hope to offer new insights into how these markets function, how they interact and how they may be better regulated in the future.

[Shiller \(2015\)](#) provides useful information on how to develop such a feedback model. Most importantly, he discusses questionnaire evidence according to which investor enthusiasm may be transferred from a decreasing stock market to an

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increasing housing market or from a decreasing housing market to an increasing stock market, thereby intensifying the bust in the decreasing market and amplifying the boom in the increasing market. In Shiller's (2015, p.96) words: "*The drops in the stock market in 2000–2003 had just gotten people increasingly fed up with the stock market and ready to transfer their affections to another market, one that they increasingly believed was the best investment for them*", making clear that "*There was a sort of cross feedback from the stock market to the housing market, and that must account for a good part of the housing boom that we saw*". This raises two closely related questions. How do investors select markets and how do they make their investment decisions?

Research in behavioral finance indicates that the typical investor's decision about how much to allocate to stock, bond and housing markets tends not to be based on careful calculations. Instead of holding a well-balanced portfolio, investors seem to concentrate on a rather limited number of assets. Shiller (2015) even argues that investors tend to think in terms of what the 'best investment' opportunity may be for them, and, equally relevant, that they act accordingly. Moreover, the confidence an investor experiences with respect to an investment opportunity depends strongly on her past experience. In particular, Shiller (2015) reports that investors regard stock markets as the 'best investment' opportunity if stock markets boom while they lose confidence in stock markets if stock prices decline. Note that this relation establishes a positive feedback process. Shiller's (2015) view on this issue is shared, amongst others, by Kindleberger and Aliber (2005), who also conclude that more and more investors enter stock markets during stock market booms because they are afraid of missing exceptional profit opportunities. For instance, Kindleberger and Aliber (2005, p. 12) emphasize that there is a pervasive sense among investors during a stock market hike that "*it is time to get on the train before it leaves the station*". In fact, feelings of regret are a decisive factor in investor behavior. As pointedly expressed by Kindleberger and Aliber (2005, p. 29): "*There is nothing as disturbing to one's well-being and judgement as to see a friend get rich. Unless it is to see a nonfriend get rich.*" Taleb (2004) reports similar evidence.

Of course, investors are not irrational. Given their limited cognitive abilities, however, they tend to follow certain modes of behavior. Shiller (2015) points out that investors rely on quantitative anchors to determine whether a market is overvalued or undervalued and whether it is time to enter or exit a market. Clearly, Shiller (2015, p. 166) states that: "*With quantitative anchors, people are weighting numbers against prices when they decide whether stocks (or other assets) are priced right.*" Dividend-price ratios are a typical quantitative anchor for stock markets. Since quantitative anchors eventually reverse booms and busts, they add a negative feedback to the dynamics. According to Shiller (2015), the same forces are at work in housing markets. He reports a striking correlation between housing prices and investors' opinions about what is the 'best investment' opportunity. When housing prices increase (decrease), the fraction of investors who think that the housing market is the 'best investment' opportunity also goes up (down).¹ This once again establishes a feedback process, where the housing market's price-rent ratio serves as a quantitative anchor. A crucial thing to note in this respect is that if investors start to switch between stock and housing markets because one market goes up while the other goes down or because one market is overvalued while the other is undervalued, both feedback loops become intertwined. Indeed, we may then observe investors shifting their enthusiasm from one market to another, thereby establishing a negative cross feedback between stock and housing markets. This cross feedback may have two effects. First, investors' switching behavior may trigger and/or amplify endogenous boom-and-bust dynamics in stock and housing markets. Second, investors' switching behavior may engender fluctuations in these markets that are countercyclical to each other. These phenomena form the core of our model.

To be more precise, let us summarize the setup of our model. Investors can participate in stock, housing and bond markets. Stock and housing markets are risky markets, allowing investors to profit from price increases and to earn dividends and rents. Bond markets are risk-free and offer investors a constant rate of return. To cope with the complexity of their investment tasks, investors try to find out which of the three markets is the 'best investment' opportunity for them. Following Shiller (2015), we assume that investors are excited about markets that exhibit positive price trends, although they are also aware that fundamental anchors may eventually become relevant and dampen or reverse market trends. Clearly, investors face a discrete choice problem in which they have to decide whether to enter the stock, housing or bond market. Within our model, the attractiveness of the stock and housing market depends on price movements and on their fundamental economic condition, while the attractiveness of the bond market is given by the risk-free interest rate. Investors' market entry decisions are based on the markets' relative attractiveness. The higher the relative attractiveness of a market, the more likely is that investors will enter it. In line with empirical evidence (Hong et al., 2004), investors' market entry decisions are furthermore subject to herding effects. Finally, stock prices are positively related to stock demand and, ultimately, to stock market participation. The same is true for housing markets, while bond prices remain constant.

The dynamics of our model is driven by a four-dimensional nonlinear dynamical system, having a unique inner steady state characterized by standard present-value relations between dividends, rents and the bond rate. Amongst other things, we establish the subsequent results. If investors react strongly to the markets' price trends, the inner steady state becomes unstable via a Neimark–Sacker bifurcation, resulting in oscillatory dynamics. This bifurcation may also emerge if investors react more sensitively to the markets' relative attractiveness. A Flip bifurcation is also possible, triggering a period-two cycle, if investors' reaction to the markets' fundamental conditions is very strong. Investigations based on our deterministic model

¹ We recommend the interested reader to check Figs. 5.1 and 5.2 in Shiller (2015), which depict a truly striking relation between stock and housing prices and what investors regard as 'best investment' opportunity.

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