Distributional Effects

of

(Un)conventional Monetary Policy in Japan

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Für meine Familie

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List of Abbreviations

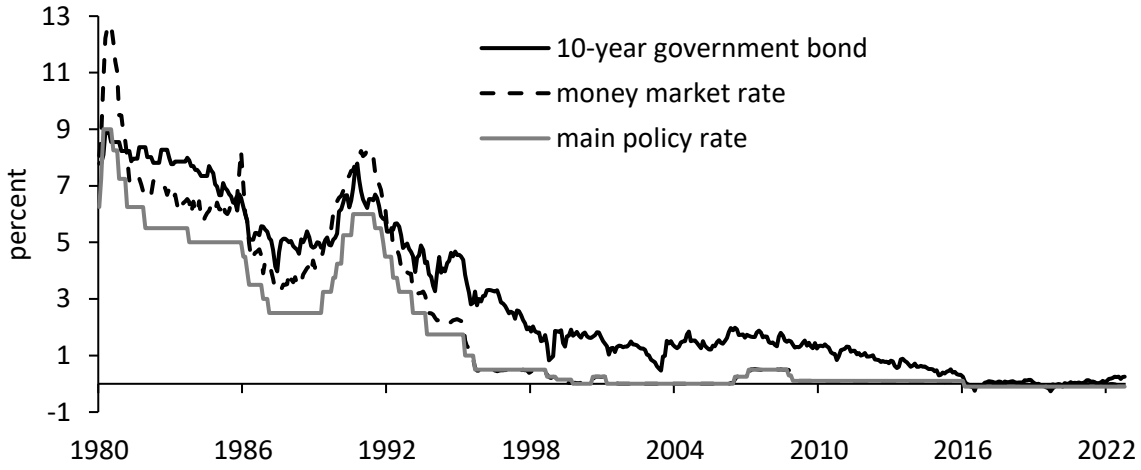
Automated teller machine	ATM
Bank of Japan	BoJ
European Central Bank	ECB
Exchange-traded funds	ETFs
Family Income and Expenditure Survey	FIES
Gross domestic product	GDP
International monetary fund	IMF
Japanese government bonds	JGB
Japanese Panel Survey of Consumers	JPSC
Japan real estate investment trusts	J-REITs
Organisation for economic co-operation and development	OECD
Short-term shadow rate	SSR
Quantitative Easing	QE
Quantitative and Qualitative Easing	QQE

Chapter 1

Introduction

Since the late 1980s, the Japanese economy has been plagued by crises and recessions. In the early 1980s a large current account surplus developed between the U.S. and Japan. In 1985, the major industrialized countries attempted to address the current account imbalance by revaluing the yen through the Plaza Accord (Funabashi 1989). The strong appreciation of the yen caused the first of several severe crises. To counter the recession, the Bank of Japan (BoJ) lowered the interest rate from 5% in September 1985 to 2.5% in April 1987 (Figure 1).

Figure 1: Interest rates, Japan



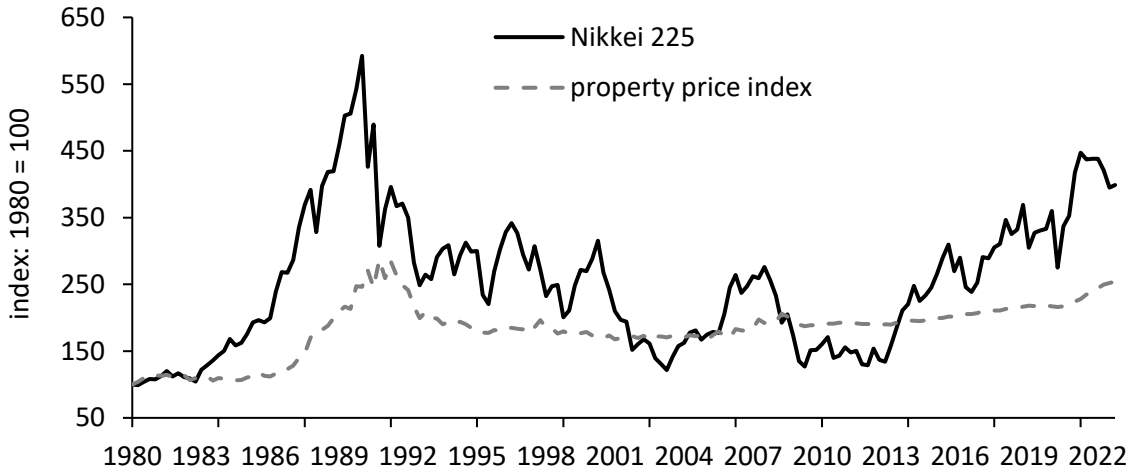
Source: Bank of Japan, Ministry of Finance.

Consequently, stock and real estate prices (Figure 2) as well as the inflation rate soared. To contain the inflationary pressure, the BoJ raised the main policy rate to 4.3% in December 1989, which led to the burst of the stock price bubble in December 1989 and the real estate bubble in 1991. To address the economic dislocations, the BoJ continuously lowered the main policy rate to 0.5% in September 1995. In July 1997, the Asian financial crisis started in Thailand and quickly rippled through to Japan causing the next crisis.

In response to the Asian financial crisis, the BoJ gradually lowered the deposit facility towards zero in October 1999, thereby perpetuating the zero-interest rate environment for many years to come. Since 2001, the BoJ eventually ventured into unconventional monetary

policies. From March 2001 to March 2006, the BoJ adopted its first unconventional monetary policy program consisting of Quantitative Easing (QE).

Figure 2: Real estate and stock prices, Japan



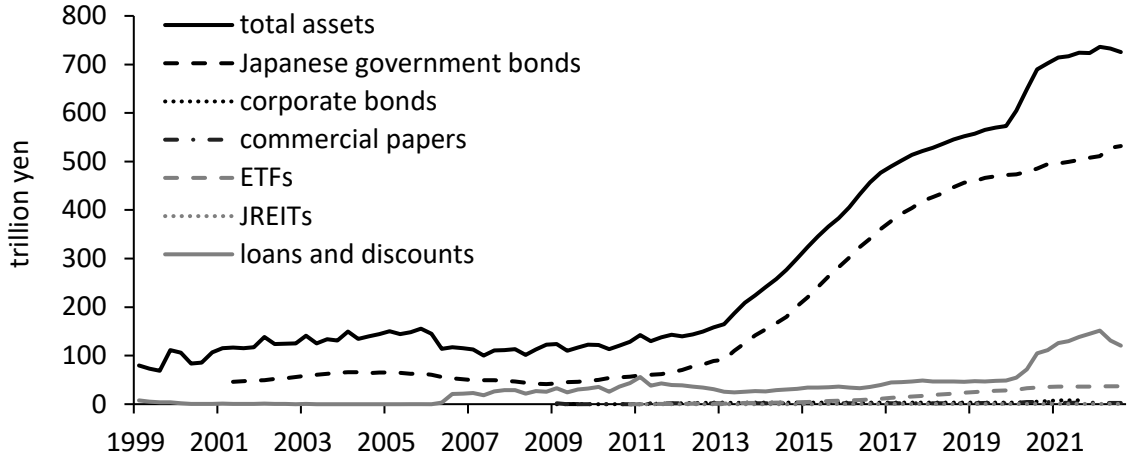
Source: Nikkei, Oxford Economics.

A short recovery phase[1] was followed by a sharp economic downturn in 2008. During the Great Financial Crisis, the Japanese economy contracted by 8.3%. In response, the BoJ started its second unconventional monetary policy program with outright purchases of Japanese government bonds (JGB), corporate bonds and commercial papers. The BoJ's holding of commercial papers and corporate bonds increased from 1.6 trillion yen to 4.9 trillion yen between 2009 and 2012. In the same time, JGBs holdings more than doubled from 4.3 trillion yen to 8.9 trillion yen. In 2010, the BoJ also started buying exchange-traded funds (ETFs) and Japan Real Estate Investment Trusts (J-REITs) (Figure 3).

In December 2012, Prime Minister Abe came into power again and quickly launched the so-called Abenomics.[2] The first arrow of the Abenomics was the introduction of Quantitative and Qualitative Easing (QQE) in April 2013. In 2016, the BoJ started its third unconventional monetary policy program. The QQE policy was from now on supplemented with negative interest rates and yield curve control.

[1] In 1998, Japan's real gross domestic product (GDP) contracted by 1.1% and in 1999 by 0.3%. Between 2000 and 2007, GDP growth somewhat recovered and grew by an annual average of 1.5%.
[2] The Abenomics consists of three arrows including a very expansionary monetary policy, an expansionary fiscal policy and structural reforms.

Figure 3: Selected balance sheet items, Bank of Japan



Source: Bank of Japan.

Since the introduction of QQE in 2013, the BoJ's total assets rose from 164.8 trillion yen to 736.2 trillion yen, an increase of a factor of almost 4.5. The monetary expansion can be seen most prominently in the balance sheet positions of JGBs and ETFs. The BoJ's JGB holding increased from 24.9% of GDP to 96.7% of GDP since the introduction of QQE in 2013. In the same time, the BoJ's ETF holdings increased from 0.3% of GDP to 6.7% of GDP. The share of JBGs held by the BoJ has even surpassed 50% of the total JGBs (Nikkei Asia 2022). The current holding of ETFs accounts for 80% of the Japanese ETF market and 8% of the entire Japanese stock market (Harada 2021).

The intention of these (un)conventional monetary measures was claimed to increase consumer price inflation, to stimulate the real economy, and to stabilize the financial markets. By lowering the real price of capital (through interest rate cuts and outright asset purchases), firms were expected to increase fixed capital investments, while consumers were expected to increase consumption. The BoJ's policy actions have presumably prevented even more severe recessions. However, the number of critics has been growing voicing unintended distributional effects of expansionary monetary policy.

One strand of literature finds that expansionary monetary policy leads to lower levels of income inequality across households. It is argued that monetary expansion tends to decrease

income inequality primarily through the earnings heterogeneity channel[3] and the job creation channel[4] as monetary stimulus assures that low-income workers remain employed or find new jobs faster (Draghi 2016, Coibion et al. 2017, Mumtaz and Theophilopoulou 2017, Furceri et al. 2018). On the other hand, expansionary monetary policy might lead to higher levels of income and wealth inequality across the populace. This strand of literature argues that the amplifying effect of expansionary monetary policy on inequality materializes through either the portfolio channel[5] or the earnings heterogeneity channel, in that high-income households hold a higher proportion of financial assets and correspondingly benefit over-proportionately from higher asset prices (Saiki and Frost 2014, Bernanke 2015, Domanski et al. 2016, Inui et al. 2017, Yoshino et al. 2020, Leroy and Heradi 2020).

For Japan, the empirical evidence is growing that inequality has risen in response to unconventional monetary policies. There are three plausible explanations. First, the interest rate was already close to the zero lower bound when Japan ventured into unconventional monetary policies in 2001. Thus, the stimulating effect on investments and job creation through lower interest rates was absent. Second, Japan's lifetime employment practices has been coming along with very low unemployment rates in general. This limits the impact of the job creation channel. Lastly, expansionary monetary policies are less effective in an aging society, where credit demand is lower and risk-aversion is higher (Iman 2013).

Rising inequality poses a number of questions and challenges to academics and policy makers alike as it has far-reaching economic and societal consequences. It has been argued, for example, that income and wealth inequality undermine people's trust in institutions, impede social mobility and amplify economic crises (Rajan 2010, Stiglitz 2012, Perugini et al. 2016). The dynamics of income and wealth inequality are intricately linked to the advancement of equal opportunities which are key for resilient and sustainable economic growth (Brunnermeier 2021).

Japan is one of the most striking cases for a change in the distribution of income and wealth over the past decades. In 1980, inequality in Japan was the lowest among G7 nations. It has

[3] The earnings heterogeneity channel captures the impact of monetary policy through the composition of households' earnings across the population.
[4] The job creation channel captures the impact of monetary policy through the creation and destruction of jobs.
[5] The portfolio channel captures the impact of monetary policy through the composition of households' savings portfolios across the population.

recently climbed up to the second highest rank among G7 nations and the ninth highest among OECD countries (Komiya and Kihara 2021). At the same time, Japan has the longest track record of monetary easing and unconventional monetary policy measures. This makes Japan a particularly interesting case for studying the relationship between monetary policy and inequality. The aim of this thesis is to shed light on distribution effects of (un)conventional monetary policy on Japanese household finances with a special focus on household saving(s) and income.

Chapter 2 examines the change in the savings culture in Japan during more than 30 years of low, zero and negative interest rate policies based on an analysis of the allocation function of interest rates and the transformation function of banks. This study is a joint-work with Gunther Schnabl. Building on the theoretical literature on saving motives, the analysis connects literature that examined the reasons for a high saving rate during the country's high-growth phase with more recent literature on reasons for the decline in the household saving rate. The influence of the Bank of Japan's monetary policy on the saving behavior is examined and connected with the contemporary development of corporate saving. It shows how the Bank of Japan's persistently loose monetary policy changed the savings culture in Japan from high to low household saving and from low to high corporate saving. It identifies the channels that have significantly altered household and corporate saving and thus persistently weakened the country's growth force.

Chapter 3 empirically analyzes the determinants of the household saving rate in Japan between 1960 and 2019 with a focus on monetary policy. It finds that the zero-interest rate policy and unconventional monetary policies of the Bank of Japan, i.e. large-scale asset purchases, have significantly contributed to the decline in the Japanese household saving rate. The hypothesis is elaborated that the portfolio channel of monetary policy consists of an asset and age dimension as the lion's share of assets is held by elderly households. It is shown that elderly households can cushion the negative strain of expansionary monetary policy on household saving thereby constituting a distribution effect from young to old.

Chapter 4 analyzes the impact of expansionary monetary policy on household saving in Japan between 1993 and 2017. This study is a joint-work with Karl-Friedrich Israel and Nils Sonnenberg. It shows that monetary expansion has contributed to a widening gap in the wealth distribution in that it tends to have an adverse effect on savings in non-academic

households, while households with at least one academic tend to be able to compensate these adverse effects or even benefit from monetary expansion. It also provides some evidence for heterogeneous effects of monetary policy in different regions, indicating that the Bank of Japan's policy measures have set in motion a redistributive process in favor of the financial and economic center of the country and at the expense of the periphery.

Lastly, chapter 5 studies the distributional effects of monetary policy on Japanese household incomes. This study is also joint-work with Karl-Friedrich Israel and Nils Sonnenberg. To isolate the portfolio channel of monetary policy and its effect on household income in Japan, it is first shown that households in the highest income brackets hold a larger share of their savings in stocks, while middle- and lower-income households hold the greatest part of their savings in bank deposits. Second, a positive link between the BoJ's expansionary monetary policy and the Japanese equity markets is identified. It is then analyzed how the performance of the stock market influences household incomes. The study finds a positive effect, which is strongest for high-income households, diminishes for middle-income households and disappears for lower-income households.

Chapter 2

Low interest rate policy and savings culture in Japan[6]

2.1 Introduction

After 30 years of low, zero and negative interest rate policies, the savings culture in Japan has changed fundamentally. Whereas in the high-growth phase of the Japanese economy after the Second World War rapid growth in savings was an important prerequisite for high investment, productivity gains, growth, and welfare gains, since the 1990s low growth, slackening productivity gains and falling wages have been accompanied by declining household saving. In 2014, the Japanese household saving rate was even negative, but has since recovered somewhat.

The paper analyzes the causes of the sharp rise and the sharp fall in household saving in Japan. The focus is put on the role of monetary policy, which has significantly altered saving and investment decisions in Japan since the early 1990s. The analysis builds on an examination of the allocation function of interest rates and the transformation function of the banking sector for an efficient capital allocation. The distinction between the high- and low-growth phases of the Japanese economy facilitates the elaboration of the role of the changing institutional environment for savings and for capital allocation.

The analysis builds on the theoretical literature on saving motives (Hayek 1929, Keynes 1936, Mises 1949, Solow 1956, Modigliani and Brumberg 1954, Friedman 1957). It connects literature that examined the reasons for high saving in Japan during the country's high-growth phase (i.e. Komiya 1966, Hayashi 1989, Okita 1957, Yoshihara 1972) with more recent literature focusing on reasons for the decline in the saving rate (i.e. Murata 2003, Koga 2006, Horioka 2009, Saito 2015). In addition, the influence of the Bank of Japan's persistently loose monetary policy on saving behavior is examined, and the complementary development of corporate saving is elaborated.

The analysis shows that the Bank of Japan's persistent low, zero and negative interest rate policies have not only been crucial in the sharp decline in the household saving rate but have

[6] Chapter 2 is based on the German version *Niedrigzinspolitik und Sparkultur in Japan: Implikationen für die Wirtschaftspolitik* together with Gunther Schnabl forthcoming in ORDO.

also significantly altered the functioning of the Japanese economy. The suspension of the allocation function of interest rates and the undermining of the transformation function of the banking sector have been accompanied by declining disposable incomes and thus a gradual decline in wealth.

2.2 The influence of interest rates on capital allocation

Interest rates play a central role in the economy. They not only influence consumption, saving and investment, but also have an impact on the quality of investment projects. While in Neoclassical models the interest rate depends on the marginal efficiency of investment, in Austrian theory the banking sector plays a central role for the quality of investment projects (Mayer and Schnabl 2021). In Keynesian models, on the other hand, the interest rate is primarily a policy instrument.

2.2.1 The allocation function of interest rates

The Neoclassical theory of interest derives the interest rate from the marginal productivity of capital as well as from time preference in the choice between present and future consumption. The demand for capital and investment depends on the productivity of capital, i.e. the expected rate of return on investments, and on the interest rate as the cost of financing investments. The productivity of capital is subject to the law of diminishing marginal returns, which falls as the capital stock grows. Firms realize all investments whose expected return is greater than the interest rate.

Investments are thus in an inverse relationship to the interest rate. The lower the interest rate, the more investment projects are realized. The supply of capital depends on the marginal utility of saving in exchanging present consumption for future consumption. The greater subjective value attributed to present need satisfaction relative to the subjective value attributed to future need satisfaction translates into a positive relationship between saving and the interest rate (Belke and Polleit 2009). As the interest rate rises, present consumption is substituted for future consumption (saving).

The Austrian theory of interest derives both the supply and demand of capital from time preference (Böhm-Bawerk 1890, Mises 1912, 1949). The interest rate is determined by the ratio of the appraisal of present goods to future goods - the time preference rate (Böhm-

Bawerk 1890). Firms invest when expected profits exceed expected costs. The marginal productivity of capital goods is determined from the future value of the consumer goods and services produced with the help of the respective capital goods. The supply of capital is determined by time preference. The higher the interest rate, the more present consumption is replaced by future consumption (saving).

In both Neoclassical and Austrian theory of interest, the interest rate has a central function in the intertemporal allocation of scarce resources (Israel 2020). The market rate of interest conveys knowledge about which investment projects are feasible with a limited amount of available savings (Mises 1912, 1949). It reveals those investment projects that offer an advantage over others (Fisher 1930). The interest rate thus separates high-return investment projects from low-return investment projects.

Economic development is based on the change in the appraisal of scarce goods, which is the source of entrepreneurial profits and losses. Borrowers and lenders enter the credit market when the expected returns on an investment project are higher than the expected costs. The resulting arbitrage movements tend to establish a single interest rate. The interest rate therefore guides investment activities and determines the length of the production structure (Hayek 1935, Garrison 2002).

In contrast, Keynes (1936) considers the interest rate as a monetary phenomenon that is determined by the supply and demand of money. The central bank determines the supply of money, the demand for money is determined by the liquidity preference. Holding savings in money has the advantage that they are available for transactions at any time. Holding savings in securities, on the other hand, yields interest income. Since people generally prefer liquid forms of savings, interest is seen as a reward for giving up the liquidity preference. As interest rates influence the financing costs of investments, by increasing the money supply, the central bank can lower the interest rate and thus stimulate investment as long as there is room for interest rate cuts.

2.2.2 The transformation function of the banking sector

The main role of financial intermediaries has traditionally been to allocate loanable funds (savings) to the most productive investment opportunities. Banks accept deposits from savers and grant credit to investors. As part of their credit allocation function, banks ensure the

efficient use of scarce financial resources and thus contribute significantly to innovation, growth and prosperity (Coase 1937, Akerlof 1970).

Due to information asymmetries, lending is subject to the risk of adverse selection[7] and moral hazard [8] and thus to high transaction, information, and search costs. Reviewing and monitoring credit risk is a core responsibility of banks. By exploiting economies of scale and scope, banks have a cost advantage in gathering relevant information and minimizing information asymmetries (Diamond 1984).

Through long stable relationships with firms, banks can more easily resolve information asymmetries as they can gather information that is not directly reflected in the balance sheet (relationship banking).[9] Due to their local proximity, small and medium-sized banks often have a competitive advantage over large banks in overcoming information asymmetries (Boot 2000, Boot and Thakor 2000, Berger and Udell 2006, Prantl et al. 2009, Canales and Nanda 2012, Hasan et al. 2014, Flögel 2016, Flögel and Gärtner 2018). Small and medium-sized banks have therefore traditionally focused on financing small and medium-sized enterprises from the same region. Small and medium-sized banks facilitate access to capital for small and medium-sized enterprises, reduce financing costs, encourage investment, and thus promote regional growth (Hasan et al. 2017, Marsch et al. 2007).

The banking sector has three main transformation functions: (1) Banks transform many small deposits of individual savers into larger loans (size transformation). (2) They transform short-term deposits into medium- and long-term loans (maturity transformation). (3) By diversifying investments into numerous investment projects, they offset unexpected losses on individual projects (risk transformation). Therefore, banks can charge higher interest rates on loans than on deposits, thereby covering their costs and earn profits. Net interest income (defined as interest income minus interest expenses) has traditionally been a key source of revenue for banks.

[7] In credit markets, adverse selection refers to the situation where lenders cannot distinguish the creditworthiness of borrowers in the presence of asymmetric information and select borrowers with a high probability of default (see Akerlof 1970).

