

Linkage between macroeconomic conditions and inequality in Japan (Preliminary) *

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Abstract

A growing attention has been paid to the linkage between financial crisis and inequality after the Great Recession. In the current paper, we ask if financial crisis causes inequality or alternatively if change in inequality causes financial crisis based on time-series analysis. We construct monthly series of income and consumption inequality in Japan using micro data set on Japanese households from the Family Income and Expenditure Survey (FIES). We then formulate time series analysis on the interaction between macroeconomic variables and inequality during the 1980s to 2010s, a period that covers asset price boom, bubble burst, and following lost decades. We find that changes in macroeconomic variables are transmitted to changes in inequality. For instance, a rise in stock price leads to an increase in inequality. By contrast, we find no clear evidence that changes in inequality lead to changes in macroeconomic variables.

Keywords: Income Inequality, Consumption Inequality

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Keywords: Income and Consumption Inequality; Time-series Analysis

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1 Introduction

A growing attention has been paid to the linkage between financial crisis and inequality after the credit boom followed by Great Recession during the 2000s. Ostry et al. (2014) based on a cross-country analysis argue that lower net inequality is robustly correlated with faster and more durable growth, for a given level of redistribution. By contrast, Bordo and Meissner (2012) based on cross-country analysis argue that inequalities are not the determinants of credit boom and financial crisis.

In this paper, we explore if increase in inequality causes financial crisis, or alternatively if bubble economy increases inequality with reference to Japan's episodes. That is, Japan's economy witnesses a large and rapid asset price rise since the late 1980s, asset price plummet during the early 1990s, and following long-lasting recession. Figure 1 displays key macroeconomic variables and inequality series. To see the linkage between macroeconomic variables and inequality series, we first construct a set of monthly series of income and consumption inequality using the micro data survey on Japanese households, *the Family Income and Expenditure Survey*. We then formulate Vector Autoregression model that consists of the inequality series as well as key macroeconomic variables.

From the time-series analysis, we find three classes of notable observations: (i) there is statistically significant transmission channel from aggregate macroeconomic variables to inequality variables. In particular, asset price movements are important driver of variations in both income and consumption inequality, (ii) there is almost no feedback mechanism from inequality variables to macroeconomic variables. That is, shocks to inequality variables do not affect dynamics of aggregate macroeconomic variables, and (iii) transmission from shocks to income inequality to consumption inequality is limited.

In order to see how aggregate macroeconomic variables affect inequality variables in details, we divide sampled households into subgroups according to their income level and formulate a VAR that consists of mean income and mean consumption of each subgroup household as well as aggregate macroeconomic variables. We find that shocks to aggregate macroeconomic variables bring about heterogenous impacts on households with different income groups. For instance, shock to stock price has a disproportionately positive impact on income of high-income households compared with income of low-income households.

It is also important to note that our study only focuses on the short-run relationship between macroeconomic activities and inequality. Our data sample covers about thirty years. By contrast, studies that concentrate on the causality from the inequality to the macroeconomic dynamics such as growth rate, including Bordo and Meissner (2012) and Ostry et al. (2014), make use of longer annual time series over more than forty years.

This paper is related to three strands of literature. The first strand of literature examines the linkage between macroeconomic environment, in particular, business cycles and developments in inequality. For instance, Krueger et al. (2011) summarize com-

mon features of developments in inequality in nine large countries and document that earnings inequality appears to be strongly counter-cyclical. Storesletten et al. (2004) conduct GMM using annual panel data of Panel Study on Income Dynamics (PSID) to extract cyclicity of idiosyncratic labor market risk. They document that the risk is strongly countercyclical. Related to the first strand of literature, the second strand of literature studies the linkage between financial crisis and inequality. Meyer and Sullivan (2013) focus on the impact of the current Great Recession on income and consumption inequality in the U.S. Meyer and Sullivan (2013) find very distinct patterns on income and consumption inequality during the Great Recession (after the Lehman shock): consumption inequality during the Great Recession rather falls, although the income inequality and unemployment rate rises during the same period. Iacoviello (2008) and Coibon et al. (2014) discuss the linkage between households debt accumulation and increase in income inequality. The third strand of literature examines differences across households in terms of households' responses to changes in aggregate macroeconomic variables. Parker and Vissing-Jogensen (2009) based on the Consumer Expenditure Survey document that the consumption growth of high-consumption households is significantly more exposed to aggregate fluctuations than that of the typical household.

