

## Aging and Housing Prices

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The world economy is facing the unprecedented challenge of changing population dynamics, with some countries experiencing a rapid rise of the young population while others are facing rapid aging. In such uncharted territory, it is crucial to ask: Is the effect of the change in nominal interest rates (determined by monetary policy) similar across countries or vastly different? Why is the recovery from collapse of the so-called property bubbles inconsistent across countries? Casual observation shows that property prices are not recovering to the pre-bubble era in rapidly aging economies as fast as in other economies, and their adjustment has taken very long (Crowe et al., 2013). However, existing research has not provided sufficient answers to such questions. We attempt to answer these questions from an econometric approach through the experience of 17 divergent economies over 46 years, focusing on population dynamics statistics. There are several theoretical frameworks to explain Reinhart and Rogoff's (2009) findings. For example, Kiyotaki and Moore (1997) provide a micro foundation theory of leveraging and de-leveraging during credit cycles. When leverage is high for the economy, even a small adverse shock makes economic conditions deteriorate sharply to induce accelerated de-leveraging. During the de-leveraging process, many assets, including property, are sometimes on fire-sale, causing lasting damage to property markets.

Nishimura (2016)[ref20], drawing on the author's experience managing monetary policy, analyzes the systems, policies, and histories of the United States, various European countries, and Japan, noting the presence of two common factors in countries facing economic crises: (1) excessive optimism caused by favorable changes in population composition (rapid increase in young population) and (2) rapid expansion of credit due to the spread of so-called new finance technologies and vehicles introduced during the excessively optimistic time. The author also alludes to the relationship between these factors and rapid increases in property prices.

Particularly, the rapid expansion of credit corresponds to the financial instability theory of Minsky (1992). The author then indicates that the financial crises from the late 20th century through the early 21st century were likely to happen given the presence of the strong cumulative interaction of factors such as dramatic shifts in population composition, property bubbles, and credit cycles.

The literature review suggests that demographics and the property market have a strong underlying influence on macroeconomic fluctuations such as economic growth and length of recessions. We attempt to decipher this mechanism by focusing on the relationship between the residential property market and demographics. We investigate the following two hypotheses, using panel data from 17 countries spread over 46 years.

- 1) Did changes in population composition influence the dynamics of residential property prices?
- 2) Did changes in population composition amplify/dampen nominal interest rates' effects on residential property prices?

This study's key contributions are highlighted below. First, there is no consensus among theories that simultaneously explain demographic changes, property price dynamics, and credit cycles; and this theoretical strand is still being developed and is not ready for testing using data. Therefore, we base our study on the most basic theoretical relationships involved in the present value relationship (PVR) model (Walras, 1954; Campbell and Shiller, 1988). Using international panel data from 17 countries with diverse population compositions, population trends, economic growth rates, and housing market environments, over almost half a century, this study empirically examines the relationship between demographics, property price dynamics, and credit cycles. In the previous research, only limited residential property price data are obtained for a limited period. It is therefore only possible to analyze at most one property boom and bust cycle. However, this study's dataset includes various cases, including countries with an increasing young population, countries that have already reached a high aging rate, and countries that have experienced two or more property boom and bust cycles in the period under study. Thus, it enables us to consider various cases necessary for this kind of analysis of slow-moving long-term factors. Second, to the best of our knowledge, this study is the first to analyze the effects of expectation errors in demographics. Mankiw and Weil's (1989) central criticism of demographics and housing market-related analysis focuses on the fact that if economic agents' expectations are rational (that is, with no persistent expectation errors) with respect to demographic projections, there should be little impact of demographic changes on residential property prices, since the supply will be adjusted accordingly when supply is sufficiently elastic. However, we find some evidence that demographic expectations are not rational and, for example, expectation errors about populations persist. (See Figure fig01) Thus, when young populations are growing and underestimation of demand persists, housing supply shortage accumulates over time to cause an increase in residential property prices. In contrast, when population is aging rapidly and overestimation of demand persists, housing supply surplus becomes persistent to depress residential property prices. Therefore, to assess the effects of possible persistent demographic expectation errors, we collect data by tracing population projection data published by each country throughout the analysis period, as far back as possible, and estimate the difference between the actual figure and the ones projected before.

Third, after assessing the long-term relationship between residential property prices and demographic factors, this study examines the interactive effect of demographic factors and nominal interest rates. Particularly, we examine whether the impact of declining nominal interest rates on residential prices are substantially smaller in an aged economy, like present-day Japan, than in an economy with a growing young population, like Japan thirty years ago.