[8] Moral hazard exists when a person does not have to bear the full (negative) consequences of his/her behavior, or even realizes benefits. In corporate finance, this can lead to companies taking out loans even though their repayment is uncertain (see Arrow 1963).

[9] Soft information is qualitative information about, i.e. the quality of management. Hard information is quantitatively assessable data such as balance sheet information.

As in Germany, there exist many small and medium-sized banks in Japan, whose main business is lending to local small and medium-sized enterprises (Schnabl 2020). The small and medium-sized banks are subdivided into regional banks[10] (comparable to German savings banks in that they limit their activity to single regions) and Shinkin banks[11] (which correspond to the German cooperative banks). Supra-regional city banks[12] have business relations mainly with large companies. After the Second World War, keiretsu financing established itself in Japan alongside relationship banking. At the center of large corporate-dominated business groups (keiretsu)[13] stood a large relationship bank (city bank) that had access to hard and soft information of the companies through cross-shareholdings (Hoshi et al. 1991, Hoshi et al.

[10] Japan is divided into 47 prefectures (including the Tokyo metropolitan area). Regional banks traditionally have a strong presence in these prefectures. First-tier regional banks are the leading banks in the prefecture with headquarters in the capital of the prefecture. They maintain close business relations with regional enterprises (usually small and medium-sized enterprises) and with regional authorities (usually as their principal bank). Regional banks accept deposits from private and public households as well as companies and provide the necessary banking services to private customers. In contrast to savings banks in Germany, regional banks have no common name, no common logo and no common supra-regional umbrella organization. They are usually joint-stock companies. Since Japan is larger than Germany and has fewer prefectures than Germany has counties, the average regional bank is larger than the average German savings bank. Second-tier regional banks were credit cooperatives that specialized in accepting deposits and lending to small and medium-sized enterprises in the region. Their scope of operations (and hence total assets) was generally smaller than of the first-tier regional banks. The 1989 reforms eliminated the differences between first- and second-tier regional banks, so that both groups of banks have nowadays a very similar business model. They are thus competing against each other.

[11] Shinkin banks, unlike regional banks, are non-profit cooperatives. They have a strong regional focus. Their members are mainly small and medium-sized enterprises and individuals from the region. Their business is primarily to provide banking services to members, i.e. deposit taking, savings plans, and payment processing. Lending to non-members is limited to 20% of total loans. Shinkin banks do not trade securities. Unlike regional banks, Shinkin banks have an umbrella organization, the National Federation of Shinkin Banks, of which all Shinkin banks are members. The Zenshinren Bank accepts deposits from individual members, grants credits, and processes payments. It also provides banking services to national and regional government organizations and other non-profit organizations.

[12] City banks are large-scale banks operating nationwide, with business activities concentrated in the economic centers of Japan (Tokyo, Osaka, Nagoya). Their lending activity traditionally concentrates mostly on large corporations (but more recently to small and medium-sized enterprises as well). In corporate conglomerates, city banks supported the foreign business of large Japanese companies (mostly industrial and commercial enterprises) that were very successful internationally after World War II. In 1989, there were 13 city banks (Bank of Tokyo, Daiichikangyo Bank, Daiwa Bank, Fuji Bank, Hokkaido Takushoku Bank, Industrial Bank of Japan, Kyowa Bank, Mitsubishi Bank, Mitsui Bank, Saitama Bank, Sanwa Bank, Sumitomo Bank, Taiyokobe Bank). Since 1990, city banks underwent a merger process with trust banks, investment banks and banks for long-term loans. Five so-called mega-banks (Mizuho Bank, Bank of Tokyo Mitsubishi UFJ, Sumitomo Mitsui Banking Corporation, Resona Bank and Resona Saitama Bank) emerged. These mega-banks are linked to numerous other financial institutions through holding companies, resulting in very large financial conglomerates (i.e. Mitsubishi UFG Financial Group). City banks have a broad customer base and offer a wide range of products and services including asset management.

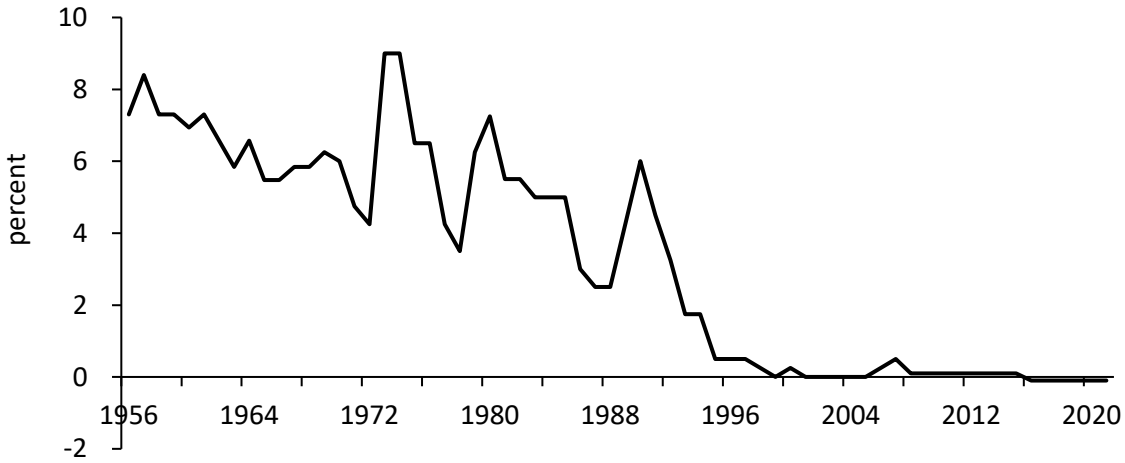
[13] Keiretsu are a group of companies that are closely intertwined in their business relationships and shareholding structure but form a group of companies only informally. At the center of the keiretsu is a bank that provides the financial resources (Porter and Sakakibara 2004).

1993, Hoshi and Kashyap 2001). Long-term relationships between the relationship bank (city bank) and keiretsu firms reduce monitoring costs and promote efficiency gains (Sheard 1994).

2.2.3 Disruption of the allocation function of the banking sector

The investment decisions of companies depend in particular on the expected development of prices, wages and interest rates. Bank lending is characterized by the selection of investment projects with high expected future returns and a low probability of default (Diamond 1984). The interest rate separates investment projects with high expected returns from investment projects with low expected returns. By structurally changing the policy rate, central banks distort price signals in the capital market. Banks are disrupted in their return-oriented credit allocation (Hayek 1929, Hayek 1935).

Figure 4: Main policy rate, Japan



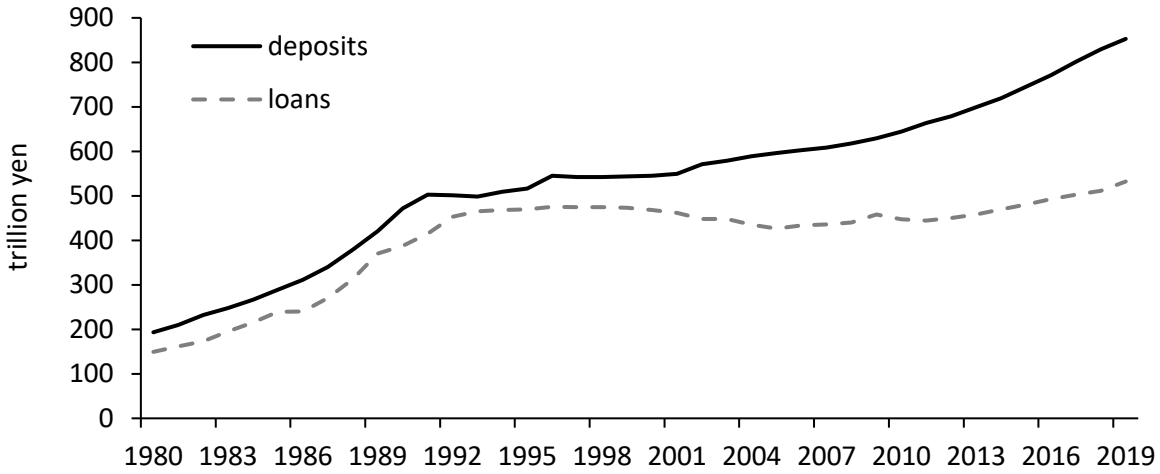
Source: IMF, Bank of Japan.

According to Hayek (1929, 1935), a reduction in the interest rate set by the central bank affects the refinancing conditions of banks. Through competition among banks, the more favorable refinancing terms are passed on to households and firms. The lower interest rate signals to market participants an increase in household savings and thus an increase in future consumption. Firms then expand their credit-financed investment projects to satisfy the expected increase in future consumption (Schnabl 2019).

A cumulative upswing occurs driven by excessive bank lending to businesses. The volume of credit grows beyond savings. As banks and corporations make larger profits in the upswing,

stock prices rise. Rising stock prices can be an incentive to exchange bank deposits for stocks when interest rates on bank deposits are low, so stock prices continue to rise. Similarly, interest rates on real estate financing fall, so that real estate prices rise. Rapidly rising stock prices and real estate prices can be an incentive to speculate on further price increases. Stock prices and real estate prices can thus become detached from the fundamental value of companies, banks and real estate.

Figure 5: Deposits and loans with Japanese banks



Source: Shinkin Central Bank Research Institute and Policy Research Institute, Ministry of Finance.

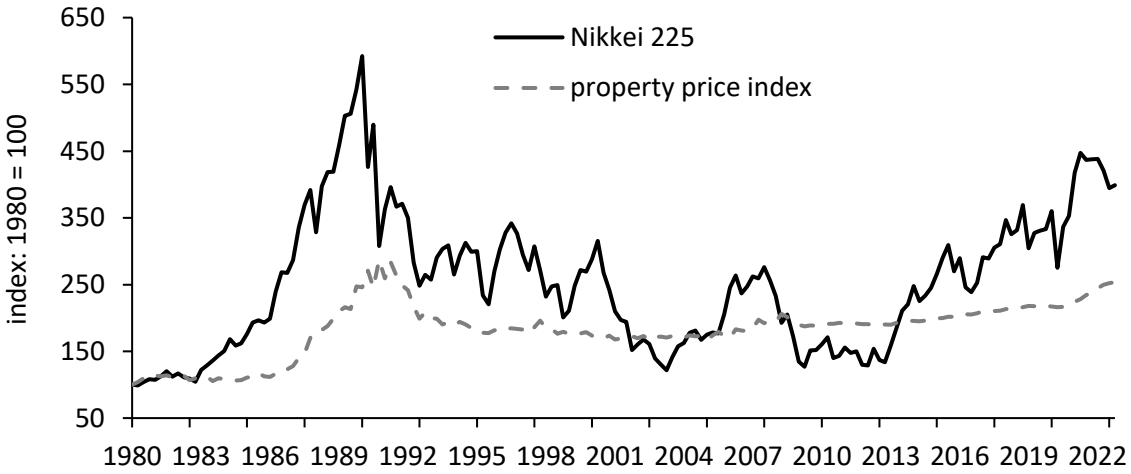
The Bank of Japan disrupted the allocation function of interest rates in Japan in two phases (Schnabl 2013). First, a large current account imbalance developed between Japan and the U.S. in the early 1980s.[14] In September 1985, the major industrialized countries attempted to address the current account imbalance by revaluing the yen through the Plaza Accord (Funabashi 1989). The strong appreciation of the yen caused a severe recession in export-dependent Japan, which the Bank of Japan countered by cutting the main policy rate from 5% (September 1985) to 2.5% (February 1987 to April 1989) (Figure 4).

In line with the Austrian business cycle theory, the Bank of Japan's strong monetary expansion translated into an investment boom and a sharp rise in stock and real estate prices (Schnabl 2013). Japanese bank lending increased by 112% from 195 trillion yen in 1983 to 415 trillion yen in 1991 (Figure 5). Investment surged, accelerating growth. The boom spurred a rise in

[14] In the run-up to the Plaza Accord (1980-1985), the U.S. dollar had appreciated by over 50% against the yen.

stock and real estate prices. The rising value of stock and real estate was often used to take out new loans. Japan's Nikkei 225 stock index rose by 214% from 12,683 points in 1985 to 33,042 points in 1989, while the real estate price index rose by 133% from 1985 to 1991 (Figure 6).

Figure 6: Real estate and stock prices, Japan



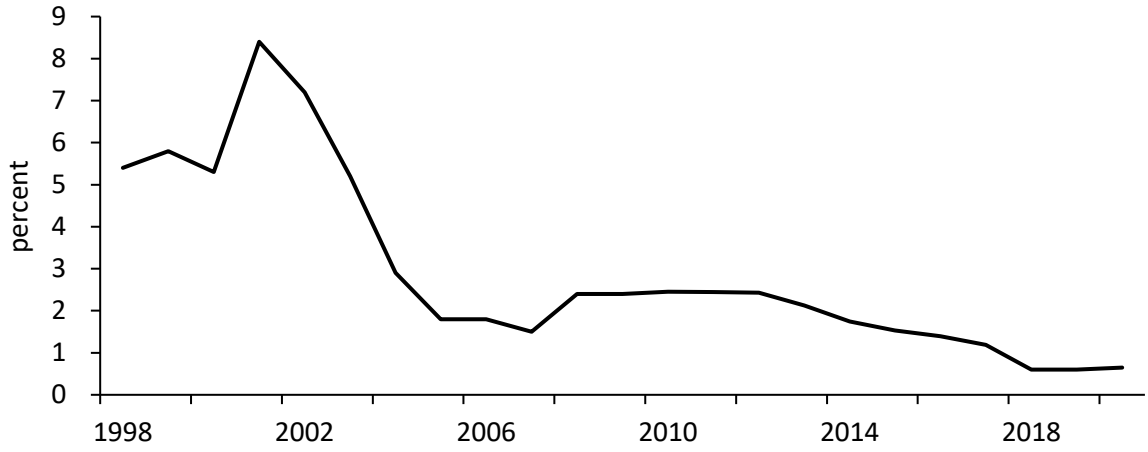
Source: Oxford Economics.

According to Mises (1912) and Hayek (1929), the boom turns into bust when the central bank raises the key interest rate to contain inflationary pressures. The bar on the profitability of past and future investment projects is then raised. Investment projects with returns below the increased interest rate prove unprofitable and are forced to be dismantled (Schnabl 2019). Prices of stocks and real estate fall. The equity of banks and companies shrinks due to the abandonment of investment projects and the increase in non-performing loans. A cumulative downswing emerges in which wages and prices fall.

In Japan in the second half of the 1980s, consumer price inflation rose from 0.1% (1987) to 3.3% (1991). In addition, the Bank of Japan viewed the development in the stock and real estate markets with growing unease. To contain inflationary pressures, the Bank of Japan raised the policy rate from 2.5% (April 1989) to 6% (August 1990 to June 1991), which led to the bursting of the stock price bubble (December 1989) and the real estate bubble (1991). The collapse in stock and real estate prices caused companies to default on loans due to falling

collateral values (Westermann 2003).[15] This created a large stock of (potentially) non-performing loans on the balance sheets of Japanese banks (Casu et al. 2006).[16]

Figure 7: Non-performing loans as a share of total gross loans, Japan



Source: FRED and Financial Services Agency.

Second, to facilitate the economic recovery and to help Japanese banks clean up their balance sheets from non-performing loans, the Bank of Japan gradually lowered the policy rate to 0% starting in 1991. This led to a renewed and henceforth persistent distortion of the allocation function of interest rates. Japanese banks initially took advantage of the favorable refinancing conditions to take out cheap loans from the Bank of Japan and to extend these as higher-interest loans via so-called carry trades in Southeast Asia. This led to a new overinvestment boom in Southeast Asia, which ended in 1998 with the outbreak of the Asian crisis (Schnabl 2000).

The collapse of the Thai bath and other Southeast Asian currencies spilled over to Japanese banks due to a currency mismatch[17] and a maturity mismatch[18] related to the carry trades. As

[15] Ogawa (2000) shows that in the boom land played a central role in the transmission of monetary policy, especially for small businesses.

[16] It was not until October 1998 that the Act on the Rapid Recovery of the Credit System came into force. The Act required banks to disclose detailed information on their non-performing loans (Schnabl 2020). The Financial Services Agency has published data on non-performing loans since 1998. In 2008, the definition of non-performing loans was revised. From then on, banks could classify non-performing loans as performing loans, provided that the company concerned could demonstrate a credible restructuring plan (successful restructuring within 10 years).

[17] Borrowing in foreign currency (original sin) and lending in local currency involves currency risks.

[18] The default risk associated with the maturity mismatch is based on short-term borrowing (in the international capital markets) combined with long-term lending (domestically).

the Japanese financial crisis unfolded, new loan defaults occurred, further increasing non-performing loans from 5.4% of total gross loans in 1998 to 8.4% in 2001 (Figure 7). The Japanese banking system entered a systemic crisis (Murai and Schnabl 2021a), which permanently entrenched the persistent low interest rate environment in Japan. Policy rates have remained largely at zero since 2001. The Bank of Japan's quantitative easing, which began in 2001, facilitated government spending programs to stabilize the economy through large-scale purchases of government bonds and now also pushed interest rates at the long end of the yield curve towards zero. As a result, all Japanese banks faced persistent declines in the interest margin[19], the transformation margin[20], and the passive margin[21] (Murai and Schnabl 2021a). The allocation function of interest rates and the transmission function of the banking sector were thus permanently disrupted (see Section 4.3).

2.3 Determinants of household saving, Japan

There are different theoretical explanations for household saving. Keynes (1936) distinguishes eight saving motives: improving the personal situation, future consumption, saving for old-age, provision, financial independence, entrepreneurial activity, inheritance and greed. The Neoclassical and Austrian theory agree that a household's willingness and ability to save are positively related to the interest rate (Solow 1956, Swan 1956, Hayek 1929, Mises 1949). Falling interest rates lower the opportunity cost of current consumption and thus reduce the incentive to save.

The life-cycle hypothesis, which sees the individual saving behavior as a function of life-cycle stages (Modigliani and Brumberg 1954), is ambiguous about how households behave when interest rates change. Individuals keep their consumption as constant as possible over the life-cycle by saving in the years of employment and by dissaving in old age (consumption smoothing). On the one hand, interest rate cuts lead to a general reduction in the incentive to save (substitution effect). On the other, lower interest rates increase the present value of future consumption, so that more must be saved to achieve the same future consumption

[19] The interest margin is defined as the average interest rate on new lending business minus the average interest rate on new deposits.

[20] The transformation margin is defined as the difference between the interest rate on 10-year government bonds and the money market rate.

[21] The passive margin is defined as the current money market interest rate minus the average deposit rate on new deposits.

(income effect) (Ando and Modigliani 1963, Elmendorf 1996). The influence of structural interest rate changes on saving in the context of the life-cycle hypothesis is thus indeterminate.

The permanent income hypothesis explains saving as a function of permanent income rather than temporary income (Friedman 1957). According to the permanent income hypothesis, only longer-term income changes have an impact on consumption expenditure (Carlin and Soskice 2014). If incomes rise unexpectedly, the corresponding surpluses are saved. If they fall unexpectedly, savings are liquidated (Ireland 1995). According to the permanent income hypothesis, temporary changes in interest rates do not affect households' saving behavior, as they do not affect the permanent part of life-time income (Friedman 1957).

2.3.1 High-growth phase

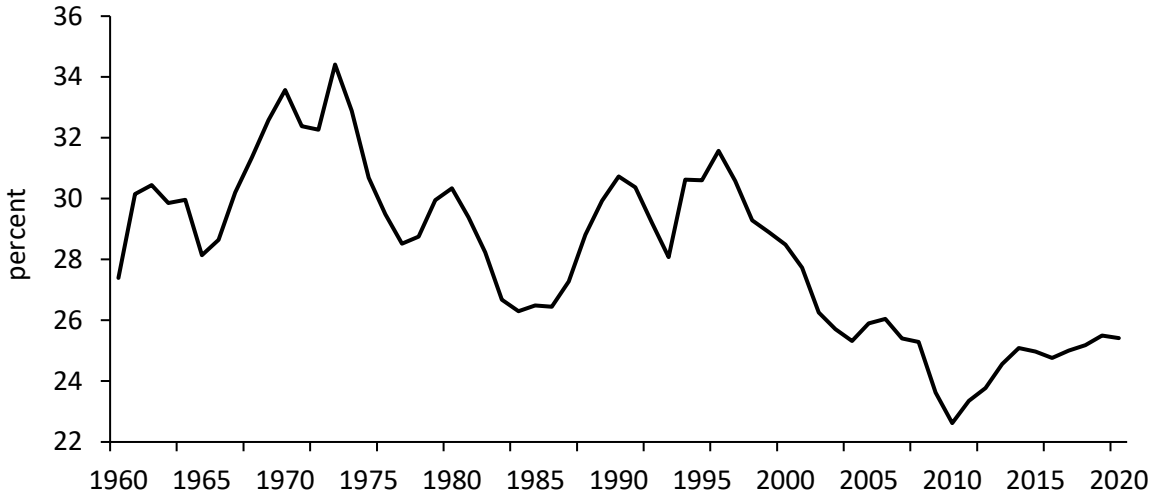
Japan's post-World War II reconstruction was accompanied by high investment (Figure 8) and high growth (Figure 9). Market reforms created the framework for sustained high growth (Hamada and Kasuya 1992). Land reforms provided incentives for farmers to modernize production, which led to a remarkable increase in agricultural productivity. In 1947, the Antitrust Law was enacted and the Fair-Trade Commission was established, leading to the breakup of large corporate conglomerates (zaibatsu)[22]. The concentration of market power of some companies was broken up and a competitive environment was created.

In 1949, the Dodge Line was adopted, which led to a stable currency (Hamada and Kasuya 1992). The tax base was broadened and the government budget was balanced. Credit and wage growth were restricted. Following an amendment to the 1942 Bank of Japan Act[23] by the US occupying power in June 1949, the independence of the Bank of Japan was strengthened. Meanwhile, the Minister of Finance retained the power to supervise the Bank of Japan, issue instructions on measures deemed necessary, and amend the statutes.