The structure of this paper is as follows. Section 2 explains our micro data set and construction methodology of time series used in our analysis. Section 3 empirically investigates how macroeconomic variables, including asset price, and inequality variables are interrelated from each other. Section 4 discusses the reason behind our empirical observations. Section 5 concludes.

2 Inequalities and Macroeconomy

In this section, we empirically explore how macroeconomic variables affect inequality variables by employing time series analysis, such as Vector Autoregression (VAR) and historical decomposition, that is commonly used in macroeconomics. In particular, we are interested in analyzing how asset price rises in the late 1990s and asset price falls during the early 1990s have affected the developments of inequality variables. In addition, we explore how income and consumption inequality interrelated from each other.

2.1 Data

To conduct the time-series analysis on economic inequalities, we construct a monthly time series of variance of logarithm of earnings and consumption as well as mean of income and consumption of households that are categorized by their characteristics. The time series is constructed from the micro data survey, *the Family Income and Expenditures Survey* (hereafter FIES), that is compiled and released by the Statistics Bureau, Ministry

of Internal Affairs and Communications in Japan.¹

The FIES is a monthly diary survey that collects earnings, income and expenditures of Japanese households and reports characteristics of sampled households including household members' ages, gender, occupation, industry of employment, marital status, and region of residence. The survey reports monthly labor income of household head, spouse and the sum of other household members. Unfortunately, the FIES does not collect information about education, which prohibits us to estimate college premium directly from the FIES. The consumption expenditures include food, services, nondurable, semidurable and durable expenditures. The survey was first conducted in 1953. However, we have access only to data for the period from January 1981 to December 2008 for the purpose of the current research. We use data of multi-person households only because the data of single-person households is available only after 2002. The survey contains approximately 8,000 households per month. Surveyed households reports monthly earnings and expenditures for a maximum of six consecutive months. The sampled households overlap, and one-sixth of the total sample is generally replaced by new households each month.

We closely follow Lise, et al. (2014), in which they study the evolution of economic inequality of Japanese economy from the boom time including the bubble period of late 1980s to the lost decades, in constructing the time series of inequality measures and means. The key difference between Lise, et al. (2014) and our study is that we employ the monthly series instead of annual series. The monthly inequality series exhibit seasonality reflecting seasonal variations in households' income and consumption at the micro level. In particular, the bonus payment, which is typically paid twice in a year, in June (or July) and December, makes strong seasonality for labor income. To obtain the seasonally adjusted series, we first construct the seasonally unadjusted monthly series and apply X12 ARIMA to these series.

We focus on the monthly series of before-tax equivalized household labor income y_L and nondurable expenditure c_{ND} .² The household labor income is calculated as the sum of labor earnings of household head, spouse and other household members, and it is equivalized using the OECD equivalent scale. We restrict the usage of data set to households with *employed* household head aged 25–59, because it is difficult to measure monthly income of self-employed workers. Both rising unemployment rates and increasing number of non-standard workers such as contingent workers and part-time workers undoubtedly contribute recent trend of rising inequality of Japanese economy. In regard to this point, our estimates may underestimate the true whole inequality. However, even if we focus on the employed household, the trend in economic inequality appears positive. We use nondurable expenditures as consumption to be consistent with

¹FIES is a source data of the households' expenditures weighting used to construct Consumption Price Index. FIES is also a primary source data of Private Consumption series in GDP that is compiled and published from the Cabinet Office.

²We have also conducted the time series analysis on disposable income, and we confirmed that our main results do not change even if we use disposable income.

consumption smoothing.³ That is, housing, purchasing cars and durable expenses such as furniture are excluded. Every variables are deflated to the 2005 price using the CPI.

2.2 Inequality and Macroeconomic Variables

2.2.1 VAR

Since the pioneering work by Sims (1980) and Christiano et al. (1999), a good number of works in macroeconomic make use of identified vector autoregression (hereafter VAR) to measure the response of aggregate macroeconomic variables to an interested structural shock, such as monetary policy shock. In this section, we make use of VARs so as to estimate how aggregate macroeconomic variables and income and consumption inequality are interrelated. We formulate a VARs using five variables. The variables include stock price (Nikkei 225), unemployment rate, index of industrial production (hereafter IIP), variance of log income, and variance of log consumption. The data covers from January 1981 to December 2008. All series are seasonally adjusted and first differenced. The number of lag is chosen according to AIC criteria. Using a Cholesky decomposition with ordering of variables as listed above, we compute response of macroeconomic variables and inequality variables to an two-standard deviation innovation to each of the variable.

