



# Income risk, macroeconomic and demographic change, and economic inequality in Japan

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## ABSTRACT

Using an OLG model with heterogeneous households, we investigate the relationship among income risk, macroeconomic and demographic changes, and economic inequality between 1980 and 2000 in Japan. By decomposing the primary factors in earnings and consumption inequality into macroeconomic variables and the demographic variable, we find that our model replicates the evolution of economic inequality in Japan. By performing counterfactual simulations, we demonstrate that two factors—changes in time-varying macroeconomic factors and the unexpected decline in the total factor productivity growth rate—played important roles in the increase in earnings and consumption inequality in the 1990s.

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## 1. Introduction

According to the life cycle permanent income hypothesis (LC-PIH), households base their consumption levels, savings rates, and labor supply on their expectation of future shocks, such as idiosyncratic labor productivity risks, as well as their anticipation of aggregate economic conditions that may affect their lifetime income. LC-PIH has been the focus of much research into the relationship between income risks and consumption inequality. It is, likewise, a focus of this study, which aim to explain two empirical findings regarding wage risk, income inequality, and consumption inequality in Japan between 1980 and 2000. First, income and consumption inequality, as measured by the variance of logarithms, increased between 1980 and 2000 (Kohara and Ohtake, 2006). Second, contrary to this upward trend in income and consumption inequality, the level of cross-sectional inequality over the life cycle remained relatively stable over this period (Abe and Yamada, 2009).

Between 1980 and 2000, the Japanese economy experienced a series of the so-called “economic bubbles”—economic booms—followed by their inevitable bursting, and subsequently, economic recessions. At the same time, the Japanese population was rapidly aging, leading to significant demographic changes. As would be expected with a changing economy, time-varying macroeconomic variables such as total factor productivity (TFP) growth rates, capital share, and government expenditures, changed significantly between 1980 and 2000.<sup>1</sup> As shown in Table 1, TFP growth rate, for

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<sup>1</sup> Finding that the bivariate specification of productivity shock, as reflected in the TFP growth rate, and the redistributive shock, as reflected in the labor share, generate the observed dynamics of the business cycle in the US, Ríos-Rull and Santauelàlia-Llopic (2010) demonstrate that the labor share is volatile and countercyclical to the TFP growth rate. We include the time-varying capital share as a macroeconomic factor to consider whether the reallocation of labor earners and capital earners affects economic inequality.

**Table 1**  
Macroeconomic variables in Japan.

	70s	80s	90s
TFP factor growth rate (%)	1.40	2.68	0.57
$G/Y$ (%)	14.04	14.35	14.82
Depreciation rate (%)	10.19	8.97	8.40
Capital share	0.3512	0.3536	0.3627
Capital income tax rate (%)	41.55	47.68	44.92

example, was extremely low in 1990s. Facing various idiosyncratic risks regarding household income, such as promotions, bonuses, and unemployment, as well as changes in macroeconomic factors such as changes in technology and factor prices, households likely adjusted their decision-making in accordance with the new reality. By doing so, they likely impacted the income and consumption inequality.

The Japanese economy between 1980 and 2000, thus, provides a good case study with which to consider the relationship between macroeconomic and demographic changes and economic inequality. Among the researchers who have done so, Hayashi and Prescott (2002) demonstrated that a standard neoclassical growth model with calibrated parameters could be used to identify the factors in major recessions in Japan, including those that occurred during the so-called “Lost Decade” of the 1990s.<sup>2</sup> Many subsequent researchers have investigated Japanese economy using a dynamic general equilibrium framework, including Chen et al. (2006, 2007) and Braun et al. (2007), who constructed a general equilibrium model for identifying the macroeconomic and demographic changes that contributed to the fluctuations in the Japanese savings rates. If macroeconomic factors do indeed explain changes in the savings rate, they may also explain changes in earnings and consumption inequality, as changes in the savings rate affect households’ capacity to share risks, as well as their labor supply decisions through wealth and substitution effects. Other empirical researchers including Ohtake and Saito (1998), largely attributed the economic inequality of the Japanese economy in the 1980s to the aging of the population. As shown in Section 2, earnings and consumption inequality, as measured by the variance of logarithms, do indeed sharply increase with age. Therefore, if the proportion of middle-aged and older households increased because of aging, then economy-wide inequality would be expected to increase.

Even when considering earnings and consumption inequality within a dynamic general equilibrium model, the impact of population aging cannot be ignored. Recognizing this fact, we construct an incomplete market overlapping generations (OLG) model calibrated to the Japanese economy focusing on the transition path between 1980 and 2000. Similar models have been extensively used for research into social security and public finance, including models developed by Conesa and Krueger (1999) and Nishiyama and Smetters (2005). Using these models, we decompose the primary factors in economic inequality into macroeconomic factors and the demographic factor of an aging population, and examine the extent of their impact on earnings and consumption inequality. To account for market incompleteness, our model assumes that households face idiosyncratic labor productivity risks that are ex post heterogeneous within cohorts and the existence of earnings and consumption inequality.

Our primary consideration is determining whether changes in time-varying macroeconomic variables, such as TFP growth, and the demographic changes resulting from an aging population lead to the upward trend in earnings and consumption inequality and the increase in cross-sectional inequality with age observed in Japan between 1980 and 2000. According to the LC-PIH, perfectly foreseeable changes in macroeconomic factors should not affect decision making regarding consumption, savings, and labor supply. However, as households are heterogeneous in not only their idiosyncratic labor productivity but also their experienced history of macroeconomic variables, foreseeable changes do indeed affect decision-making. As our model quantitatively demonstrates, different cohorts with different histories experience fluctuations in their earnings and consumption paths that increase inequality, generating an upward trend in inequality paths.

Our analysis is at the cross roads of two streams of economic literature. The first is quantitative macroeconomics research into the Japanese economy in accordance with that of Hayashi and Prescott (2002), who used a standard neoclassical growth model to demonstrate that time variations in TFP growth and decreases in workweek length greatly contributed to the sustained recession experienced during the Lost Decade. Our research also draws on Chen et al.’s (2006, 2007) and Braun et al.’s (2007) extension of Hayashi and Prescott’s (2002) results to explain fluctuations in Japanese saving rates over time. We, therefore, consider our research to be an extension of this stream of literature because it applies a model similar to those used in previous studies. However, unlike previous studies, which generally used a general equilibrium model to investigate the so-called *first moments* of the Japanese economy—macroeconomic variables such as GDP and savings rate—we use our model to examine the so-called *second moments*—earnings and consumption inequality as measured in variances of logarithm.

<sup>2</sup> Kehoe and Prescott (2007) have reported the findings of many researchers who used the dynamic general equilibrium framework to investigate deep recessions experienced by several countries. Also see Cole and Ohanian (1999).

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