[22] The origins of the zaibatsu date back to the Meiji era (1868-1912). Zaibatsu were holding structures of large industrial and financial groups (Hadley 1970). Due to their size and the greater importance of equity financing, zaibatsu had operational control over significant parts of the Japanese economy (Hoshi and Kashyap 2001).

[23] The 1942 Bank of Japan Act stated in article 1 that the purpose of the Bank of Japan was to regulate the currency, manage the credit and financial system, and to keep the credit system in line with national policies, thereby properly promoting the general economic activities of the country.

Figure 8: Gross fixed capital formation as a share of GDP, Japan



Source: IMF, OECD.

The post-war period was characterized by the steering of savings in favor of far-reaching industrial policies (Hoshi and Kashyap 2001, Werner 2002). The Japanese banking system was initially highly regulated.[24] The 1948 Temporary Interest Rate Adjustment Act[25] granted the Japanese Ministry of Finance interest rate-setting authority. The 1948 Securities and Exchange Act made it difficult for commercial banks to underwrite securities.[26] The 1950 Foreign Investment Law de facto prohibited the inflow and outflow of capital, so that the investment boom during the high-growth period (1955-1975) had to be financed by domestic savings.

The Treasury's interest rate-setting authority translated into the regulation of almost all interest rates. Lending rates tended to be kept low, creating excess demand for credit. This allowed the government to influence bank lending in favor of key industries (window guidance).[27] The Ministry of International Trade and Industry determined the eligible

[24] Reinhart and Sbrancia (2011) speak of financial repression for the period between 1953 and 1973 in Japan. In contrast, McKinnon (1991) and Horiuchi (1984) argue that the Japanese financial market was not repressed because real interest rates were higher than real interest rates in most developed countries during the high growth period.

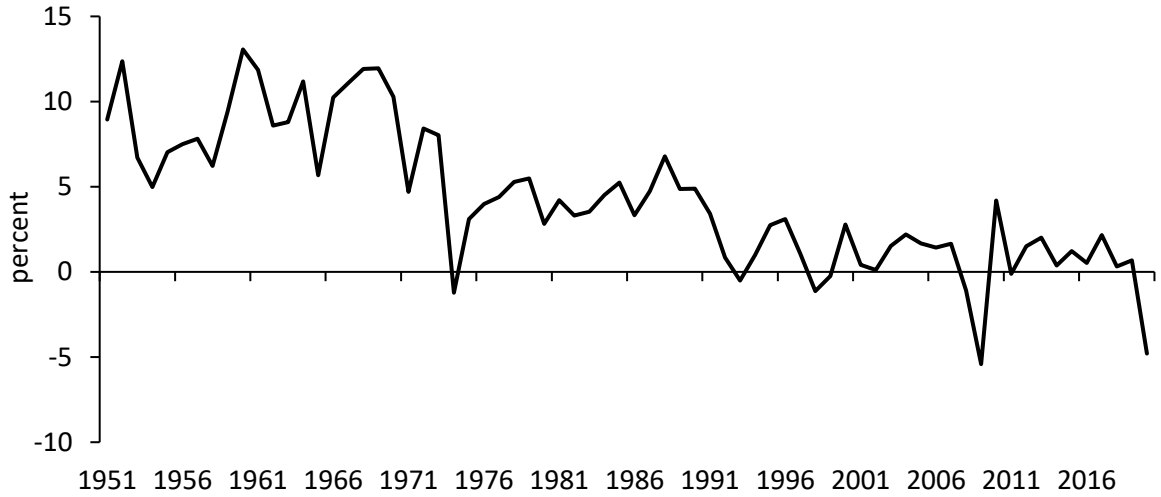
[25] The law remained in effect until the 1990s (Suzuki 1987).

[26] Until the late 1960s, tax law favored debt financing over equity financing. New issues of corporate bonds were issued at par value instead of market value. Dividend payments had to be taxed with income until 1965 (Abegglen and Stalk 1985).

[27] On a quarterly basis, the Bank of Japan communicated commercial banks by how much they should increase or decrease their lending activity. Exceeding or falling short of the credit ratio set by the Bank of Japan was penalized with a lower credit allocation in the future (Werner 2002).

industries. Households had very limited credit available, while savings were largely held in demand and time deposits as well as in life and non-life insurances.

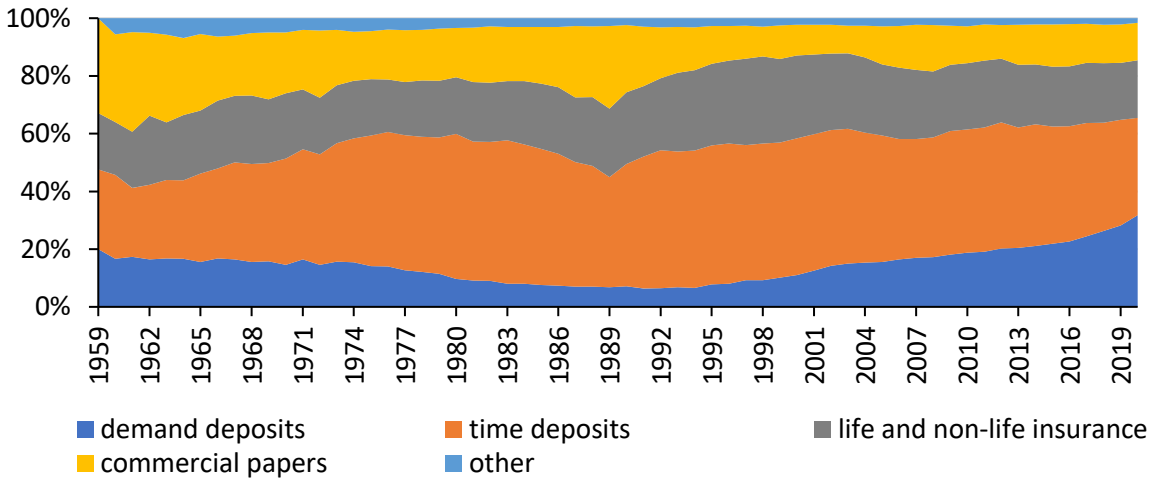
Figure 9: Real GDP growth, Japan



Source: Penn World Table. Real GDP is calculated in 2017 prices.

The high-growth phase of the Japanese economy was accompanied by a sharp increase in household saving (Kawasaki 1990) (Figure 11 and Figure 13). Net household saving as a share of disposable income (as a share of GDP) was 16.7% (9.4%) in 1960 and rose to 23.1% (14.5%) in 1974. In 1991, the household saving rate fell to the level of the 1960s. Over the whole observation period, Japanese households held an average of 78% of their savings in demand and time deposits and in life and non-life insurances (Figure 10).

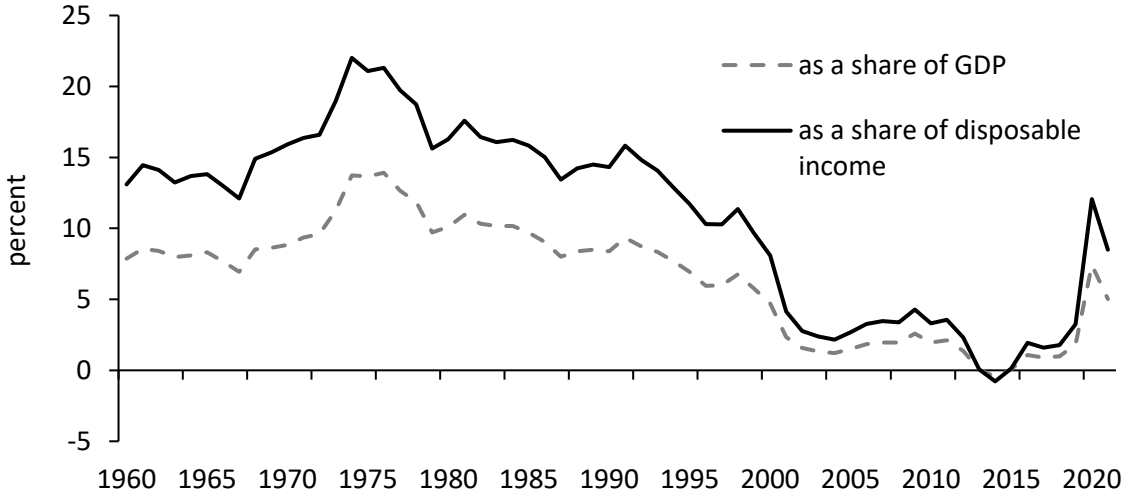
Figure 10: Structure of household savings, Japan



Source: Ministry of Internal Affairs and Communications.

Consistent with the Solow-Swan growth model, total household saving rose sharply as disposable income rose (Figure 12) and thus households could save large shares of their income (Komiya 1966, Mizoguchi 1970, Hayashi 1989). During the period from 1950 to 1973, the Japanese economy grew at an average annual rate of 10% in real terms (Figure 9). In 1960, the annual per capita income was 479 U.S. dollar. Within 15 years, it rose to 4,659 U.S. dollar. As the demand for labour increased, the bargaining power of workers strengthened, so that annual household incomes rose by an average annual rate of 8% until 1995 (Figure 12).

Figure 11: Net saving rate of Japanese households, Japan



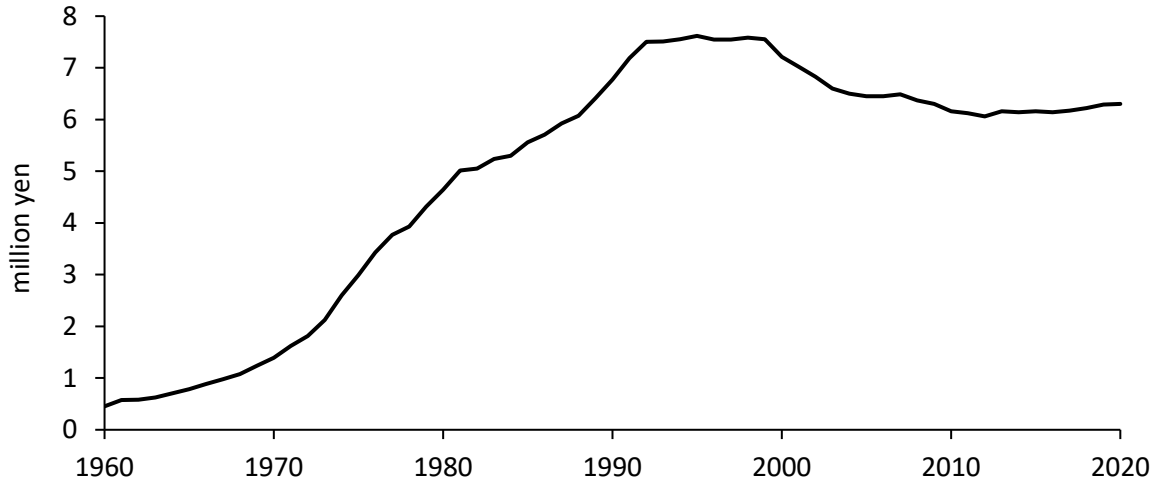
Source: Cabinet Office.

In line with the life-cycle hypothesis (Modigliani and Brumberg 1954), Japan's strong post-war population growth caused the working-age population to grow rapidly, which had a positive effect on the accumulation of savings (Okita 1957, Modigliani and Sterling 1983, Horioka 1990). An increasing number of people were at an age when savings are formed. Consistent with the permanent income hypothesis (Friedman 1957), the saving rate also increased due to the growth of bonus payments as the transitory income (Figure 18) (Komiya 1966, Mizoguchi 1970).

Hayashi (1989) argues that the initial low level of household wealth provided an incentive to save. Precautionary saving is seen as a determinant of the high Japanese household saving rate (Hayashi, 1986, Tachibanaki 1994, Sato 1987). After the World War II, the social security

system[28] was still underdeveloped, which encouraged precautionary saving (Shinohara 1959, Komiya 1966, Mizoguchi 1970, Yoshihara 1972, Shinohara 1972, Modigliani and Sterling 1983, Hayashi 1989, Anderson 1990). Faced with the increase in life expectancy as well as the lack of adequate institutional retirement provision, older households increased their labour force participation and were thus able to accumulate more savings (Modigliani and Sterling 1983).

Figure 12: Average annual household income, Japan



Source: Ministry of Internal Affairs and Communications.

Government measures also favored the accumulation of savings. On the one hand, credit was directed to key industries, which meant that little consumer credit was granted. This dampened consumption and encouraged the accumulation of savings. Interest income from bank deposits and government bonds was tax-exempt under the *maruyu*-system (introduced in 1963) (Ito 1991), which according to Komiya (1966) encouraged further household saving. On the other side, long-term time and postal savings deposits, which the government could easily convert into long-term loans to firms, were remunerated at a higher interest rate than short-term deposits (Hoshi and Kashyap 2001).

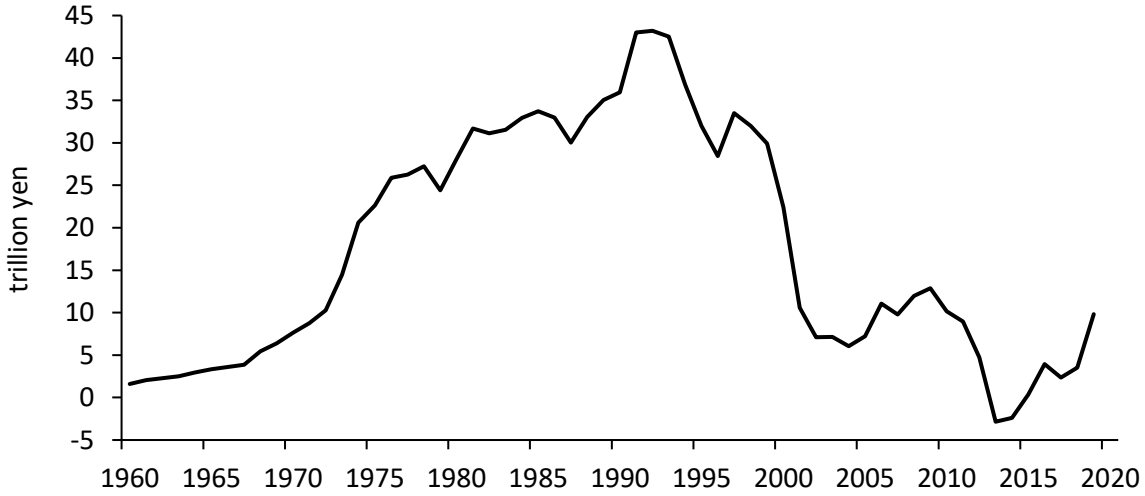
2.3.2 Low-growth phase

The end of the 1970s marked the beginning of a prolonged period of financial market deregulation. Interest rate regulations in the overnight money market and the secondary

[28] The share of social security expenditure accounted for around 15% of total government expenditure until 1975. Since 2005, the share has averaged 30% (see also Figure 19).

bond market were dismantled.[29] In 1979, the Foreign Investment Law was abolished. The new Foreign Exchange and Foreign Trade Law in 1980 now allowed capital imports and capital exports, and thus facilitated persistent net capital exports. But as early as 1986, the liberalization of the Japanese capital market was accompanied by an expansionary monetary policy. This led to the Japanese bubble economy, the bursting of which resulted in the prolonged economic stagnation (see Section 2.2.3).

Figure 13: Net household saving, Japan



Source: Cabinet Office.

The increasingly expansionary monetary policy since the 1990s resulted in a new financial repression (Schnabl 2020). As the Bank of Japan first pushed short-term interest rates and, in the course of unconventional monetary policy (quantitative easing), long-term interest rates towards zero, banks' interest margins, the main traditional source of income, were increasingly reduced (Murai and Schnabl 2021a).[30] As a result, banks' lending ability was constrained. The politically motivated softening of lending conditions (forbearance lending (Sekine et al. 2003)) reduced the incentive of firms to pursue innovation and efficiency gains (McGowan et al. 2017, Caballero et al. 2008, Herok and Schnabl 2018) (see Section 2.4.3).

The economic stagnation, reflected in the stagnation of GDP and of disposable income, was accompanied by a marked decline in the net saving of Japanese households (Figure 13). While

[29] It was not until 1993/94 that the remaining interest rate restrictions, such as interest rate ceilings for term deposits, were lifted.

[30] Interest income accounted for about 60% of Japanese banks' total income between 2000 and 2005 (Loukoianova 2008).

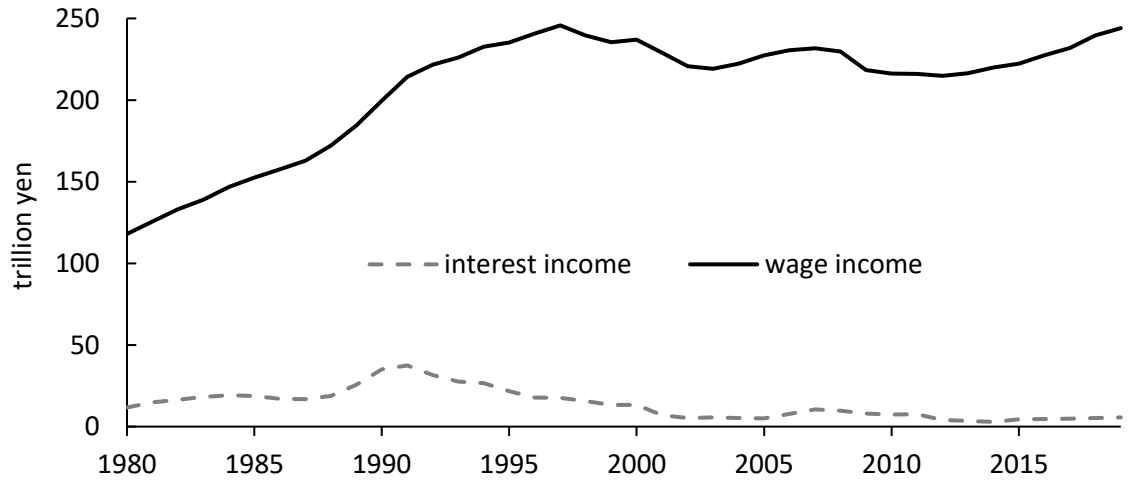
net saving was at a record high of 43 trillion yen in 1991, it declined to -3 trillion yen in 2013 and has since recovered to just under 10 trillion yen in 2019.

Figure 14: Wage levels and labour force, Japan

Source: Ministry of Internal Affairs and Communication, Ministry of Health, Labour and Welfare.

The sharp decline in growth and productivity gains had a negative impact on disposable incomes. With the bursting of the bubble economy, real wage growth initially slowed down. Since the Asian crisis (1998) and the associated Japanese financial crisis, real wage levels have been trending downwards (Figure 14).

Figure 15: Interest and wage income of the Japanese household sector

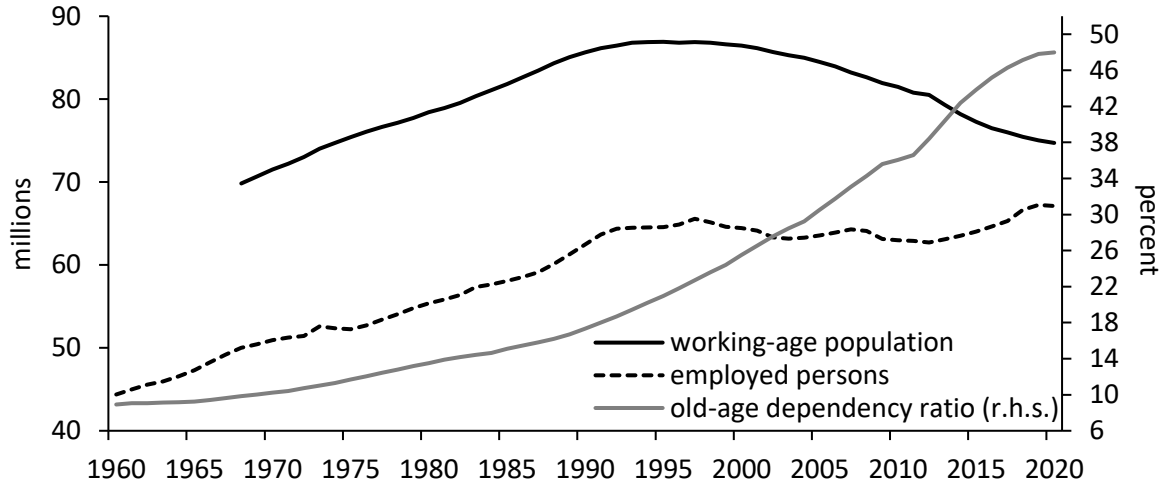


Source: Cabinet Office. The household sector includes private companies. Data before 1994 are based on 1993 national accounts.

While real wages fell sharply during the crises, they did not recover to the same extent in the recovery phases after. At the same time, interest income on household savings fell substantially (Figure 15). Iwasaiko and Okada (2012) show that higher income taxation and higher social security contributions had a negative impact on household saving through lower disposable incomes since the late 1990s. Based on the Solow-Swan growth model, lower saving results from declining disposable incomes.

Due to lower birth rates and low immigration compared to other industrialized countries, the number of working-age people (15-64) declined sharply, from which a negative impact on the savings formation can be inferred on the basis of the life-cycle hypothesis (Modigliani and Brumberg 1954). Japan is considered the second oldest country in the world with a median age of 48.4 years (2020). With the demographic change of the society, the old-age dependency ratio has increased from 8.9% in 1960 to 48.6% in 2020. Over the same period, the fertility rate has fallen from 2 children per woman in 1960 to 1.4 at present. Koga (2006), Horioka (2009), Saito (2015) and Curtis et al. (2017) infer a negative impact of the aging process on the savings rate of Japanese households in line with the life-cycle hypothesis.