Figure 2 displays cumulative impulse response function of inequality variables to five identified shocks. Shock to stock price increases inequality of both income and consumption in a statistically significant manner. Shock to IIP and to unemployment rate only increases consumption inequality and they do not have a statistically significant impact on income inequality. In other word, consumption inequality is more reactive to shocks to macroeconomic variables than income inequality. It is also important to note that inequality increases in response to both adverse and favorable aggregate macroeconomic shocks. While positive shock to IIP and stock price increase industrial production and consumption inequality, a positive shock to unemployment rate decreases industrial production and increases consumption inequality. Regarding the linkage between income and consumption inequity, it is noted that while shocks to income inequality are translated to consumption inequality in a statistically significant manner, shocks to consumption inequality are barely translated to income inequality.

Figure 3 displays cumulative impulse response function of macroeconomic variables to five identified shocks. It shows that feedback from shocks to inequality variables to macroeconomic variables is small. In response to shocks to both inequality variables, the macroeconomic variables barely change in the wake of shocks to inequality variables.

2.2.2 Historical Decomposition

Using the estimated results of the VARs, we decompose time-series variations in income and consumption inequality into shocks to stock price, IIP, unemployment rate, income

³For the detailed definition on nondurable expenditure, see Lise, et al. (2014).

inequality, and consumption inequality. By doing this, we intend to capture the role of each shock in accounting for variations in equality variables over the sample period, in particular, during the boom and during the bubble burst. Figure 4 displays the historical decomposition of income inequality variations and Figure 5 displays the historical decomposition of consumption inequality variations. For both inequality variables, the bulk of variations are accounted for by own shocks. For both variables, what comes to the second largest shock is shocks to stock price. Shocks to stock price has played an important role in driving income and consumption inequality in particular from the late 1980s to the early 1990s. Their influence have gradually faded away in the subsequent periods. In recent years prior to the Lehman crisis, shocks to stock price has started to contribute to driving up inequality.

2.3 Source of Inequality

To see how aggregate macroeconomic variables affect inequality, we formulate two VAR each using eight variables. The first VAR includes the same three macroeconomic variables used above, stock price (Nikkei 225), unemployment rate, IIP, and mean of households's income with five different income quantiles: from 0th to 20th quantile, 20th to 40th quantile, 40th to 60th quantile, 60th to 80th quantile, and 80th to 100th quantile. The data covers from January 1981 to December 2008.

Figure 6 displays cumulative impulse response of mean income of each subgroups to shocks to macroeconomic variables. Stock price shock results in the largest and significant increase in the mean income of the highest-income subgroup. Though it results in increase in the mean income of other subgroups, the impacts are minor compared with that on the highest-income subgroup. The similar patten is observed regarding the impact of shock to IIP. Shocks to unemployment bring about only minor impacts on all of the subgroups.

Figure 6 displays cumulative impulse response of mean consumption of each subgroups to shocks to macroeconomic variables. Stock price shock results in the largest and significant increase in the mean income of the highest-income subgroup. Though it results in increase in the mean income of other subgroups, the impacts are minor compared with that on the highest-income subgroup. The similar patten is observed regarding the impact of shock to IIP. A positive shock to unemployment bring about a asymmetric impacts on households.