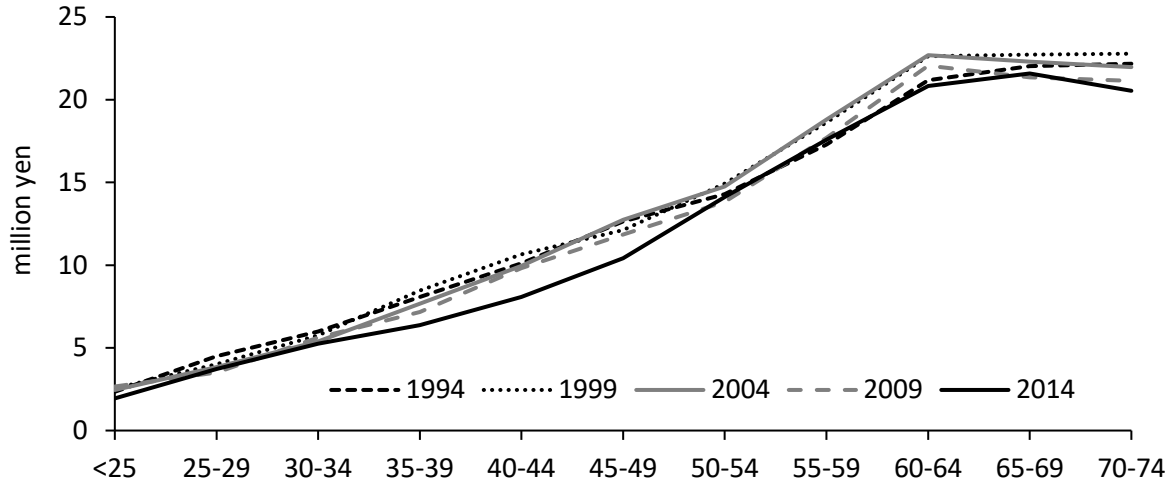
Figure 16: Labour force, employed persons and age dependency, Japan



Source: World Bank, Ministry of Internal Affairs and Communication, OECD. The working-age population is defined as people aged between 15 and 64. The labour force is defined as employed persons and unemployed persons. Unemployed persons are those who seek but do not find employment and are available in the short term. The old-age dependency ratio describes the share of the population older than 64 years in the labour force.

In line with the sharp increase in the old-age dependency ratio (Figure 16) the working-age population in Japan has fallen sharply from 86 million in 1991 to 75 million in 2020. The number of employed persons has grown from 64 million to 67 million over the same period. The increase in the employed persons was particularly evident in the wake of the Abenomics from 2013 onwards, which was accompanied by a significant increase in the wage income of the household sector (Figure 15) (while average wages continued to fall). Thus, with respect to the life-cycle hypothesis (Modigliani and Brumberg 1954), the slight decline in employed persons between 1990 and 2012 is consistent with the decline in household saving. The increase in the employed persons in the wake of the Abenomics can explain the recovery in household saving and the household saving rate since 2013.

Figure 17: Net household savings by age group, Japan



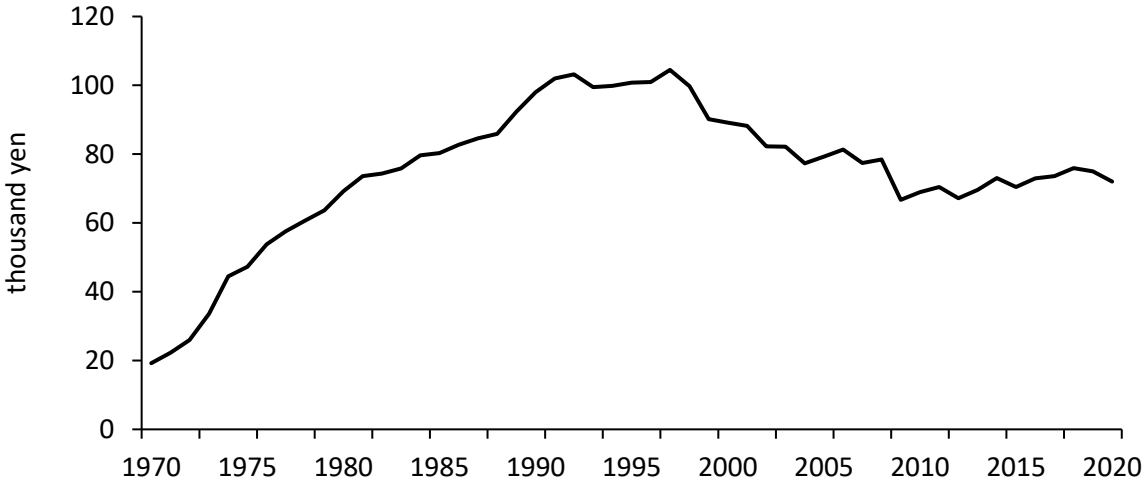
Source: Ministry of Internal Affairs and Communications. Household savings by age group refer to employee households, defined as households whose head is employed as a salaried employee or wage earner in a public or private enterprise.

The life-cycle hypothesis of Modigliani and Brumberg (1954), on the other hand, is not confirmed in that those aged between 40 and 60 saved less over time. However, while they did not dissave a decline in the savings accumulation of the over-60s can be observed over time (Figure 17). Since the people aged over 60 in Japan save more than other age groups and the size of this group has increased relative to other age groups, they have contributed disproportionately to the decline in aggregate savings.

The decline in wage levels in Japan since 1992 is associated with a decline in bonus payments, which have trended downward along with wage incomes since the early 1990s (Figure 18).

The decline in bonus payments relative to labour income since 1992 implies, consistent with the permanent income hypothesis (Friedman 1957), a negative impact on the household saving rate (Horioka 2007).

Figure 18: Average annual bonus payments per employee



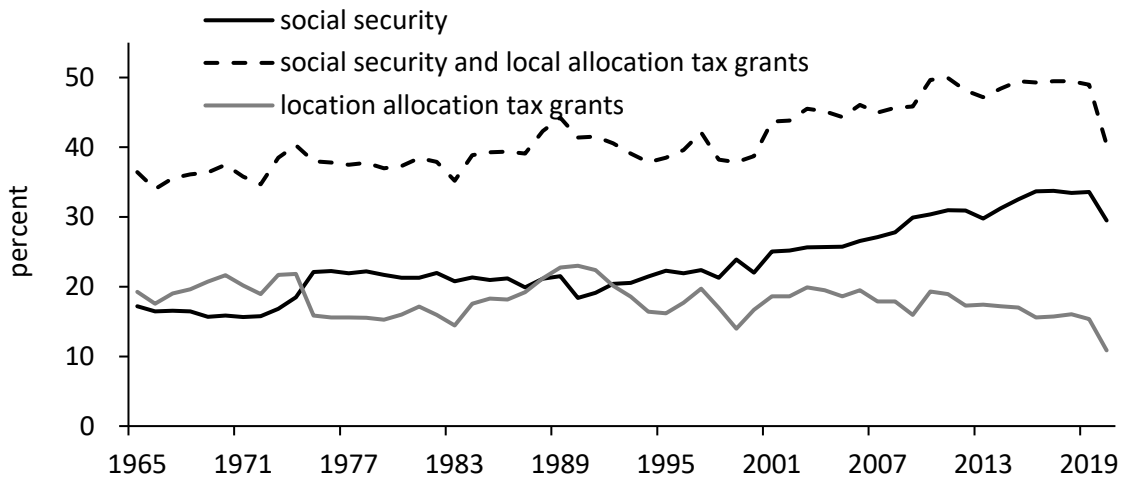
Source: Ministry of Health, Labour and Welfare.

During the high-growth phase until the 1990s, wealth and prosperity had risen strongly in the Japanese economy (Figure 6). With the risen wealth and prosperity of the Japanese society, the incentive to accumulate more wealth may have declined. However, for younger generations it became more difficult to accumulate wealth because of a declining real wage level and elevated asset prices during the bubble economy. Although the decline in domestic asset prices between 1991 and 2012 facilitated wealth accumulation compared to the second half of the 1980s, asset prices remained at high levels. Asset prices resumed to rise with the Abenomics, so that barriers to accumulate wealth remain.

In addition, the social security system, especially old-age provision, was significantly expanded, which in return greatly increased government spending and public debt (Yoshino and Mizoguchi 2010). A public long-term care insurance scheme was introduced in 2000 and the public pension system was reformed in 2004. The share of subsidies to the social security system in the total central government budget increased from 18.4% in 1990 to 32.7% in

2019. Adding local allocation tax grants[31], the share of the total central government budget increased from 41.4% (1990) to 48.0% (2019) (Figure 19).

Figure 19: Social security and regional equalization grants as a share of the central government budget, Japan



Source: Ministry of Finance.

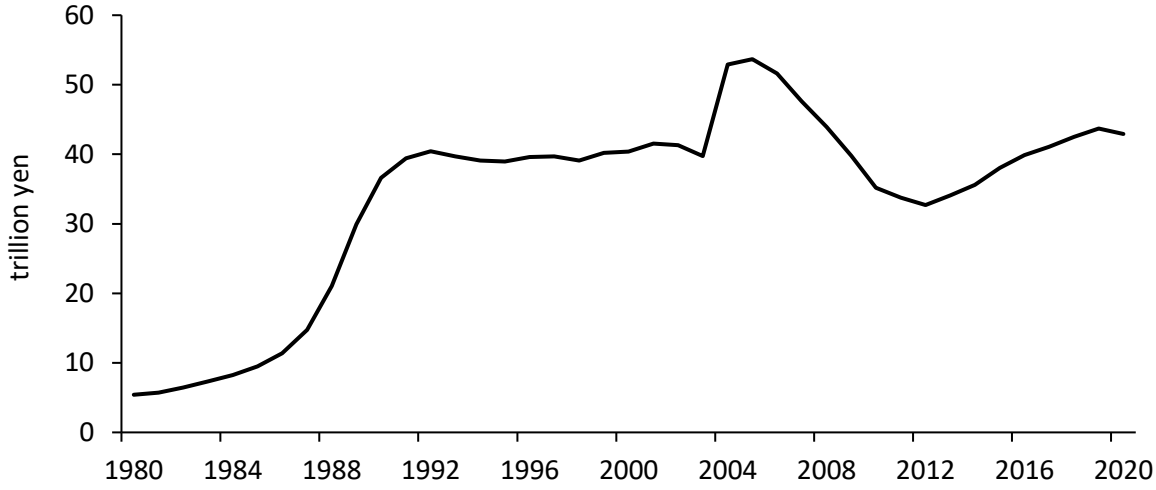
According to Yoshino and Taghizadeh-Hesary (2015), financing flows in the Japanese economy were significantly altered from the 1990s onwards. Whereas during Japan's high-growth phase, high savings financed high investment, from the 1990s onwards declining savings were increasingly channeled into social security via a detour of growing government debt.[32] Social security spending increased by 175% since 1991 from 19.1 trillion yen to 33.6 trillion yen (2019). According to Horioka et al. (2007) and Horioka (2009), this was amplified by declining disposable incomes.

Incentives to save introduced by the government were also reduced. Beginning in the 1980s, government intervention in financial markets, which restricted consumer lending, was dismantled. In 1990, consumers gained improved access to consumer credit, which Horioka et al. (2007) attribute to the decline in household saving. Between 1988 and 1992, consumer credit grew strongly and has remained broadly constant since, despite significant fluctuations (Figure 20). In 1988, tax benefits for savings (*maruyu*) were abolished (Horioka 2007). Since

[31] The local allocation grants constitute financial support for overaged perfectures.
[32] Public debt increased from 67% as a share of GDP in 1990 to 260% in 2020.

the 1990s, ever-decreasing interest rates increased the incentive to consume and decreased the incentive to save (Latsos and Schnabl 2020).

Figure 20: Stock of outstanding consumer loans, Japan



Source: Cabinet Office.

2.3.3 Monetary policy since 1990

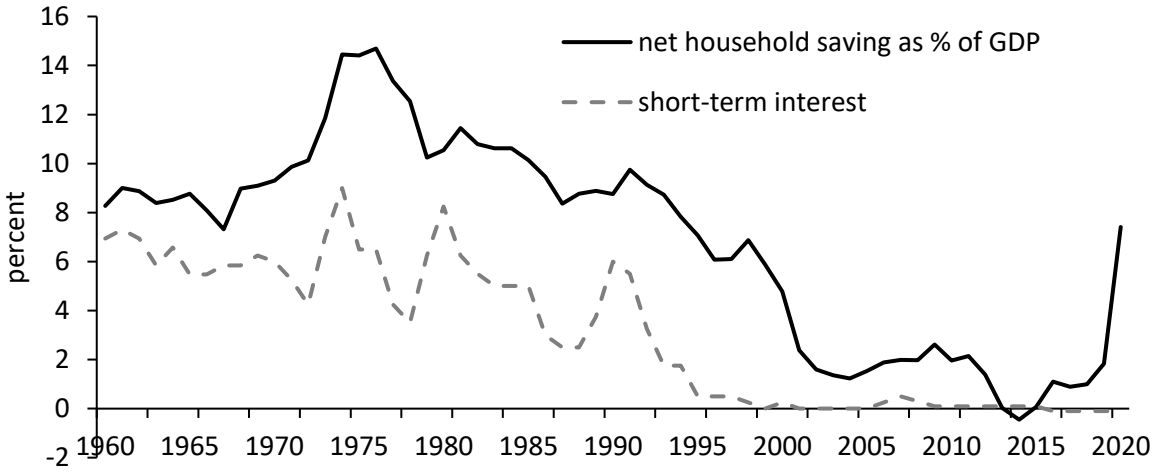
Since 1990, the Bank of Japan's increasingly loose monetary policy has influenced household saving behavior mainly through three channels. First, since the burst of the bubble economy, the Bank of Japan first lowered the short-term interest rate from 6% in 1991 to 0% in 2000 and largely kept it since then near the zero lower bound. On the 28th of January 2016, the Bank of Japan introduced negative interest rates of 0.1% on commercial banks' deposits at the Bank of Japan.[33]

After venturing into unconventional monetary policies in 2001, the Bank of Japan kept pushing down the long-term interest rate by purchasing government bonds. The interest rate on 10-year government bonds fell from 1.3% in 2001 to 0% in 2016, where it has been held ever since the introduction of yield curve control in September 2016. There is a strong

[33] The negative interest rate policy was implemented through a three-tier system. Tier 1: The Basic Balance (interest rate: 0.1%) corresponds to the average of all commercial banks' deposits at the Bank of Japan in 2015 minus the minimum reserves. Tier 2: The Macro Add-on Balance (interest rate: 0.0%) corresponds to the minimum reserves plus deposits at the Bank of Japan associated with Bank of Japan lending programs. Tier 3: The Policy Rate Balance (interest rate: -0.1%) corresponds to all commercial bank deposits in excess of the other two items. In the case of increasing deposits beyond Tier 1 and 2, the Bank of Japan may apply a multiplier to avoid too large an increase. The share of negative-rate deposits in total commercial bank deposits at the Bank of Japan was therefore small.

correlation between the development of (short-term) interest rates and the saving rate until the onset of the Abenomics[34] in 2013 (Figure 21). Since 2013, there has been an upward trend in the saving rate, again due to the Abenomics (see 2.3.2) and in 2020 due to the Corona crisis.

Figure 21: Short-term interest rates and net household saving rate[35], Japan



Source: OECD, IMF, Bank of Japan.

Second, expectations that interest rates will continue to fall have negative incentives that can lead to the zombification of firms and thus to declining productivity gains (Hoffmann and Schnabl 2016 and see Section 2.4.2). This is because additional profits accrue to firms as financing costs continue to fall. Additionally, aid from the central bank or the state can be expected in times of crises. Since the onset of increasingly loose monetary policy, productivity gains have continued to decline, from which pressure on real wages can be derived. Stagnating and since 1998 falling real wage incomes together with falling interest income from savings, have reduced the opportunity to accumulate savings (see Section 2.3.2).

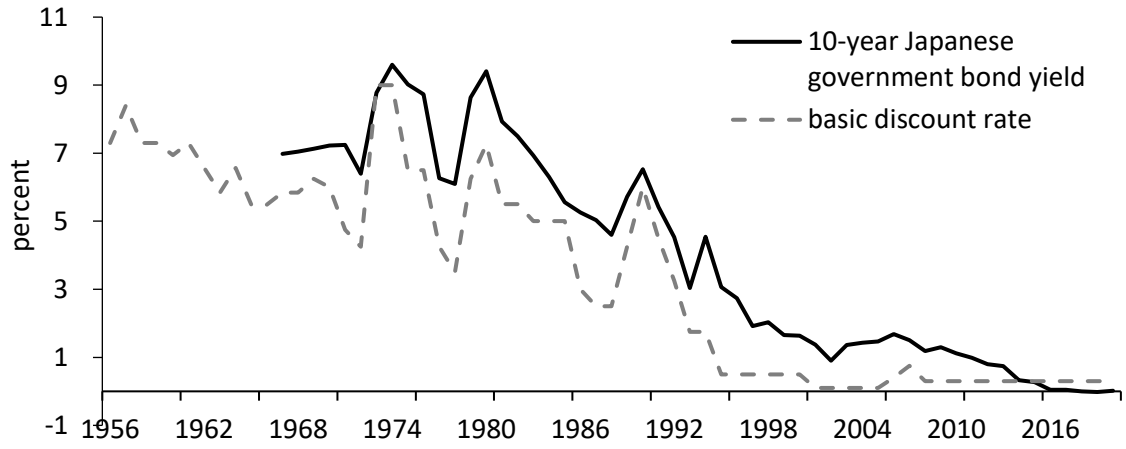
Third, increasingly expansionary monetary policies have distributional effects on wealth and income (Haldane 2014, Mersch 2014, Duarte and Schnabl 2019). Although stock and real

[34] Abenomics is an economic policy strategy that Prime Minister Shinzo Abe launched in January 2013. The three so-called "arrows" included a very expansionary monetary policy, an expansionary fiscal policy and structural reforms. Over time, the expansionary monetary and fiscal policies came to the fore.

[35] Net household saving is defined as household net disposable income after deducting consumption expenditure, fixed capital consumption and adjusting for changes in pension entitlements. Households include non-profit institutions serving households. The adjustment item captures (mandatory) household saving through the accumulation of funds in work-related pensions. The net household saving rate represents the total amount of net saving as a percentage of household net disposable income. It shows how much households save from current income and how much income they have added to their net wealth (OECD 2021).

estate prices fell for a long time after the burst of the bubble economy, Japanese capital owners are likely to have benefited from the rise in asset prices in other countries (especially the United States) as Japan is a net exporter of capital. At the same time, the savings of the Japanese middle class, which are still largely invested in bank deposits, have been devalued in real terms amid moderate inflation rates and low deposit rates, while the incomes of the rich strata of the population, who hold their savings in equity and real estate, continue to rise.[36] In addition, the negative impact of unconventional monetary policy on productivity gains is likely to put pressure on the wage incomes of the broader population (Hoffmann and Schnabl 2016).

Figure 22: Short and long-term interest rate, Japan



Source: Refinitiv, Bank of Japan. The basic discount rate is the upper limit for the interest rate of uncollateralized transactions in the financial market for lending and borrowing of short-term funds.

Low interest rates on bank deposits and government bonds (Figure 22), combined with moderate inflation rates, are devaluing low-risk assets in real terms. While those with high incomes often save and invest in stocks and real estate, lower and middle-income segments invest most of their savings in bank deposits and life insurances. This is particularly true in Japan. As inflation was low for a long time, bank deposits were a particularly popular form of saving. With low-, zero- and negative-interest rate policies, deposits have been increasingly devalued in real terms. The persistently loose monetary policy is thus likely to have

[36] Fujiki et al. (2012) show that stock market participation, defined as the percentage of households holding stocks, was about 15% between 2007 and 2010. The concentration of wealth held in assets can lead to distributional effects via asset price inflation.

contributed to a redistribution at the expense of the Japanese middle class, while the rich are likely to have benefited from the rise in stock and real estate prices.

Israel and Latsos (2020) analyze the impact of conventional and unconventional monetary policies in Japan on wage incomes. They show that expansionary monetary policies have contributed to diminish the gender wage gap and contributed to increase the education pay gap. Inui et al. (2017) show that expansionary monetary policy shocks before the millennium led to rising income inequality through wage repression. Saiki and Frost (2014) illustrate for the post-2008 period that the Bank of Japan's unconventional monetary policy increased Japanese household income inequality through the portfolio channel. Taghizadeh-Hesary et al. (2020) also link the sharp increase in money supply since the turn of the millennium to rising income inequality in Japan.

The rapid growth in employment and wages during Japan’s high-growth phase created a fast-growing middle class and contributed significantly to the increase in the savings accumulation. Thus, distributional effects of monetary policy at the expense of the middle class can be associated with a declining saving rate. Israel et al. (2022) show that over the period between 1993 and 2017, the Bank of Japan's increasingly loose monetary policy contributed to a widening of the gap in net household saving. Persistently low interest rates had a negative impact on the saving behavior of non-academic households.

2.4 Determinants of corporate saving in Japan

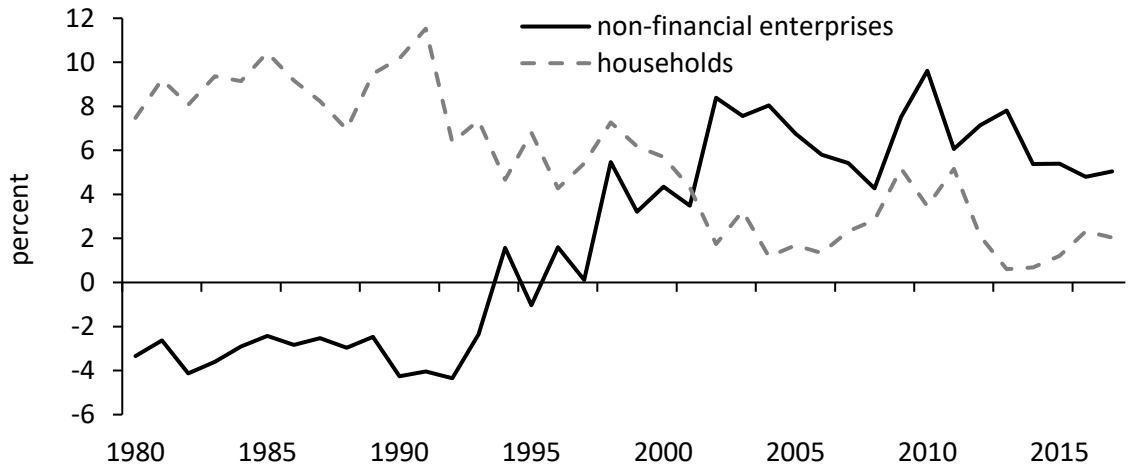
In addition to household saving, corporate saving has changed significantly over time. Whereas in the high-growth phase companies were on the demand side of on the capital market to finance investment, in the low-growth phase the corporate sector became a supplier on the capital market, as shown by the net lending/borrowing of the corporate sector compared with the household sector (Figure 23).

2.4.1 Credit crunch and reluctance to invest

Hayek's (1929) monetary overinvestment theory explains the Japanese bubble economy as an overinvestment boom and speculative bubble in the stock and real estate markets (Hoffmann and Schnabl 2016) (see Section 2.2.3). As the Bank of Japan lowered the interest

rate below the natural rate of interest[37], additional investment was financed by bank lending. More favorable financing conditions meant that many investment projects with low expected returns were financed. When the Bank of Japan raised the interest rate in the late 1980s, the bar on the profitability of investment projects was raised. Investment projects with low expected returns had to be dismantled.

Figure 23: Net lending/borrowing of enterprises and households as a share of GDP, Japan



Source: Cabinet Office. Net lending/borrowing is the difference between gross saving less (inter alia) gross investment and depreciation.

As many investment projects (especially in the real estate sector) proved unprofitable, Japanese banks were faced with a large stock of impaired loans. Loan growth slowed in the first half of the 1990s. As a result of the Asian crisis, from 1998 onwards outstanding loans declined and only started to increase slightly with the Abenomics in 2013 (Figure 5).[38] As the strong credit growth until the late 1980s was followed by stagnation, a debate on the causes of the credit crunch sparked off (Ishikawa and Tsutsui 2006). The discussion was linked to how economic policy should respond correctly to stagnating credit growth.

As Japanese banks held a substantial amount of stocks and real estate on their balance sheets, which served as collateral for loans, the decline in asset prices[39] since the bursting of the

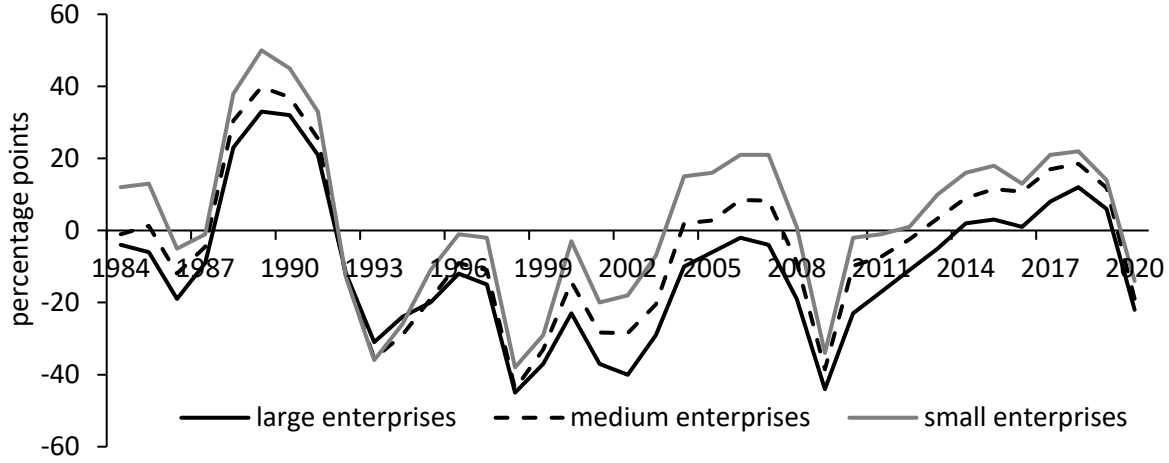
[37] The natural rate of interest is a theoretical construct. It reflects an equilibrium between investment and saving.

[38] Moreover, lending shifted from private to public financial intermediaries between 1989 and 1999. The share of private financial institutions in the total financial sector fell from 76.4% in 1989 to 62.3% in 1999, while the share of public financial institutions rose from 23.6% to 37.7% (Bank of Japan 2005).

[39] Since many Japanese firms have extensive real estate holdings, stock valuations in Japan are closely related to real estate valuations (Hoshi and Kashyap 2001).

bubble economy (Figure 6) had a negative impact on the risk-adjusted capital ratios of Japanese banks (Posen 2000, Westermann 2003).[40] In order to meet the requirements of risk-adjusted capital ratios agreed in the Basel I Accord, many Japanese banks had to increase their capital ratios in the wake of the Japanese banking crisis. The capital ratio can be increased either by raising additional capital or by reducing lending (Westermann 2003). As Japanese banks were limited in their ability to acquire new capital due to reluctant government capital injections, they reduced lending (Ito 1996, Woo 2003, Giannetti and Simov 2013), which had a negative effect on investment. According to Posen (2000) and Bernanke (2000), this led to a further increase of the risk of insolvencies, which is why they called for an expansionary monetary policy stance.

Figure 24: Development of business expectations, Japan



Source: Tankan Survey, Bank of Japan. The index shows the difference between the share of firms that have a positive business expectation and the share of those with a negative business expectation. Small businesses in the Tankan survey are companies with total assets of 20 million yen to 100 million yen. Medium enterprises are enterprises with total assets of 100 million to 1 billion yen. Large companies are companies with total assets of over 1 billion yen.

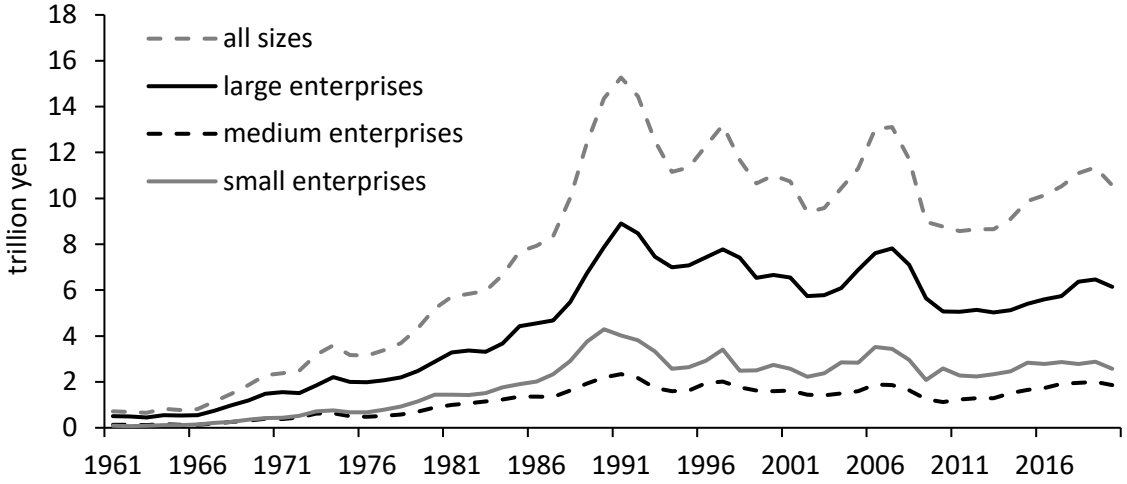
To compensate for the loss in value to be written off on the asset side of the balance sheets due to falling stock and real estate prices, companies reduced their (credit-financed) investment and increased their saving (Koo 2003). At the same time, the Bank of Japan

[40] In the Basel I Accord (1988), Japan had negotiated that stocks would be considered "tier 2 capital" and therefore relevant for meeting the risk-adjusted capital ratios ($\geq$ 8% for internationally active banks and $\geq$ 4% for exclusively domestically active banks). This meant that changes in stock prices directly translated into the balance sheets of the banking sector (Westermann 2003).

countered the credit crunch with drastic interest rate cuts, which according to Schnabl (2013, 2016), dampened firms' demand for credit. This is because the low interest rate environment coupled with financial market liberalization[41] significantly reduced companies' financing costs. Increasingly beneficial refinancing costs reduced the incentive to increase efficiency and to innovate and thereby the demand of credit. In addition, the persistent stagnation of the economy undermined the bargaining power of trade unions, leading to restrained wage settlements and thus an erosion of consumer purchasing power.

Figure 24 shows that negative business expectations have dominated for all company sizes since the 1990s.[42] Recovery phases were repeatedly followed by drastic crises. Due to the negative development of disposable incomes, no increase in consumer purchasing power could be expected, which is why companies remained reluctant to invest. This was especially true because monetary and fiscal policy bailouts disincentivized restructuring, which rendered monetary provision in form of capital investments unnecessary (Herok and Schnabl 2018). Despite cyclical fluctuations, investments of all company sizes are on a declining trend (Figure 25).

Figure 25: Investment expenditure by company size, Japan



Source: Ministry of Finance.

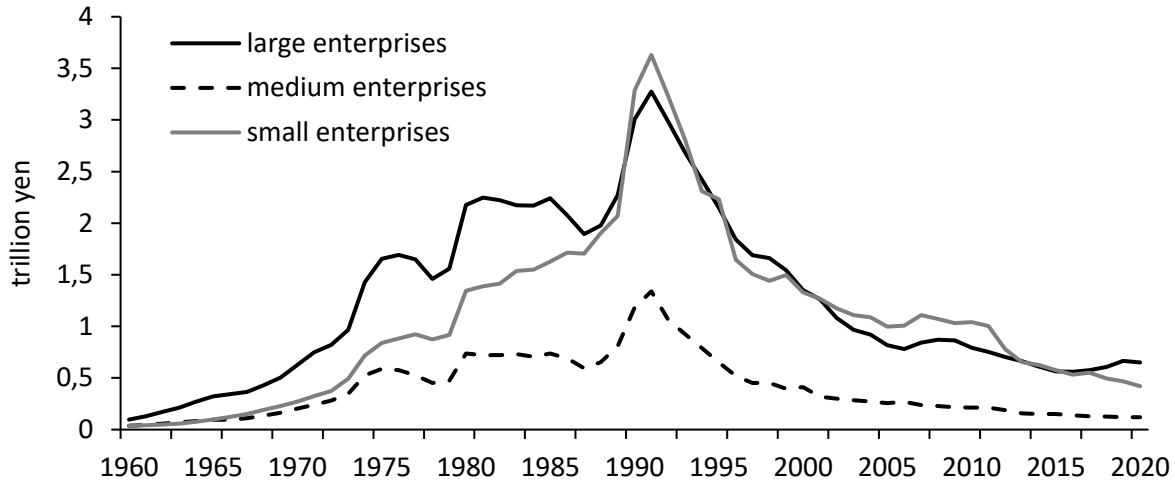
[41] The liberalization of the Japanese financial market was completed with the Big Bang of 1998 (Fujiki et al. 2012). Japanese banks were now exposed to more international competition. This triggered a process of disintermediation in the financial and banking market, which was reinforced by the ongoing low interest rate policy, and increasingly undermined the importance of banks as relationship lenders.

[42] Yoshino and Taghizadeh-Hesary (2015) show that the Bank of Japan's quantitative easing has not significantly increased aggregate demand, including investment.

2.4.2 Financing costs, wage repression and ploughing back of profits

Due to the ongoing crisis, Japanese companies benefited from both the decline in financing costs and restrained wage demands. The Bank of Japan's increasingly loose monetary policy lowered companies' financing costs to a large extent. Figure 26 shows interest expenses by firm size. The interest expenses of all firm sizes increased with the Bank of Japan's interest rate hikes in the late 1980s and early 1990s and then continued to decline as monetary policy became increasingly loose. Typically, risk premia and thus interest rate expenses are expected to rise as a result of reoccurring crises. However, this has been prevented by the Bank of Japan's monetary policy responses since the 1990s.

Figure 26: Interest expenses by company size, Japan



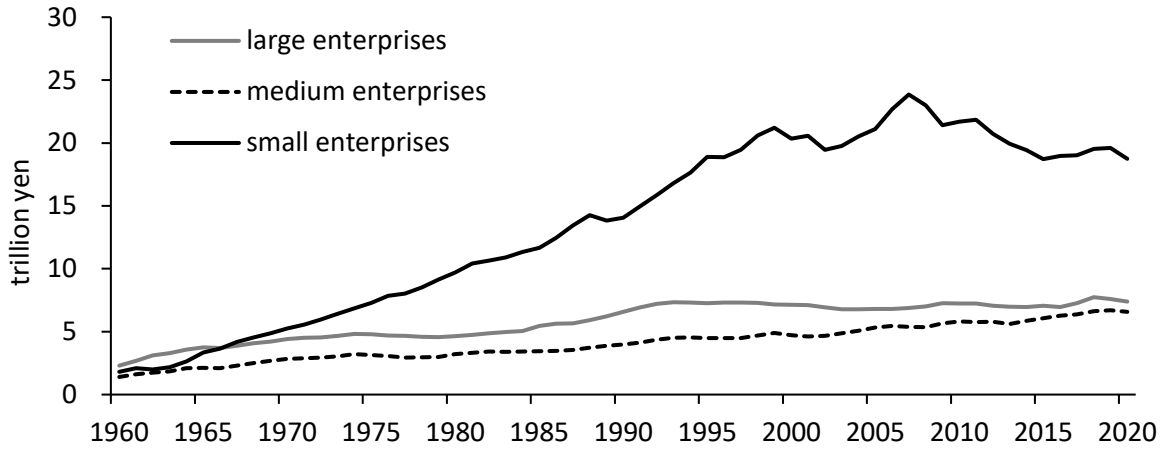
Source: Ministry of Finance.

At the same time, corporate spending on wages stagnated (Figure 27), as the prolonged crisis undermined the bargaining power of trade unions. The workers' willingness to remain reluctant in their wage demands is probably an important reason why unemployment in Japan has not risen despite the long crisis. Wage expenditures by small and large firms have been on a downward trend since 1998, while they have risen only slightly for medium-sized firms (Figure 27).

As a result, even despite the ongoing stagnation, profits remained stable and even rose again during the Abenomics until the outbreak of the Corona crisis in 2020 (Schnabl 2020). However, due to negative business expectations, profits were not invested (see Section 2.4.1)

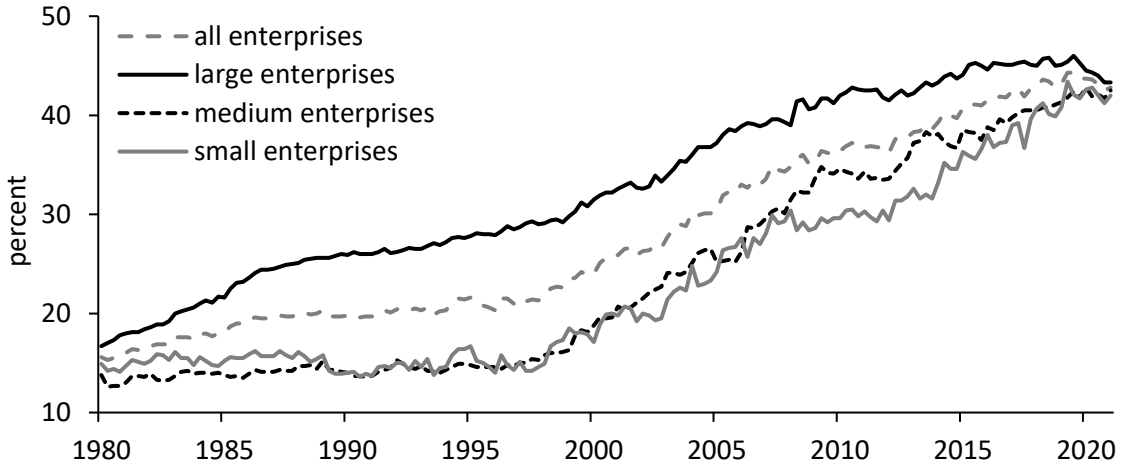
but spent on repaying loans and increasing equity (Murai and Schnabl 2021b).[43] The equity ratios of Japanese companies have therefore continued to rise for all company sizes (Figure 28).

Figure 27: Wage expenditure by company size, Japan



Source: Ministry of Finance. Wage cost include wages and salaries subject to tax deduction and comparable expenses, as well as social security contributions and payments into pension schemes.

Figure 28: Equity ratios of Japanese companies



Source: Ministry of Finance.

[43] Hong et al. (2021) show that, on average, Japanese firms' investment positively responds to a cut in policy rates. However, the response of individual firms varies significantly: healthier firms increase their investment spending and cash holdings, while financially weak firms take advantage of lower longer-term interest rates to refinance without increasing their investment.

In the view of Murai and Schnabl (2021b) “zombie firms” are therefore not only firms that have persistently low earnings and can only conditionally afford their interest service. Zombies in a broader sense are firms that (can) rely in the long run on a softening of financing conditions by the Bank of Japan, on government aid and on wage restraint by trade unions, so that "creative destruction" according to Schumpeter (1912) does not occur. They also refrain from investments and are therefore less dependent on (additional) bank lending. The persistent reluctance to invest combined with constant profits resulted in the corporate sector in Japan to become a net saver. Since 1997, the net lending of Japanese companies has on average remained at 5.6% of GDP, while the net borrowing, i.e. saving, of Japanese households has been on a declining trend since 1991 (Figure 23).

2.4.3 Disruption of the transmission function of the banking sector

As a result, the Bank of Japan's persistently loose monetary policy has not only altered the saving behavior of households and firms but has disrupted the allocation function of interest rates and the transmission function of the banking sector. During the high-growth phase of the Japanese economy, household savings surged and were passed on by banks to firms to finance profitable investment.

In this context, banks had the important task of assessing future returns on investment projects by resolving information asymmetries (see Section 2.2.2). The high-growth phase of the Japanese economy was based on the strength of export-oriented large companies (favored by the state), and on small and medium-sized enterprises. The small and medium-sized banks outside the economic centers, which provided credits to the small and medium-sized enterprises thus fulfilled a particularly important function for the growth and prosperity of Japan’s middle class.[44]

Since the mid 1980s, monetary and fiscal policy has permanently disrupted Japan's growth momentum by creating the incentive to overinvest and misallocate during the bubble economy. After the bubble burst, the persistent low-, zero- and negative-interest rate environment undermined the incentive for companies to strive for efficiency gains and

[44] A misallocation of resources in the high-growth phase could be seen in the state-directed credit allocation in this period. However, in this case the possibly negative growth effects might have been overcompensated by the generally high growth dynamics.

innovation through investment. Companies' retained earnings were often invested in the acquisition of other companies – particularly abroad (in the case of large companies). Small and medium-sized enterprises increased their bank deposits (Figure 5 and Figure 29 left panel).

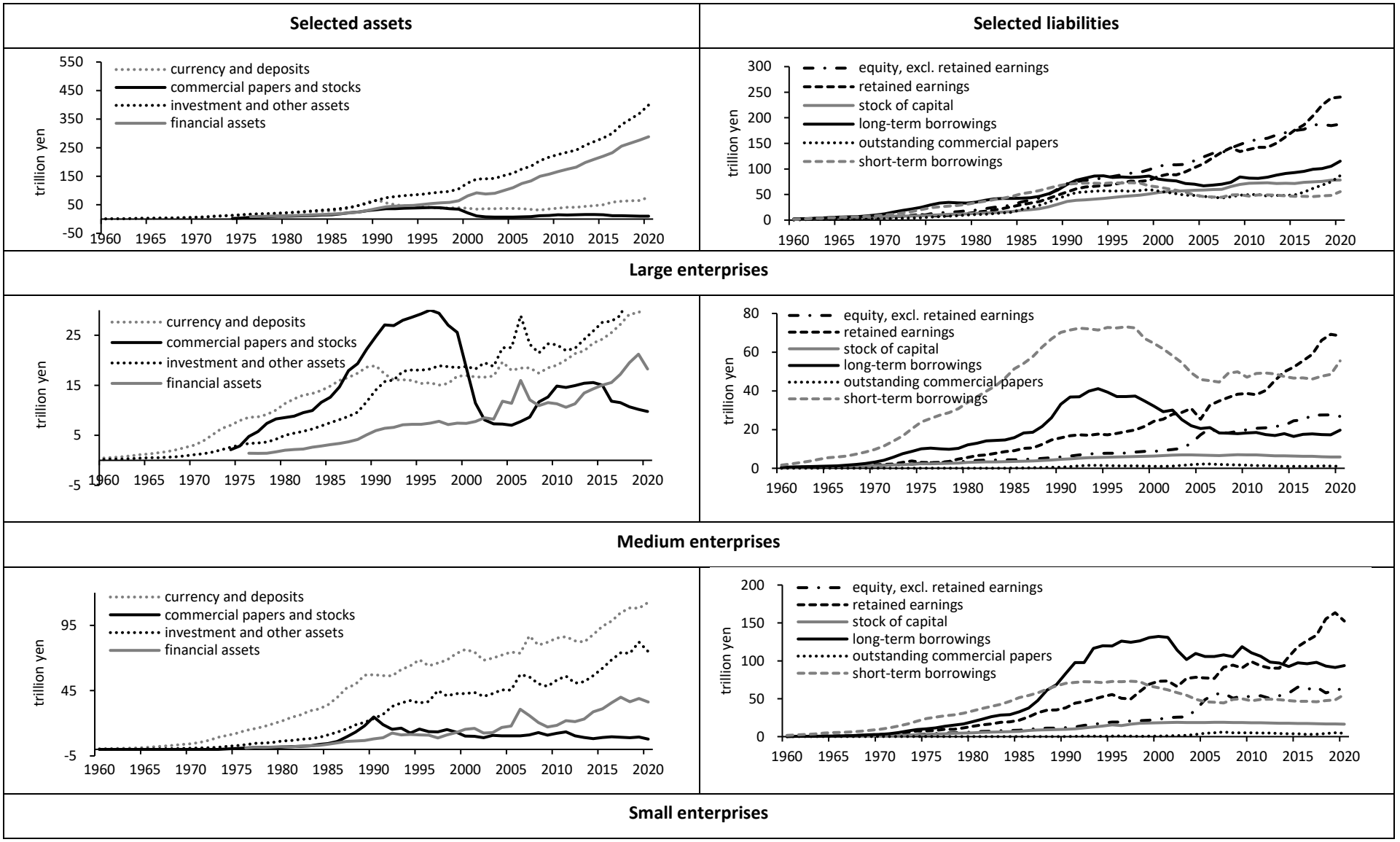
Bank loans of large companies tended to remain constant, while small and medium-sized companies reduced their liabilities to banks significantly (Figure 29 right panel). The business relationship between banks and companies changed because of the companies' growing equity and declining outstanding loans (deleveraging or substitution of debt by equity).