3 Conclusion

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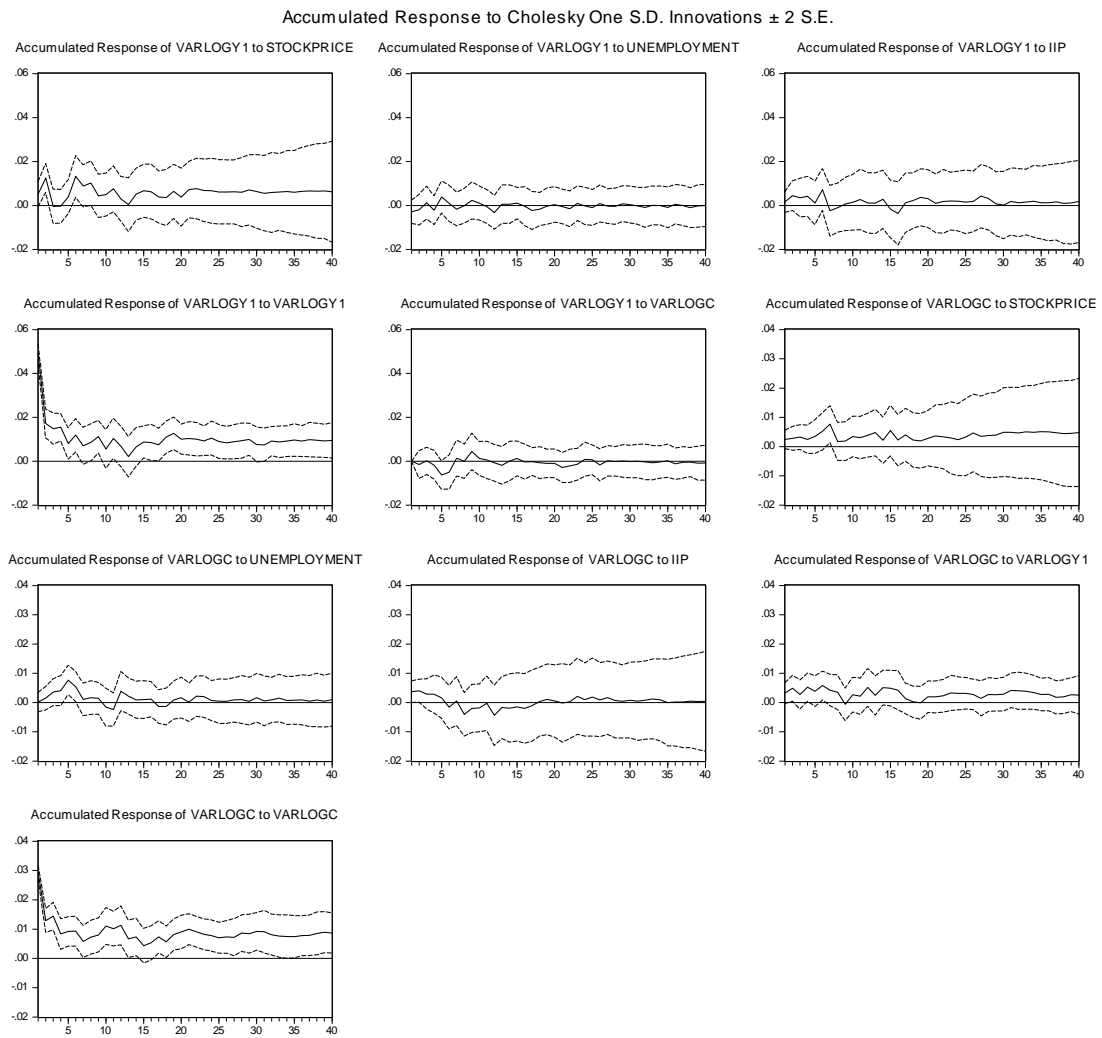


Figure 2: Cumulative impulse response functions of income and consumption inequality to shock to stock price, IIP, unemployment rate, and themselves.

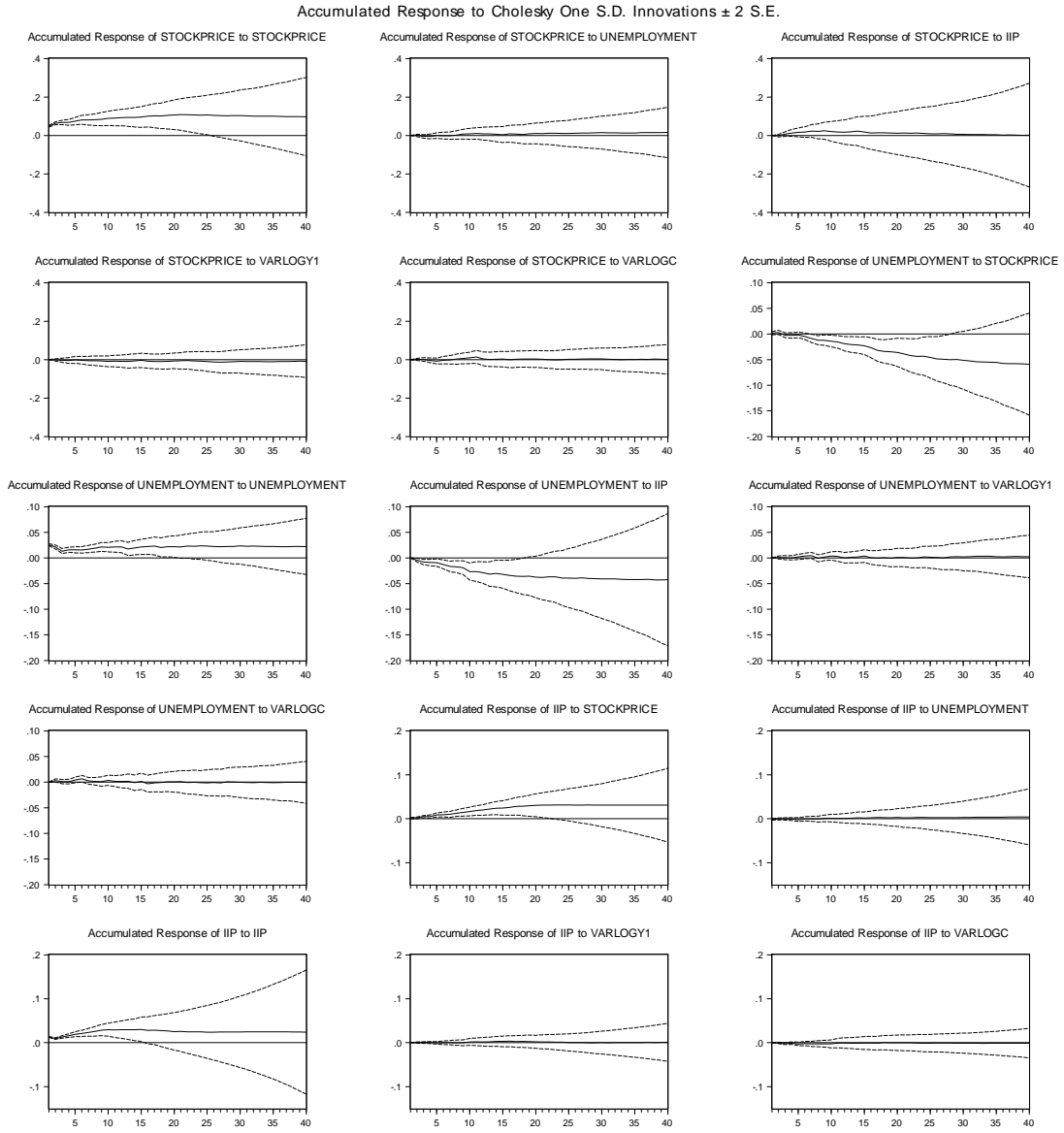


Figure 3: Cumulative impulse response functions of stock price, IIP, unemployment rate to shock to themselves, income inequality, and consumption inequality.