Banks became reluctant to lend to firms and tended to overlook potential risks when extending existing loans, what Peek and Rosengreen (2005) call forbearance lending. Commercial banks' forbearance lending was reinforced by the Bank of Japan's monetary policy and government loan guarantees, such as those provided by the Japan Federation of Guarantee Corporations (Schnabl 2020). Regulatory forbearance by the Japanese authorities, accommodated by prolonged low interest rates, weakened investment, credit demand and aggregate growth in the long run (zombification) (Caballero et al. 2008, Goto and Wilbur 2019).

At the same time, small and medium-sized enterprises' bank deposits increased sharply, so that the ratio of deposits to loans not only continued to exceed unity, but also further increased significantly from 1998 onwards (Figure 5). Japanese banks were thus increasingly confronted with the problem of investing the growing deposits/savings of enterprises and households on the capital market. For example, individual Shinkin banks collected companies' deposits at the Shinkin central bank, which invested them (comparatively riskily) on international capital markets (Murai and Schnabl 2017). The role of domestic savings as a driver of domestic growth was thus undermined, as was the transformation function of the banking sector.

Banks were initially able to compensate for the decline in corporate demand for credit by purchasing government bonds, as the government became increasingly indebted. This form of investment was lucrative for Japanese banks, as the margin between the money market rate and the interest on government bonds (transformation margin) initially developed similarly to the margin between deposit interest rates and average lending rates (interest margin).

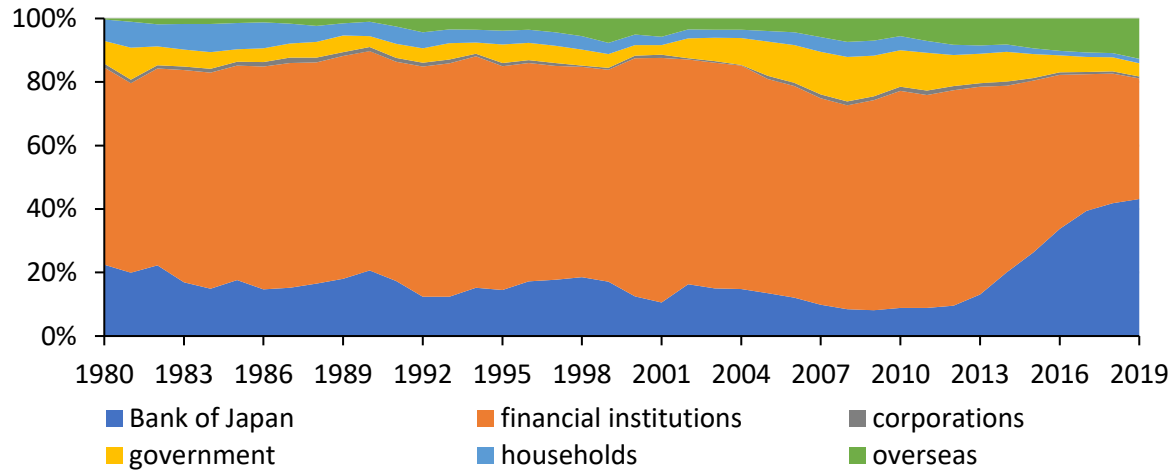
Figure 29: Selected balance sheet items of Japanese companies by size



Source: Ministry of Finance

Moreover, under Basel III, government bonds do not require risk mitigation or costly monitoring, which contributed to cost savings (Murai and Schnabl 2021a). Initially, the share of outstanding government bonds held by financial institutions rose strongly (Figure 30). Since the onset of the Abenomics, however, the Bank of Japan bought government bonds at a large scale, so that commercial banks were squeezed out of this form of investment. This further increased the need to generate income through commissions and fees (Schnabl 2020), which amounted to a further shift away from traditional banking.

Figure 30: Japanese government bonds outstanding by type of investor

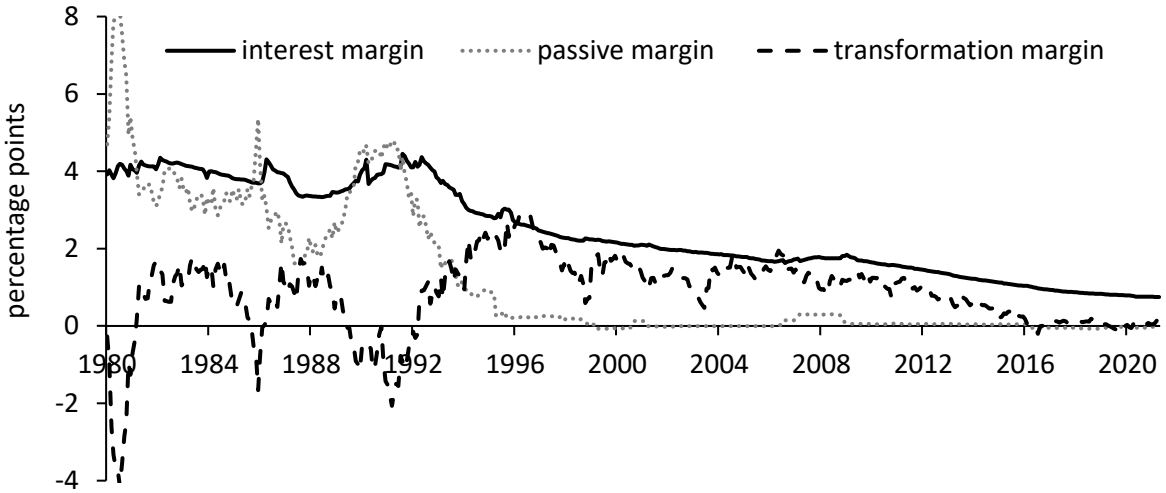


Source: Bank of Japan.

The Bank of Japan-led erosion of the traditional lending business of Japanese banks is reflected in the declining margins (interest margin, liability margin and transformation margin (Figure 31)) and shrinking interest surpluses, resulting in growing cost pressures on banks (Schnabl 2020). This has been particularly true for small and medium-sized banks outside Japan's economic centers, which were and are traditionally very heavily dependent on the lending business. By contrast, large city banks were able to form large financial conglomerates through mergers with other city banks and investment banks, which (not least due to economies of scale) could generate higher returns on the international capital and investment markets.

As a result, staff were reduced, branches closed, and banks merged. City banks reduced the number of regular employees by 42%, from 158,869 in 1994 (the year with the highest number) to 92,826 in 2019 (Figure 32).

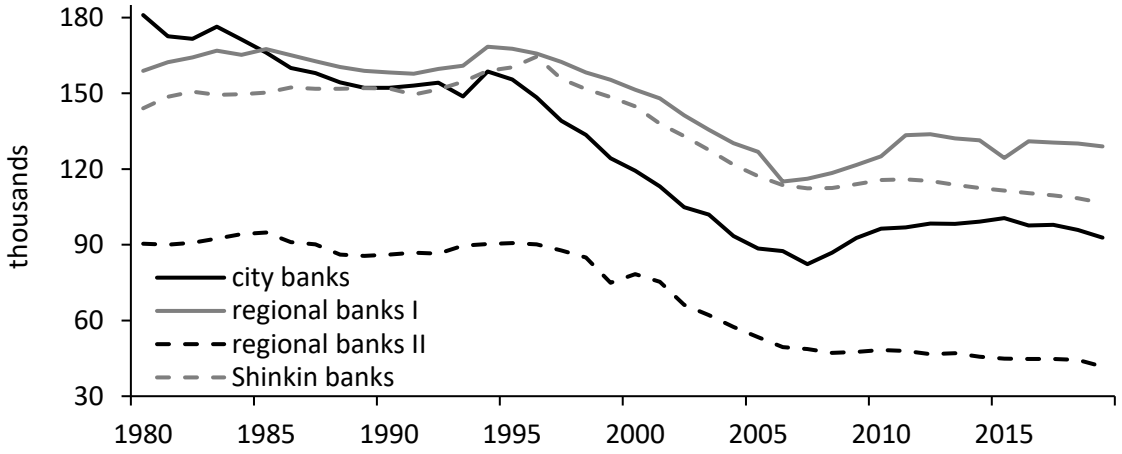
Figure 31: Margins in the Japanese banking sector, Japan



Source: Bank of Japan, Ministry of Finance.

First-tier regional banks reduced the number of regular employees by 23%, from 168,462 in 1994 (the year with the highest number) to 128,977 in 2019. In the same period, second-tier regional banks reduced the number of regular employees from 90,721 to 37,682 in 2019, a decrease of 58%. Shinkin banks reduced the number of regular employees by 33%, from 164,537 in 1996 (the year with the highest number) to 104,042 in 2019.

Figure 32: Number of regular employees by bank type, Japan

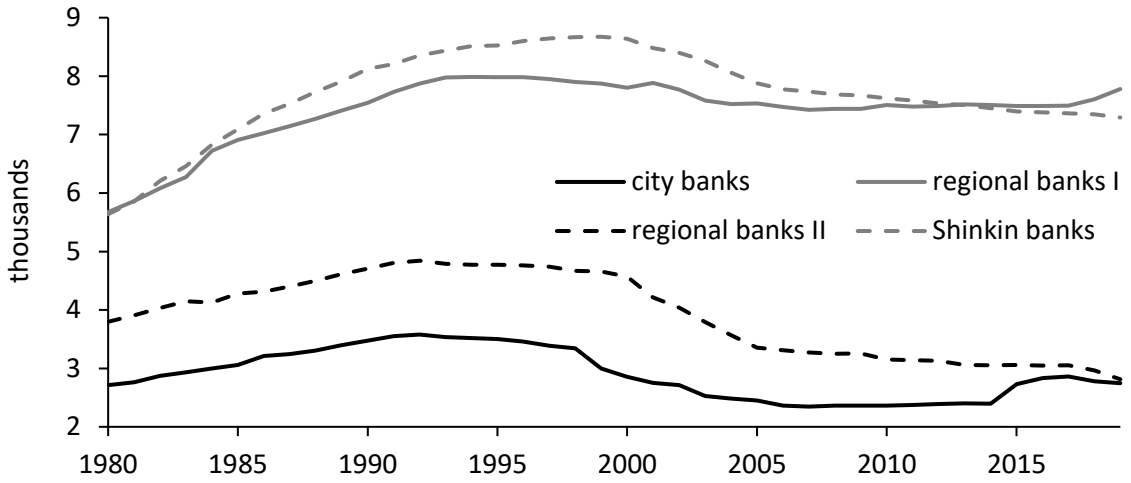


Source: Japan Financial Yearbook.

Figure 33 shows that the number of branches of all bank types increased very sharply in the 1980s, which can partly be attributed to automation in the payment business (automated

teller machines (ATM)).[45] The number of branches of city banks fell by 23% from the peak in 1992 with 3,579 branches to 2748 branches in 2019.[46] First-tier regional banks reduced the number of branches by 1.2% from the peak in 1993 of 7,978 to 7,778 in 2019, and second-tier regional banks by 42% from the peak in 1992 of 4,842 to 2,813 in 2019. Small Shinkin banks, focused on regional lending, reduced the number of branches by 15.9% from 8,673 in 1999 (the year with the most branches) to 7,294 in 2019.

Figure 33: Number of branches by bank type, Japan



Source: Japan Financial Yearbook. No distinction is made for changes in the size of branches. Small stations that only have ATMs are also counted as branches.

The reduction of employees and branches was accompanied by a gradual process of mergers. The number of city banks, second-tier regional banks and Shinkin banks has been greatly reduced. Hosono et al. (2007) distinguish four motives for mergers: realizing efficiency gains, increasing market power, expanding the scope of power of senior management (empire building), and improving bargaining power with the government for possible financial support (recapitalization). Mergers often followed the convoy principle (Shimizu 2000): economically weaker financial institutions were taken over by economically stronger institutions, often with the participation of the government.[47] For example, the recapitalizations of the banking

[45] There are two types of branches: 1) Branches with employees that offer banking services, i.e. sell mutual funds and insurance, take out loans and open accounts are called "shiten" or "honshiten". 2) Branches, where services are limited, i.e. only ATMs are called "shuchoujo".

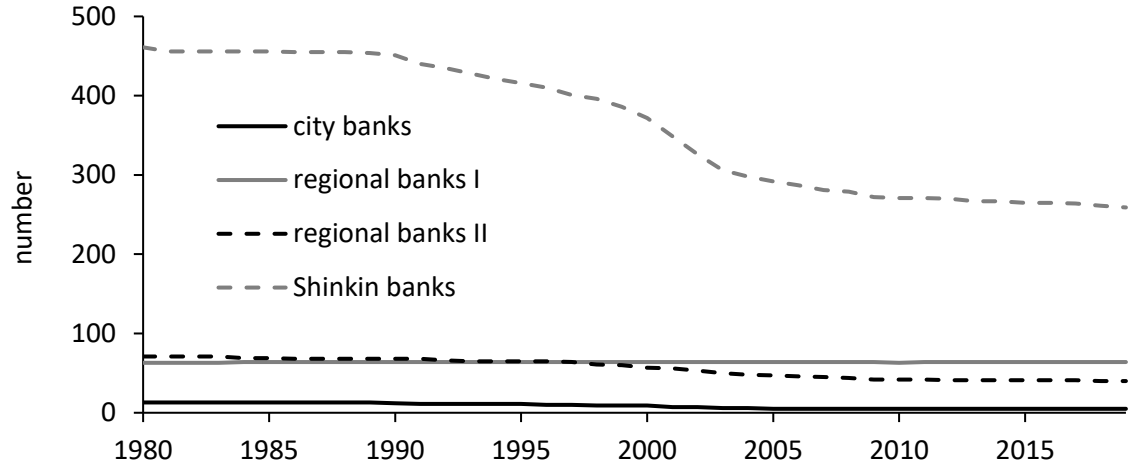
[46] The increase in the number of branches in 2015 is a special effect associated with the Tokyo Olympics (expansion of the number of ATMs).

[47] According to Nakaso (2001), the Japanese Financial Supervisory Authority treated banks more as public providers of financial services than as competing financial intermediaries.

sector from 1998 onwards were underpinned by the mergers of regional and city banks (Hosono et al. 2007).[48]

The concentration process mainly affected city banks, second-tier regional banks and Shinkin banks, while all first-tier regional banks were able to maintain their autonomy between 1999 and 2020 (Figure 34).[49] That all 64 first-tier regional banks have been able to maintain their autonomy since 1999 can be attributed to the fact that they have higher capital than the second-tier regional banks. Gerstenberger and Schnabl (2021) show that the concentration process in the Japanese banking sector has not been accompanied by efficiency gains.

Figure 34: Number of banks by bank type, Japan



Source: Japan Financial Yearbook.

Since 2019, there have been proposals to relax Japan's legislation relating to monopolies to facilitate mergers of regional banks to keep them competitive (Reuters 2019). Previously, there had been growing concerns about potential collapses. Prime Minister Abe drafted a bill in response to complaints from banks that the Bank of Japan had painfully squeezed interest margins. Previous antitrust laws often prevented mergers of smaller banks outside major cities because the merged banks would have gained a dominant market share in the relevant region. Under the bill, the new merged banks are supposed to ensure that they do not raise

[48] For example, the Special Measures Law for the Promotion of Financial Institutions Reorganization of October 2002 allowed the government to recapitalize the Kanto Tsukuba Bank in September 2003. The Financial Function Reinforcement Law took effect in April 2004 and allowed the recapitalization of sound regional and Shinkin banks. Under this law, for example, the Kiyo Holdings and the Howa Bank were recapitalized in 2006.

[49] Liu et al. (2022) show that low interest rates contribute to market leaders expanding their resources to solidify their market power. As a result, this leads to greater market concentration and lower productivity growth.

interest rates in an “unfair manner”. The softening of the legislation relating to monopolies is to be limited in time and accompanied by strengthened financial market supervision.

2.5 Conclusion

The Bank of Japan's ongoing low-, negative- and zero-interest rate policy has permanently changed the saving behavior in Japan. Whereas in the high-growth phase after the Second World War a comparatively market-friendly environment with a stable currency led to a significant increase in savings and investment, the bursting of the Japanese bubble economy has permanently changed the saving behavior. Increasingly expansionary monetary policies have significantly reduced households' incentives to save, not least via falling interest rates and negative growth and income effects. At the same time, persistently loose monetary policies have direct and indirect distributional effects in favor of companies, which have – not least because of the negative growth effects of monetary policy – remained reluctant to invest domestically.

This resulted in a fundamental shift in the savings culture in Japan. While the incentives and opportunities for households to save have been steadily reduced, the corporate sector has become a net saver. Rising corporate bank deposits have been a major contributor to the creeping change in the business model of Japanese banks. Return-oriented corporate lending has increasingly taken a back seat, while investment consulting and investment decisions in international financial markets have come to the fore.

The lingering loss of the banking system's traditional function is reflected in shrinking margins, declining interest surpluses, the gradual reduction of staff and branches, and a gradual concentration process. The result is a sustained weakening of the growth dynamics of the Japanese economy in two dimensions. First, the transformation function of banks is undermined, so that the banking sector no longer directs its activity towards financing the most profitable investments. Second, bank activity shifts away from financing by way of credit to international portfolio investment.

As a result, productivity gains have plummeted, which is accompanied by a decline in real household wages and interest income. The erosion of the savings culture in Japan can thus be directly linked to a significant loss of wealth, especially for the middle class. This is particularly

true for the Japanese periphery away from the major economic centers, whose economic fate is closely linked to local small and medium-sized enterprises and small and medium-sized banks, which are exposed to concentration effects in favor of large banks and enterprises.

Chapter 3

Japanese monetary policy and determinants of household saving

3.1 Introduction

After World War II, Japan, like Germany, went through far-reaching institutional reforms. In Germany, the 1948 currency and economic reform[50] contributed to Germany's economic miracle. In Japan, reforms known under the Dodge-Plan[51] broke up the centrally planned war economy and introduced a stable currency, market competition, market prices and decreased the scope of government interventions (Hamada and Kasuya 1992, Ito and Hoshi 2019).

The market-oriented reforms created the framework for Japan's remarkable economic catch-up process, which was accompanied by a high household saving rate. Until the early 1970s, the Japanese household saving rate had been among the highest, when households saved about one quarter of their disposable income. This has triggered research on the determinants of the Japanese household saving dating back to the 1960s. Most studies concentrating on the high growth phase of the Japanese economy have analyzed whether households saved according to the life-cycle hypothesis and the permanent income hypothesis (Mizoguchi 1970, Yoshihara 1972, Hayashi 1986, Sato 1987, Hayashi et al. 1988, Hayashi 1989).

Since the 1990s, the Japanese economy has been plagued by crises and recessions. To counter the economic dislocations, the Bank of Japan increasingly intervened in the market process and lowered interest rates towards zero in 1999. It ventured into unconventional monetary policies in 2001, which have persisted ever since. The Japanese economy grew with an average annual growth rate of 0.4% since the 1990s. The stagnant economic growth was accompanied by a declining household saving rate. In 2013, net household saving even turned negative and only recovered slightly since then. Recent research analyzed the significant drop

[50] The 1948 German currency and economic reform was implemented by Ludwig Erhard. Keystones of the currency and economic reform in 1948 were 1) free market prices, 2) a stable currency and 3) competition. For further details concerning the economic effects of the 1948 German currency and economic reform, see Buchheim (1998), Ritschl (2016) and Schnabl (2019).

[51] The basic points of the Dodge Plan consisted in 1) balancing the national budget to reduce inflation, 2) collecting taxes more efficiently, 3) decreasing the scope of government interventions and 4) fixing the exchange rate to 360 yen to one U.S. dollar to keep Japanese export prices low (Ito and Hoshi 2019).

in the household saving rate since the 1990s with a focus on the life-cycle hypothesis as Japan is aging very fast (Koga 2006, Kaiji et al. 2006, Horioka et al. 2007, Horioka 2007, Iwaisako and Okada 2012, Curtis et al. 2017, Niimi and Horioka 2019, Keiko 2019).

Institutional changes related to the BoJ's persistent zero interest rate policy coupled with unconventional monetary policy instruments and an increasing social security system have remained widely under-researched with respect to the impact on household saving. The paper analyzes the most prominent determinants of household saving proposed in the literature and puts a special focus on the impact of monetary policy and social security benefits on the saving rate of Japanese households. For the analysis, a unique long-run dataset was constructed covering the period from 1960 until 2019.

The paper finds a robust relationship between the monetary policy stance of the BoJ and the net household saving rate. The expansionary monetary environment has contributed to the decline in household saving. The analysis suggests that the distributive portfolio channel of monetary policy has an age dimension as the lion's share of financial assets is held by the elderly Japanese, which cushions the negative impact of declining interest rates. The analysis further provides evidence that household saving is disincentivized in an environment, which facilitates a debt-financed social security system. In line with the literature, the empirical analysis does not find robust evidence for the life-cycle hypothesis and the permanent income hypothesis per se.

This study contributes to the existing literature in three ways. First, it uses the longest continuous dataset available to study the most prominent determinants of household saving in Japan dealt with in the literature. Second, it provides empirical evidence that monetary policy and social security system spending under the contemporaneous monetary environment are two important determinants of Japanese household saving behavior. Lastly, the study contributes to the evolving debate on distribution effects of monetary policy in Japan.