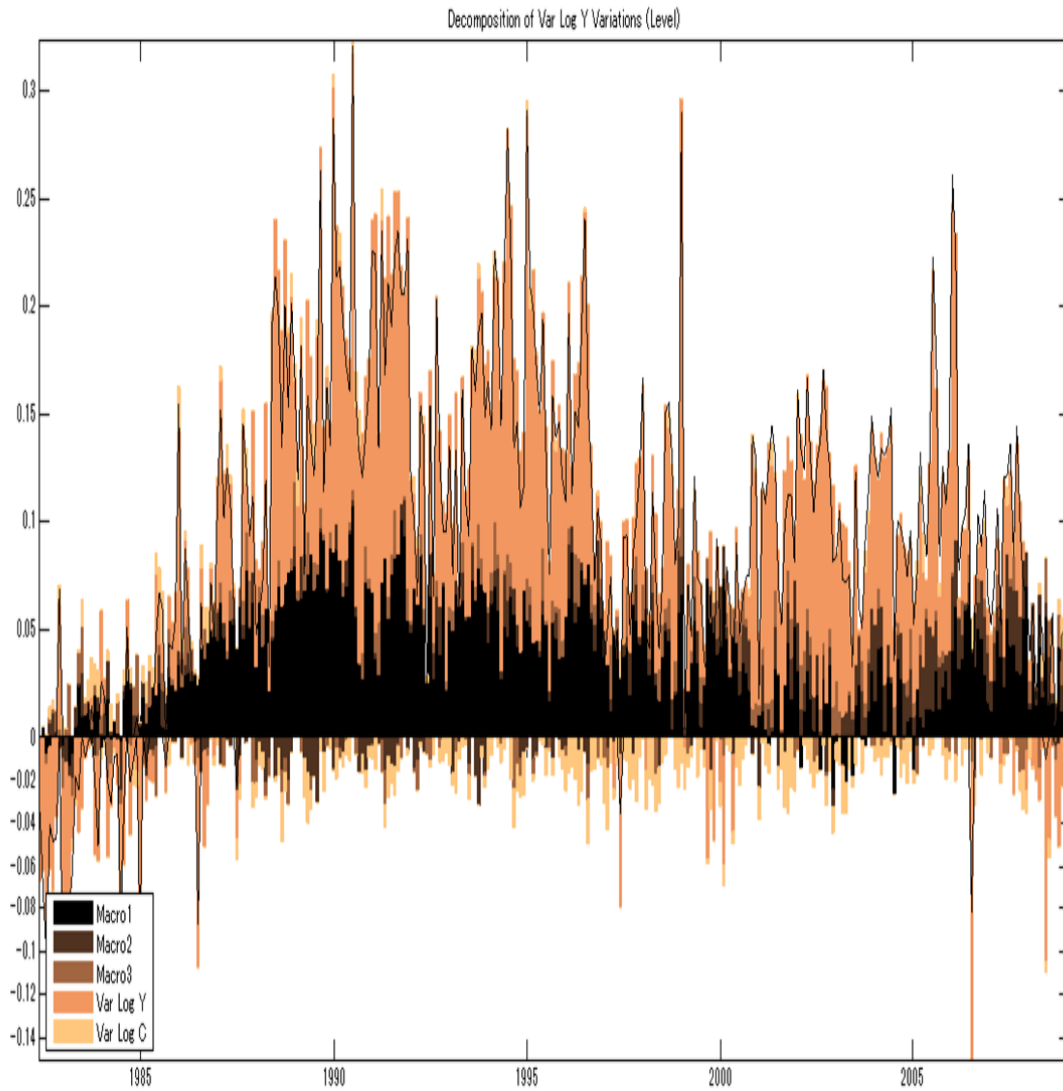


Figure 4: Historical decomposition of income inequality into shock to stock price, IIP, unemployment rate, income inequality, and consumption inequality.