The following section presents theoretical determinants of household saving behavior and gives an extensive literature review on the studies focusing on Japanese household saving. Section 3 presents the dataset and the empirical framework. In Section 4, the estimation results and robustness checks are shown. Section 5 concludes.

3.2 Determinants of household saving in Japan

This section provides an overview of the theoretical factors explaining household saving behavior followed by a literature survey on household saving in Japan.

3.2.1 Theoretical determinants

The most prominent determinants of household saving in the literature are disposable income (Keynes 1936), consumption smoothing in relation to permanent income (Friedman 1957), demographics and life-cycle stages (Modigliani and Brumberg 1954), wealth (Modigliani and Brumberg 1954, Ando and Modigliani 1963), and the time preference embodied in interest rates (Smith 1789, Böhm-Bawerk 1890). Institutional factors have been acknowledged to influence household saving, but this topic has remained underresearched. In this paper therefore two institutional factors – namely the social security system and monetary policy – are introduced as important determinants of the household saving behavior in Japan.

Keynes (1936) acknowledges the importance of individual psychological factors and formulates eight different saving motives. These saving motives are the preference for precaution, foresight, calculation, improvement, independence, enterprise and pride and avarice. These subjective factors, however, are regarded as given and relatively stable over time so that the propensity to save depends only on changes in the objective factors. The principle objective factors are a change in the wage-unit, a change in the difference between income and net income, windfall changes in the rate of time-discounting, changes in fiscal policy and changes in expectations of present and future income levels. Keynes (1936) therefore builds on the ability to save and suggests that household saving can be approximated by a linear function of the current level of disposable income. Thus, the more disposable income is at a households' command, the more they save.

Friedman (1957) suggests that consumption and therefore saving patterns are formed from future expectations of long-term average income. In that, people are regarded to optimize their standard of living through consumption smoothing. Changes in income can be either of permanent or transitory nature. According to the permanent income hypothesis, only changes in the expected long-term average income (permanent income) have an impact on

consumption expenditure. In turn, transitory increases in income will be saved and not spent. Households save if their current income is higher than the anticipated level of permanent income (such is the case of bonus payments). If the income falls unexpectedly, savings are liquidated (Ireland 1995).

The life-cycle hypothesis views the saving behavior as a function of disposable income, wealth, and life-cycle stages (Modigliani and Brumberg 1954, Ando and Modigliani 1963). Individuals are assumed to prefer a relatively stable level of consumption by saving in the years of employment and dissaving in old age after retirement. The life-cycle hypothesis therefore expects the saving pattern over a lifetime to be inverted U-shaped. Next to the life-cycle stages, the initial wealth endowment of a household is an additional determinant of the saving decision (Modigliani and Brumberg 1954, Ando and Modigliani 1963). An initially low level of wealth is expected to positively influence the propensity to save.

Smith (1789) points to the time preference and the preference for private profit as the main determinants for household saving. As saving is foregone consumption, the willingness to put money aside is determined by the interest rate. Rising interest rates raise the opportunity cost of current consumption and lead to more household saving. Böhm-Bawerk (1890) gives three reasons why the time preference and thus interest rates are strictly positive. First, marginal utility of income falls over time with higher expected income in the future. Second, the marginal utility of goods falls over time as people are willing to pay positive interest to get access to resources in the present and insist on being paid interest to give up these resources in the present (which is called positive time preference). Third, present goods are technically superior to future goods. Production is regarded as roundabout, which means that capital is used to transform input factors such as land and labour into output.

Central to how institutions[52] can influence private saving decisions is the impatience and uncertainty inherent in human action.[53] The household saving decision depends on the marginal utility of exchanging present consumption for future consumption, that is, the households' intertemporal rate of substitution. The greater subjective value attributed to

[52] Institutions set the rules of the game in a society shaping human interaction through imposed constraints. As such, institutions provide the external incentive structure of an economy (North 1990).
[53] This concept is closely related to the Austrian time preference theory of interest (Böhm-Bawerk 1890, Mises 1949). For a detailed description of the time preference theory of interest and the allocative function of interest rates see Schnabl and Sepp (2022).

present need satisfaction relative to the subjective value attributed to future need satisfaction translates into a positive relationship between interest rates and saving (Belke and Polleit 2009).

Institutions, i.e. social security systems can influence the households' perceived uncertainty and impatience and as such the saving behavior. Having a well-defined safety net which provides for financial precaution in the future can reduce economic uncertainty and the willingness to save, respectively. Central bank's monetary policy can influence households' intertemporal rate of substitution. Expansionary monetary policy, i.e. lowering interest rates, lowers the opportunity costs of present consumption and thus reduces the incentive to save (Smith 1789, Ricardo 1821, Mises 1949). It may also influence the saving pattern by facilitating the expansion of the social security safety net. Persistent unconventional monetary policies, i.e. large-scale asset purchases, can further affect the ability and willingness to save through distribution effects on household income and saving.

Distribution effects of monetary policy[54] on household saving mainly materialize through the earnings heterogeneity channel and the portfolio channel (Coibion et al. 2017, Nakajima 2015 and Inui et al. 2017). The portfolio channel captures the impact of monetary policy through the composition of households' savings portfolios. Monetary policy measures that elevate asset and equity prices benefit those households' that hold a larger portion of their savings in financial assets. In Japan, the lion's share of financial assets is held by elderly households whose head is aged 60 or above (Niimi and Horioka 2019, Nippon 2021). Therefore, the portfolio channel of Japanese monetary policy is composed of an asset and age dimension.

3.2.2 Previous research

Japan is an important case to study the determinants and development of household saving behavior. The literature focusing on the high-growth phase of Japanese household saving mainly analyzed whether households saved according to the life-cycle hypothesis. Recent research mostly analyzes the decline in the saving rate in light of demographic changes. The

[54] For an extensive overview of potential transmission channels through which monetary policy constitutes distribution effects on household finances see Coibion et al. (2017), Nakajima (2015) and Inui et al. (2017).

empirical literature focusing on institutional factors such as monetary policy and the social security system is sparse.

Yoshihara (1972) analyzes Japanese consumption and income data to explain how growth rates influence Japan's household saving rate between 1953 and 1967. He challenges Keynes' (1936) view that the relationship between income and saving is linear as Japan has one of the highest saving rates, but not the highest GDP. His results suggest that the high household saving is due to various factors such as the age composition of the Japanese society, the relative importance of bonus payments, the initial low level of assets and habit persistence.

The evidence of the life-cycle and permanent income hypothesis as an explanation of the high Japanese household saving rate during Japan's economic catch-up process is mixed. For the period between 1958 and 1968, Mizoguchi (1970) shows that income from bonus payments, additional payments for overtime work, income from side business and transfers had markedly increased. In line with the permanent income hypothesis, he suggests that this has led to an upward trend in the household saving rate. However, as the permanent income hypothesis only explains the upward trend in the household saving rate, Mizoguchi (1970) argues that the high level of household saving is explained by the life-cycle hypothesis.

In contrast, Hayashi (1986) argues that the Japanese demography speaks against the life-cycle hypothesis. He models the life-cycle hypothesis for Japan from 1970 to 1980 and calculates steady state simulations of the household saving rate. He points out that the conceptual national accounting difference between the U.S. and Japan explains part of the extraordinary high Japanese household saving rate and not necessarily the life-cycle hypothesis. Hayashi (1989) confirms this observation by using the U.S. definition[55] to calculate Japan's national saving rate from Japanese national accounts for the period from 1955 to 1987. However, Hayashi et al. (1988) acknowledge the existence of a life-cycle element in households' high saving rate as households are induced to save more early in life to meet higher down-payments of their mortgage. Yet, they argue that the factor is comparatively small.

Recent literature focusing on the decline in the Japanese household saving rate resonates the life-cycle hypothesis as one of the main explanatory variables. Horioka (2007) assigns the

[55] The U.S. definition of national saving accounts excludes government capital and values depreciation at replacement cost.

declining household saving rate since the mid-1970s to the rapid aging of Japan's population. For the same time span, Horioka et al. (2007) find evidence that the age structure of Japan's population can explain the level of past and future trends in the household saving rate.

Goh et al. (2020) use time-series data from 1960 to 2015 on population age shares of Japan to test if these have long-run effects on domestic saving. They also find support in favour of the life-cycle hypothesis. Curtis et al. (2017) use a model of household life-cycle saving decisions to quantify the impact of demographic changes on aggregate household saving rates in Japan for the period between 1955 and 2003. Their simulation suggests that the growing number of retirees suppresses Japanese households' saving rate since the mid-1970s.

These findings are underlined by Koga (2006) as well as Iwaisako and Okada (2012) who investigate the sharp decline in the Japanese household saving rate since the 1990s. Koga (2006) shows that the impact of Japan's aging society as predicted by a life-cycle model is in line with time series data on the Japanese household saving rate. Iwaisako and Okada (2012) emphasize business cycle effects associated with the 1998 financial crisis. The burden of the financial crisis was mostly borne by the younger generation exacerbating a downward pressure on the household saving rate. This effect is argued to be amplified because of the further aging society.

More recently, the focus has shifted towards analysing the (dis-)saving behaviour of the elderly in Japan. As Japan has moved towards being one of the oldest nations worldwide, dissaving of elderly households is expected. Keiko (2019) points towards mixed evidence regarding the life-cycle hypothesis as there is no general wealth decumulation of elderly households observable for the period between 1984 and 2012. He explains this observation by pointing towards bequest motives and precautionary saving on behalf of elderly households. He neither finds clear evidence in support of the permanent income hypothesis.

Horioka (2009) as well as Horioka and Niimi (2017) find that the elderly retired decumulated their wealth only at a rate between 1 to 3 % annually. This implies that many die with significant wealth. Niimi and Horioka (2019) show that precautionary saving and bequest motives play a relatively important role in explaining the low wealth decumulation of the retired elderly. They also suggest that the financial burden of parental care leads to high saving rates among older households.

There are only few papers that discuss the effect of the social security system on Japanese household saving. For instance, Horioka (2007) concludes that Japan's high household saving rate was a temporary phenomenon caused by temporary economic, demographic and institutional factors such as an underdeveloped public pension system. Horioka et al. (2007) simulate the impact of the 2004 public pension reform on the household saving rate. Their results suggest that the enlarged public pension system will exacerbate further the downward pressure on household saving.

Latsos and Schnabl (2021) provide evidence that monetary policy is an important driver in changing the incentives for household saving. They show that the decline in household saving since the 1980s is associated with low-interest rate policies by the BoJ. Israel et al. (2022) find that over the period from 1993 to 2017 monetary expansion contributed to a widening gap in the ability to save for households of different academic backgrounds.

As additional institutional factors the limited availability of consumer credit and the *maruyu*-system of tax-exempt interest income are also argued to have contributed to Japan's high household saving rate in the past (Mizoguchi 1970, Sato 1987, Hayashi et al. 1988).

3.3 Data and empirical framework

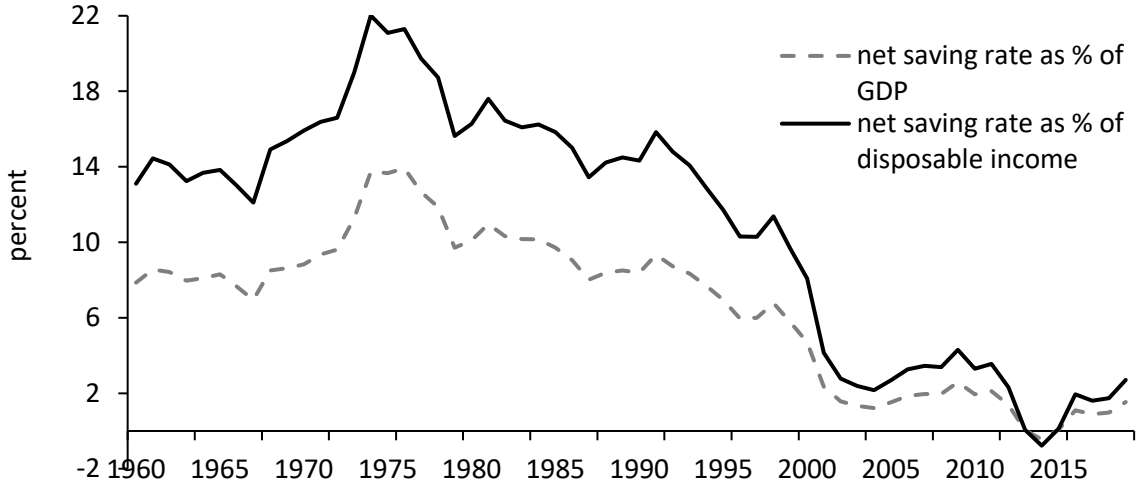
A newly constructed continuous long-run (1960-2019) dataset from several data sources is used. It covers Japan's shift from high to low growth, which is associated with an exceptionally high and low household saving rate, respectively. The variables and empirical framework are presented and discussed in the following sections.

3.3.1 Data description

The target variable of the following analysis is the annual net saving rate of Japanese households. It is calculated as the ratio of net household saving to either GDP or household disposable income. Net household saving is compiled according the 1993 Japanese System of National Accounts as household disposable income deducting consumption expenditures, fixed capital consumption and adjusting for changes in pension entitlements.[56]

[56] The adjustment item refers to required savings that households make by contributing to pension schemes related to their employment, which helps to build up funds for their retirement.

Figure 35: Japanese household net saving rate

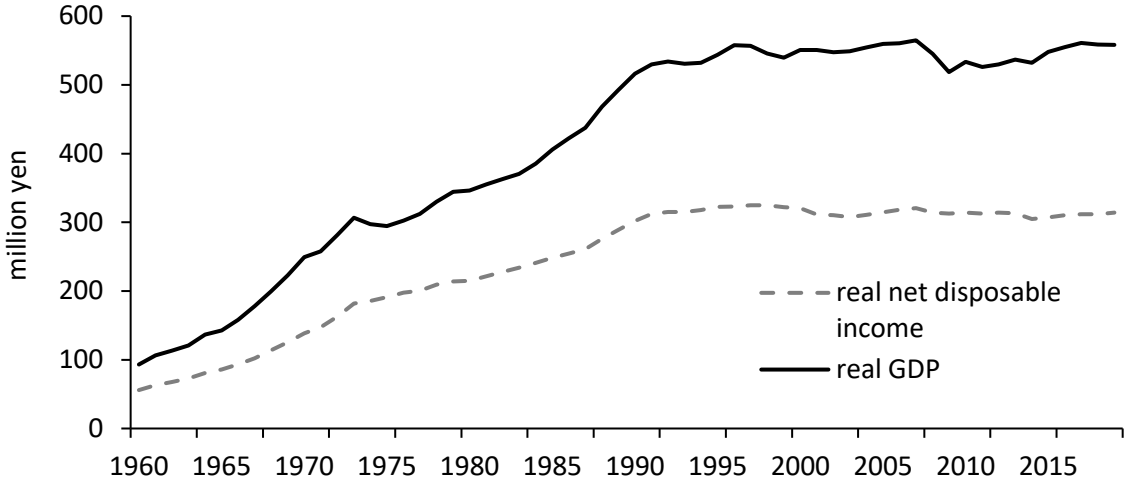


Source: OECD.

Over the six decades analyzed in this study, Japan's net saving rate has gone through dramatic changes. After the reconstruction phase after World War II, Japan's household saving rate has climbed up to one of the highest in the industrialized world, where households saved almost one quarter of their disposable income. With the burst of the stock price bubble in 1989 and the real estate bubble in 1991 the household saving rate deteriorated persistently. In 2013, net household saving even turned negative, reaching -0.6% (as a share of GDP) and -1.0% (as share of disposable income), respectively (Figure 35). Since 2013, the household net saving rate recovered somewhat. This can be associated with positive employment effects of Shinzo Abe's Abenomics (Schnabl and Sepp 2022).

Since the ability to save is constrained by the overall state of the economy, and according to Keynes' (1936) notion that household saving directly depends on household disposable income, the rise in household saving in the 1960s can partly be attributed to Japan's catch-up process in GDP and income after World War II. The main variable to capture the ability to save in the analysis is thus net household disposable income. It denotes income available to households from salaries, self-employment, social security benefits, and financial investments minus depreciation costs. From 1960 to 1990, Japan's economy grew in real terms by an average of 5.9% annually. In the same time, household disposable income grew by an average of 5.8% annually. The marked decline in growth since the bursting of the bubble economy had a negative impact on GDP and income, which have stagnated since the 1990s with an average annual growth rate of 0.4% and 0.3%, respectively (Figure 36).

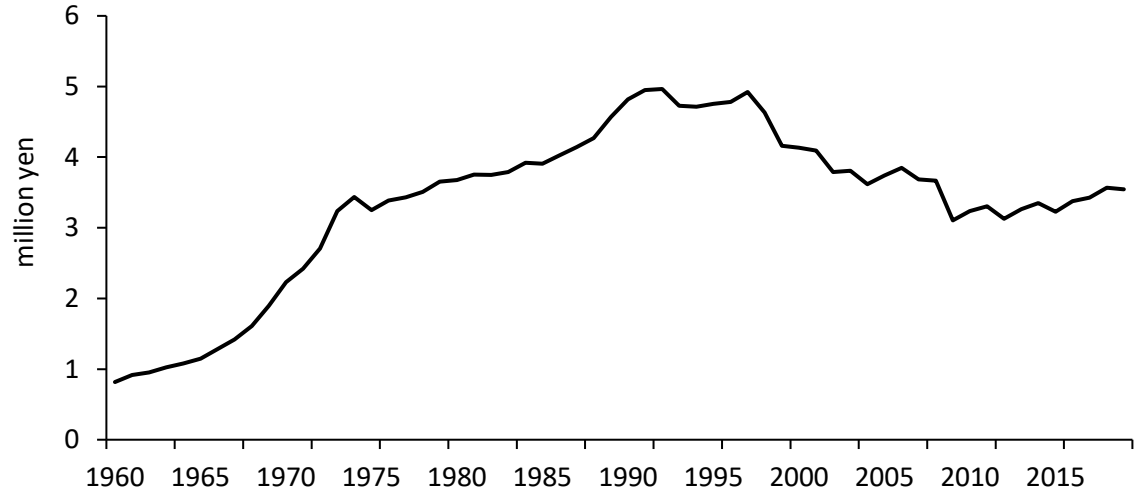
Figure 36: Real net household disposable income and real GDP, Japan



Source: OECD. Real net household disposable income and real GDP are calculated in 2020 prices.

To capture the permanent income hypothesis, special cash earnings to account for bonus payments are included in the model. Special cash earnings reflect payments for temporary or special reasons. They also include payments because of summer and year-end bonuses and allowances. The gradient of bonus payments resembles the economic environment outlined in Figure 2. From 1960 to 1990, bonus payments increased at an average annual rate of 6.1%. Since 1990, bonus payments fell on average by 0.8% annually (Figure 37).

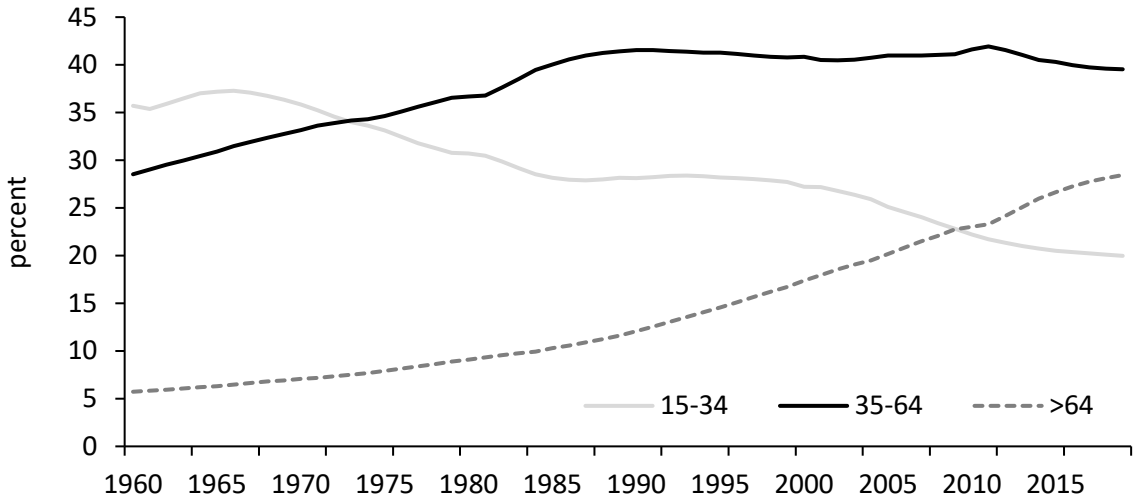
Figure 37: Real bonus payments per household per year, Japan



Source: Ministry of Health, Labour and Welfare. Real bonus payments are calculated in 2020 prices.

According to the life-cycle hypothesis, individuals seek to smooth their consumption throughout life by borrowing when their income is low, saving when their income is high and dissaving when they are in retirement. This coincides with an individual's income, which is typically low in younger years, climbs up in prime-age and is replaced either by pension benefits or by wealth decumulation in retirement. Hence, three age groups – measured as the population share of the respective age group estimates from the population census – are included as proxies for the life-cycle hypothesis. The three age groups capture the OECD's definition of the working-age and elderly population.[57]

Figure 38: Age groups as a share of the total population, Japan



Source: Ministry of Internal Affairs and Communication.