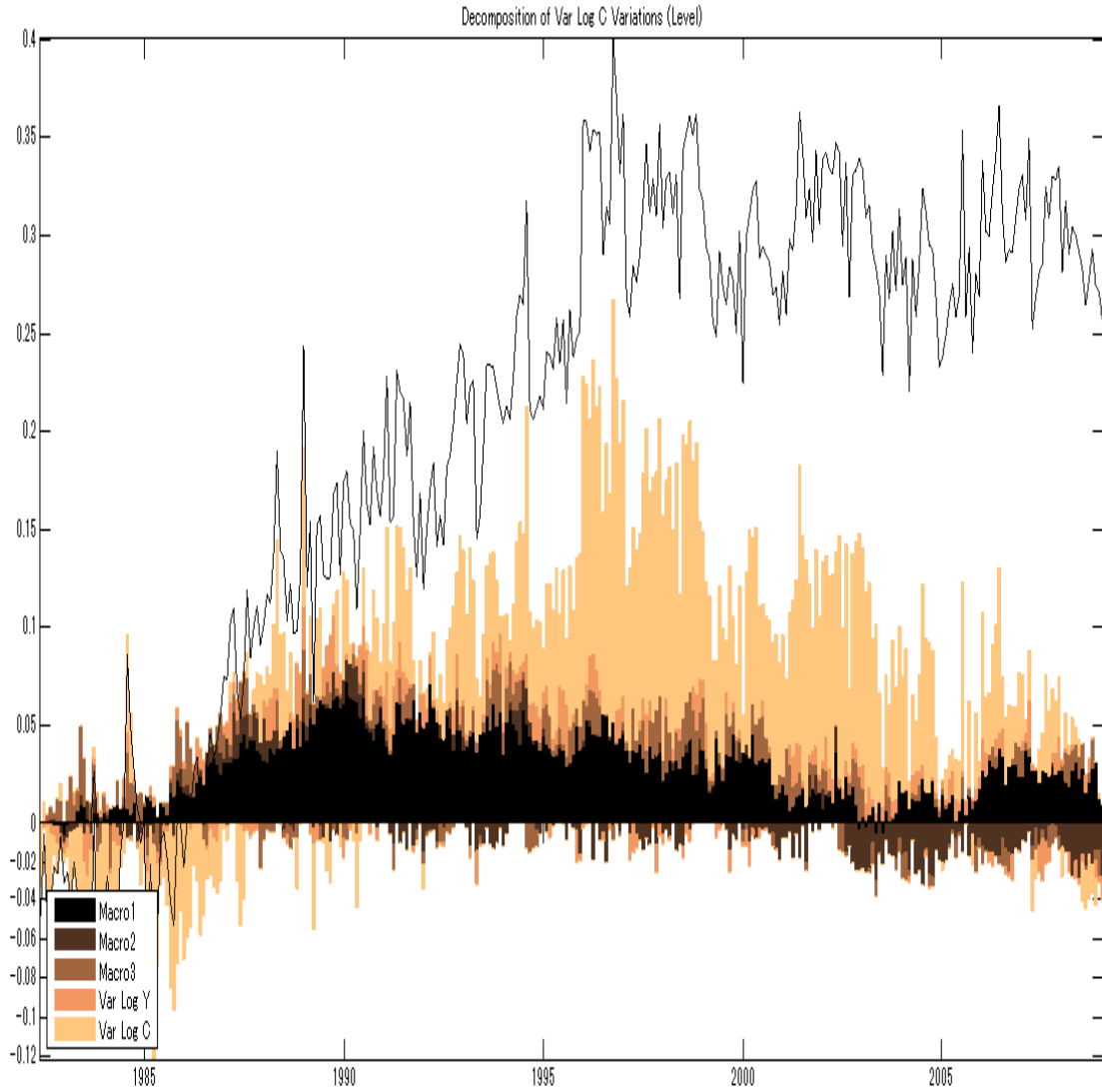


Figure 5: Historical decomposition of consumption inequality into shock to stock price, IIP, unemployment rate, income inequality, and consumption inequality.

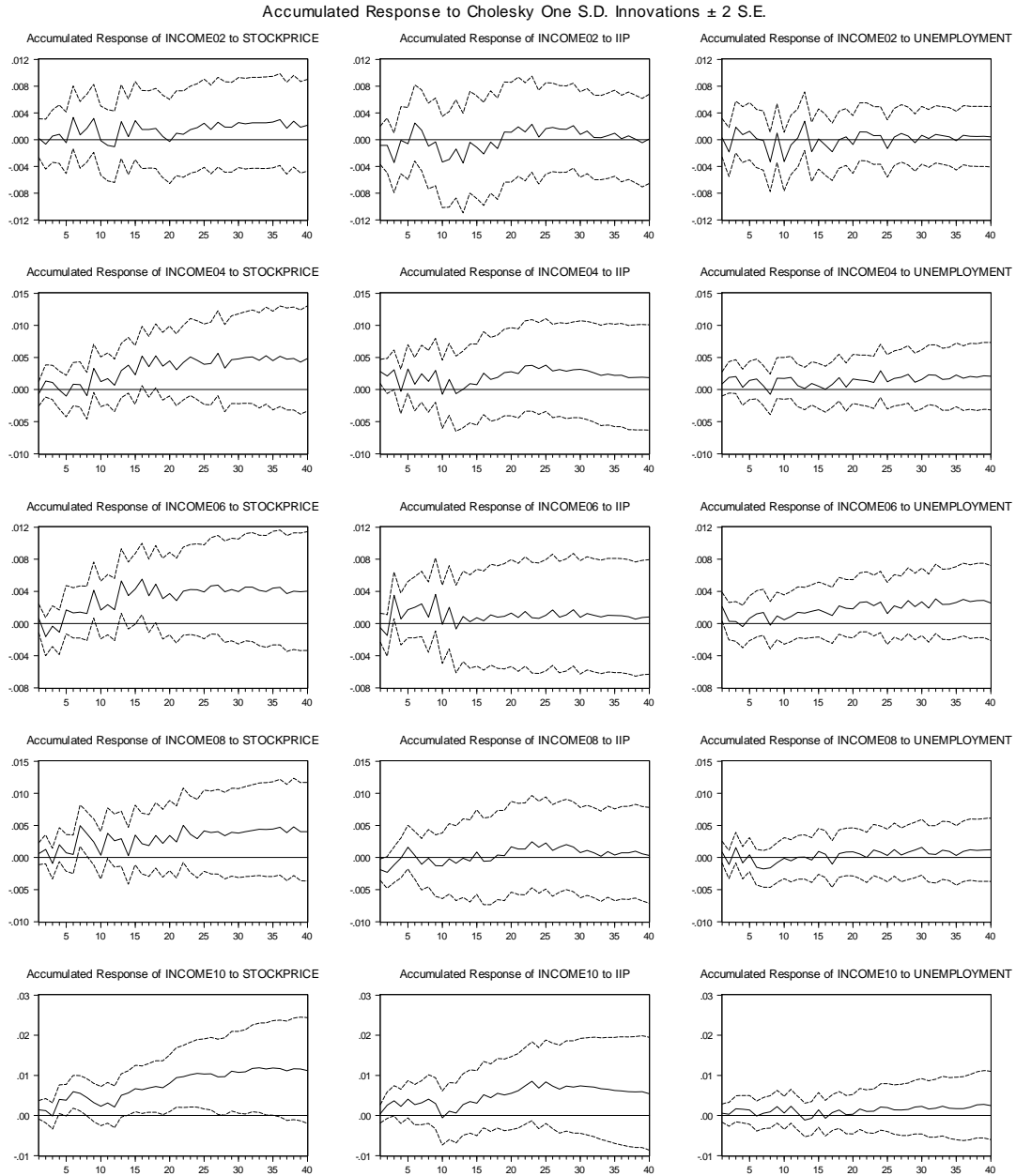


Figure 6: Cumulative impulse response functions of mean income of households with different income quantiles to shock to stock price, IIP, and unemployment rate.

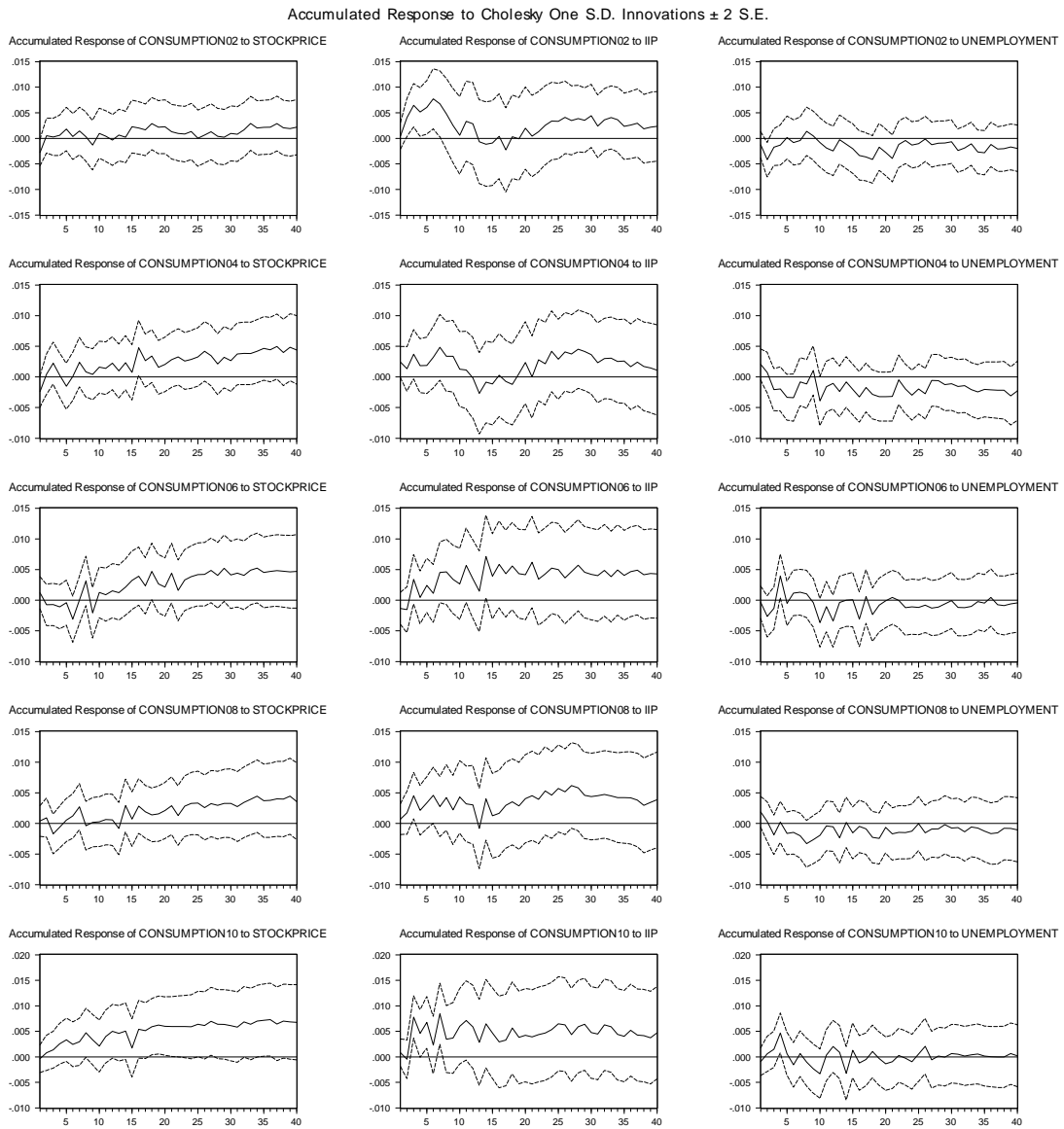


Figure 7: Cumulative impulse response functions of mean consumption of households with different income quantiles to shock to stock price, IIP, and unemployment rate.