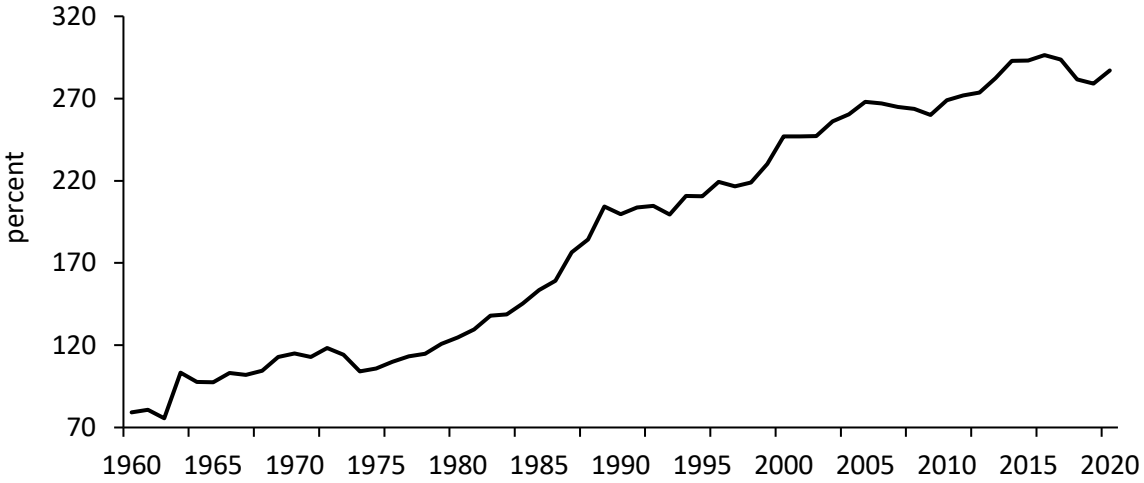
The first age group represents the share of those aged between 15 and 34. The population share of the young peaked in 1966 with 37.3%, and declined steadily ever since, standing at 19.9% in 2019. The second age group are those in their prime working-age (35-64). The share has grown up to 41.6% of the total population in 1990 and has been stagnant since. The third age group represents the elderly and (mostly) retired Japanese population aged above 64. In 1960, their share stood at 5.7% and has climbed up to 28.4% in 2019 making Japan the second oldest nation worldwide (Figure 38).

An additional dimension of the life-cycle hypothesis influencing the saving behavior is the wealth endowment. Theoretically, in young years the initial level of wealth is low incentivizing

[57] According to the OECD's the working-population is defined as the population aged between 15 and 64. The elderly population are defined as those aged above 64.

saving to build up wealth over the working years. In old age, wealth is decumulated through dissaving. A suitable proxy for the wealth endowment of Japanese households is the ratio of average household savings to average annual household income. While in the 1960s the average Japanese household accumulated savings in the magnitude of 96% of annual income, in 2019 the savings to income ratio amounted to 279% (Figure 39).

Figure 39: Savings to income ratio, Japan



Source: Ministry of Internal Affairs and Communications.

Social security spending as a share of the general account budget[58] of the government is one of two institutional proxies in this study (Figure 40). Social security spending includes payments to the public pension system and public transfers within the regional financial equalization scheme (local allocation tax). The local allocation tax can be seen as a transfer to the elderly population, as Japan's economically weak prefectures tend to be overaged (Latsos and Schnabl 2021).

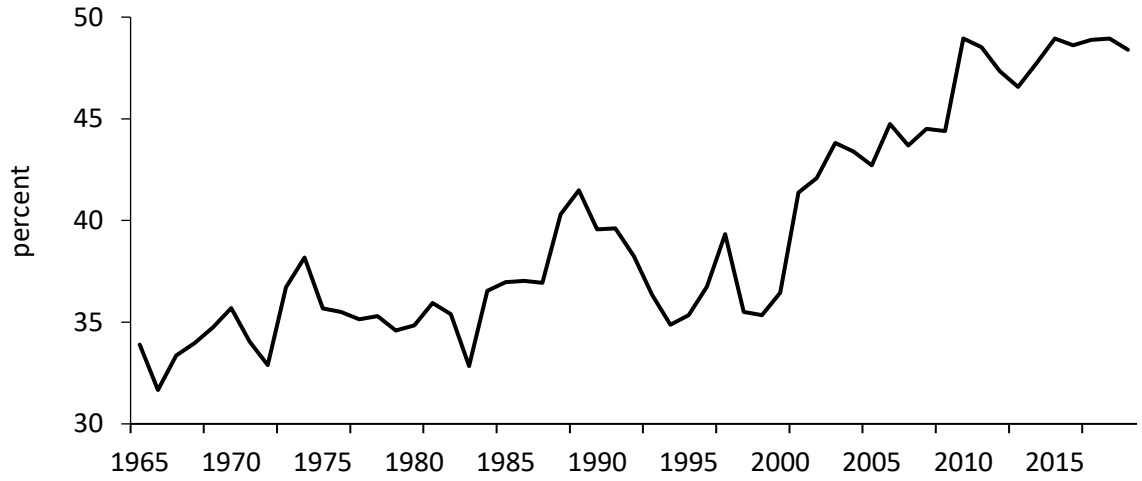
For a long time, social security spending was comparatively low in Japan. While in the UK 13.1%, in Germany 13.5% and in France 16.1 % of the GDP was spent on social security, Japan only spent 5.8% of its GDP in 1995. In 2000, public long-term care insurance[59] was introduced,

[58] The general account budget covers government expenditure such as social security, public works, education and national defense.

[59] To address the needs of Japan's progressively aging population, the public long-term care insurance was introduced in 2000. The program is based on three basic concepts. First, to support independence. Second, a user-oriented system based on the freedom of choice. Third, the adoption of a system where the relation between benefit and burden is clear. To support the basic concepts, the program has three distinctive characteristics. First, all persons aged 40 and over contribute by paying a premium according to their income.

and in 2004 the public pension system was reformed. Since 2000, social security spending as a share of GDP grew from 6.2% to 9.5%, and from 36.4% to 48.4% as a share of the general account budget, respectively. According to Yoshino and Mizoguchi (2010), the expansion of social security benefits was largely financed through increased public debt. Yoshino and Taghizadeh-Hesary (2015) argue that financial flows in the Japanese economy were significantly altered from the 1990s onward. Savings were increasingly channeled into social security via growing government debt.[60] Social security spending increased by 80% since 1990 to 49.1 trillion yen in 2019.

Figure 40: Social security spending as a share of the general account budget, Japan



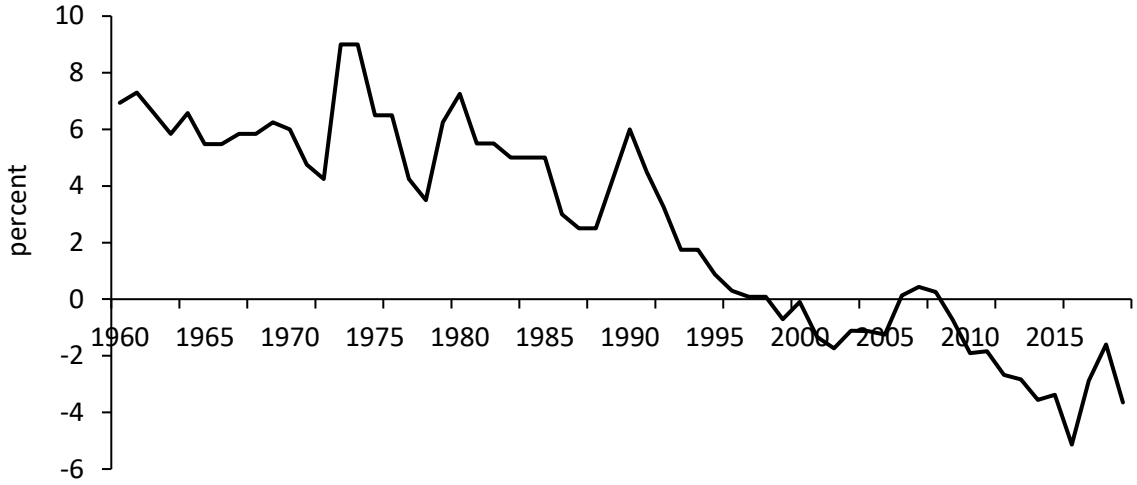
Source: Ministry of Finance.

Monetary policy can influence the saving behavior in two ways. First, the interest rate has the function to allocate scarce resources inter-temporally (Israel 2020). It conveys the knowledge about which investment projects can be realized with a limited amount of available savings (Mises 1912, Mises 1949). The interest rate thus separates high-yielding investment projects from investment projects with low yields. Therefore, it directs investment activities and determines the length of the production structure (Hayek 1935, Garrison 2002). Second, the willingness to save is directly connected with the interest rate. With declining interest rates, future consumption (saving) is substituted by present consumption.

Second, all persons aged 65 and over can access the benefits. Third, all services are subject to co-payment of 10% regardless of income (Ministry of Health, Labour and Welfare 2016).

[60] General government debt increased from 63% as a share of GDP in 1990 to 235.4% in 2019.

Figure 41: Krippner's shadow short-term rate of interest, Japan



Source: Bank of Japan, Krippner.

To counter the setbacks of the bubble economy, since the early 1990s the BoJ gradually lowered the short-term interest rate towards the zero lower bound in 1999 and ventured into unconventional monetary policies in 2001. With the outbreak of the Great Financial Crisis in 2008, the Japanese economy contracted by 8.3% in real terms in 2009. In response, the BoJ started its second unconventional monetary policy program with outright purchases of JGBs, corporate bonds and commercial papers (Saiki and Frost 2014). In 2016, the BoJ adopted further aggressive monetary easing tools, i.e. Quantitative and Qualitative Easing.[61] [62] Currently, the BoJ is holding 80% of the Japanese ETF market and 8% of the entire Japanese stock market making it the single largest investor in the Japanese economy (Harada 2021). The share of JGBs held by the BoJ amounts to over 50% of the total JGBs (Nikkei Asia 2022).

The monetary policy indicator used in the analysis is a combination of the main policy rate and the Krippner shadow rate (ssr). The Krippner shadow rate is a useful summary statistic that incorporates both conventional and unconventional monetary policy measures of the BoJ (Figure 41). Krippner (2020) translates the influence of asset purchases on the yield curve into changes in the short-term interest rate. Since the overnight rate is constrained by the zero-lower bound, this allows to have an idea of how unconventional monetary policy

[61] The qualitative dimension refers to asset purchases such as JGBs, ETFs and J-REITs. The quantitative dimension refers to expanding the monetary base.

[62] The BoJ's unconventional monetary policy programs reflect massive interventions into market mechanisms, especially with respect to the signaling function of prices (Kirzner 1973, Hayek 1974).

translates into conventional interest rate cuts bringing the shadow rate into negative territory.

3.3.2 Estimation framework

The study analyzes the most important determinants of household saving, which the economic theory postulates. The empirical analysis is supplemented by two institutional factors, namely social security benefits, monetary policy.

An OLS model with robust standard errors ϵ_t over the timespan of 54 years is used as the empirical framework:

$$y_t = \alpha_t + \beta_1 inc_t + \beta_2 pih_t + \beta_{3,4,5} lch_t + \beta_6 wh_t + \beta_7 ssp_t + \beta_8 ssr_t + \beta_{9,10,11} lch_t \; x \; ssr_t + \beta_{12} ssp_t \; x \; ssr_t + \beta_{13} maruyu_t + \epsilon_t \quad (1)$$

The target variable y_t is the annual net household saving as a share of GDP of year t. The explanatory variable inc_t corresponds to the real net household disposable income. It represents the ability to save and the corresponding coefficient β_1 captures the propensity to save. It is expected that the covariate is positively associated with the net household saving rate. The permanent income hypothesis is captured by the real average yearly bonus payments pih_t. The permanent income hypothesis postulates that unexpected income surpluses are saved. Thus, a positive sign for β_2 is expected.

The variable lch_t represents the indicator for the life-cycle hypothesis. In the baseline estimation, the life-cycle hypothesis is represented by three different age groups as a share of the total population to capture the effect of Japan's demographic structure on the household saving rate. The first age group are those aged between 15 and 34 (β_3), the second age group is the share of the population between 35 and 64 (β_4) and the third age group is the share of the population aged older than 64 (β_5). According to the life-cycle hypothesis, a positive sign is expected for the coefficients β_3 and β_4 and negative sign for the coefficient β_5. The wealth indicator wh_t is included in the model in form of the savings to income ratio. According to the life-cycle hypothesis, higher wealth disincentivizes saving. The corresponding coefficient β_6 is assumed to be negative.

To capture how the institutional setting influences households' perceived uncertainty and impatience – especially through the saving motive of precaution – social security spending as a share of the government general account ssp_t is included. The respective coefficient is β_7. It is presumed that a well-endowed social security system disincentivizes the willingness to save, and thus negatively affects the household saving rate. However, as Yoshino and Mizoguchi (2010) and Yoshino and Taghizadeh-Hesary (2015) argue that social security benefits are largely financed by debt instruments, the coefficient might be positive according to the Ricardian equivalence.

A persisting low-interest environment caused by monetary policy can distort the information and allocation function of the interest rate and thereby negatively affect growth.[63] In addition, distribution effects of monetary policy can increase saving inequality between households affecting the saving behavior adversely. The monetary policy indicator ssr_t and its corresponding coefficient β_8 account for both conventional and unconventional monetary policies of the BoJ. It is expected that the increasingly expansionary monetary policy stance of the BoJ is negatively associated with the household saving rate, implying a positive sign.

To capture potential distribution effects of monetary policy an interaction term between the monetary policy indicator and the life-cycle indicator is included. The rationale is to apprehend the age dimension of the portfolio channel of monetary policy. Hence, $\beta_8 + \beta_{9,10,11}$ accounts for the age dimension of the portfolio channel of monetary policy on the household saving rate. As the lion's share of financial assets is held by elderly households it is expected that the dissaving behavior of elderly households is cushioned by an additional incentive to save through unconventional monetary policies driving up asset prices.

Under a monetary policy environment, which facilitates a debt-financed social security system, the effect on household saving can be two-fold. First, growing social security benefits and the expectation thereof could disincentivize saving. Second, growing public debt could incentivize saving in line with the Ricardian equivalence. To understand the effect on household saving better, an interaction effect between the Krippner shadow rate and social security spending is included. The interaction term between the ssr_t and the ssp_t thus highlights the effect of social security spending under the contemporaneous monetary

[63] For instance, Schnabl and Hoffmann (2008), Hamada and Okada (2008) and Yoshino and Taghizadeh-Hesary (2017) argue that the BoJ's persistent monetary interventions have contributed to Japan's lost decades.

environment on the household saving rate, which is captured by the sum of the coefficients $\beta_8 + \beta_{12}$.

To capture the effect of the tax exemption on certain savings accounts under the *maruyu*-system on the household saving rate, the dummy variable $maruyu_t$ is included in the model. It takes the value 1 for the years between 1963 and 1988 when the *maruyu*-system was in place, and 0 for all the remaining years. Tax exemption of savings is regarded as an incentive for higher saving thus a positive coefficient is expected for β_{13}.

Given the time series properties of the data, it is tested for unit roots by employing the Augmented Dickey-Fuller test. The null hypothesis of a unit root is rejected at a common level of significance for the ssr_t resulting in the time series to be I(0) stationary. The variables y_t, inc_t, pih_t, $35-64_t$, $>64_t$, $65-74_t$, wh_t, $nikkei_t$, ssp_t and $sspgdp_t$ are I(1) stationary. Finally, the variables $15-34_t$, $15-44_t$, $45-64_t$, $>74_t$ and $\ln(M0)_t$ are I(2) stationary. As stationary time series are employed, no structural break is detected via the Chow test.

3.4 Estimation results and robustness checks

In the following section, the estimation results of the baseline model are presented. Then robustness checks are conducted and presented.

3.4.1 Baseline estimation

The estimation results of the baseline model with robust standard errors, making the inference robust to heteroscedasticity and autocorrelation, are summarized in Table 1.[64]

The real net household disposable income (β_1) is positively associated with the net household saving rate and is statistically significant. The result gives support to the Keynesian determinant of household saving. The estimation results do not reveal support for the permanent income hypothesis as the coefficient on real bonus income (β_2) is not statistically significant. The estimation results lend no support to the life-cycle hypothesis as the coefficients β_3, β_4 and β_5 are not statistically significant. In line with the life-cycle hypothesis,

[64] The regression coefficients of the main effects are conditional relationships (Jaccard et al. 1990). Therefore, the main effects are interpreted at levels of 0 of the conditional variables.

the savings to income ratio (β_6) is statistically significant and negative, suggesting that the higher the wealth endowment the lower the incentive to save.

Table 1: Estimation results of the baseline estimation

Explained variable	**Baseline model**
	net saving rate as % of GDP
$\beta_1 - \mathrm{inc}_t$	**6.64e-08****
	(3.03e-08)
$\beta_2 - \mathrm{pih}_{tt}$	-4.23e-07
	(6.71e-07)
$\beta_3 - 15 - 34_t$	0.20
	(0.89)
$\beta_4 - 35 - 64_t$	0.59
	(0.59)
$\beta_5 - > 64_t$	-1.06
	(0.90)
$\beta_6 - \mathrm{wh}_t$	**-0.04*****
	(0.01)
$\beta_7 - \mathrm{ssp}_t$	-0.09
	(0.07)
$\beta_8 - \mathrm{ssr}_t$	**0.29*****
	(0.11)
$\beta_9 - 15 - 34_t \times \mathrm{ssr}_t$	0.13
	(0.21)
$\beta_{10} - 35 - 64_t \times \mathrm{ssr}_t$	**-0.26***
	(0.14)
$\beta_{11} - > 64_t \times \mathrm{ssr}_t$	**-0.74*****
	(0.26)
$\beta_{12} - \mathrm{ssp}_t \times \mathrm{ssr}_t$	**0.03***
	(0.02)
$\beta_{13} - \mathrm{maruyu}_t$	**-0.95***
	(0.52)
R^2	0.53
Observations	54

***p < 0,01; **p < 0,05; *p < 0,1

The coefficient of the social security spending (β_7) is not statistically significant with respect to the net household saving rate. This indicates that social security spending does not incentivize nor disincentivize household saving. The shadow rate ssr_t is highly significant and positively associated with the dependent variable. The result is in line with the theoretical prediction that the household saving decision depends on the marginal utility of exchanging present consumption for future consumption. The model estimates that a reduction of the ssr_t by one percentage point decreases the net household saving rate by 0.29 percentage points (β_8).

The interaction term of the ssr_t and the second age group (β_{10}) is highly significant. The estimated coefficient is negative, and its absolute value is slightly smaller than that of the ssr_t

alone. This indicates that the age dimension of the portfolio channel of monetary policy almost completely absorbs the negative effect of low interest rates on household saving for those aged between 35 and 64 ((-1) (β_8+β_{10})). The interaction term of the ssr_t and third age group (β_{11}) indicates that the negative impact of decreasing interest rates on the household saving rate of elderly households is offset by the age dimension of the portfolio channel of monetary policy. This might be one of the reasons why the empirical literature does not find dissaving of the elderly households in Japan (in line with the life-cycle hypothesis). A one percentage point decrease in the ssr_t is on average associated with a 0.45 percentage point increase ((-1) (β_8+β_{12})) in the net household saving rate for the elderly population. This constitutes a distribution effect of monetary policy from young to old. The younger population (15-34) faces the negative impact of monetary expansion on household saving, whereas those aged between 35 and 64 can almost completely offset the negative effect and the elderly (>64) experience a positive impact of interest rate cuts on their saving rate.

The estimated coefficient for the interaction term of the ssr_t and the ssp_t (β_{12}) is significant at the 10% level of significance. This provides an indication that a monetary environment, which facilitates a debt-financed social security system disincentivizes saving. A reduction in the ssr_t by one percentage point is on average associated with a 0.32 percentage point decrease ((-1) (β_8+β_{12})) in the net household saving rate.

The dummy variable to capture the effect of the *maruyu*-system of tax-exempt interest income (β_{13}) is statistically significant and negative. The effect is not in line with the expected presumption that tax-exempt interest income exhibits a positive impact on the saving rate.

3.4.2 Robustness checks

The estimation results are predominantly robust to variations and transformations of the explanatory variables and the explained variable. Table 2 summarizes estimation results for the baseline model specification with variations of the explanatory variables.

Model 1 uses the natural logarithm of the base money M0 instead of the ssr_t as a proxy for monetary policy making. The base money M0 is under direct control of the BoJ and reflects, both conventional and unconventional monetary policies, i.e. large-scale asset purchases.

Table 2: Variation of the explanatory variables

Explained variable net saving rate as % of GDP	**Model 1**	**Model 2**	**Model 3**	**Model 4**
$\beta_1 - \text{inc}_t$	**6.74e-08*** **	**8.36e-08 *** **	5.37e-08	**6.78e-08** **
	(2.66e-08)	(2.87e-08)	(3.51e-08)	(3.28e-08)
$\beta_2 - \text{pih}_t$	-5.06e-07	-7.43e-07	-2.77e-07	-5.84e-07
	(7.55e-07)	(6.34e-07)	(7.34e-07)	(8.02e-07)
$\beta_3 - 15 - 34_t$	-0.03	-0.41		0.47
	(0.70)	(1.08)		(0.96)
$\beta_{3'} - 15 - 44_t$			0.40	
			(0.85)	
$\beta_4 - 35 - 64_t$	-0.74	0.12		0.37
	(0.61)	(0.65)		(0.63)
$\beta_{4'} - 45 - 64_t$			0.68	
			(0.61)	
$\beta_5 - > 64_t$	-1.04	-1.18		**-1.67***
	(0.90)	(0.88)		(0.99)
$\beta_{5'} - 65 - 74_t$			**-1.96****	
			(0.91)	
$\beta_{6'} - > 74_t$			-0.94	
			(2.89)	
$\beta_7 - \text{wh}_t$	**-0.04****	**-0.04*****	**-0.03****	
	(0.02)	(0.01)	(0.01)	
$\beta_{7'} - \text{nikkei}_t$				-0.00
				(0.00)
$\beta_8 - \text{ssp}_t$	0.00		-0.12	-0.11
	(0.06)		(0.08)	(0.07)
$\beta_{8'} - \text{sspgdp}_t$		**0.34***		
		(0.20)		
$\beta_9 - \text{ssr}_t$		**0.24****	**0.19****	**0.31****
		(0.10)	(0.09)	(0.14)
$\beta_{9'} - \ln(\text{M0})_t$	**-20.25****			
	(9.81)			
$\beta_{10} - 15 - 34_t \text{ x ssr}_t$		0.24		0.10
		(0.24)		(0.20)
$\beta_{10'} - 15 - 34_t \text{ x } \ln(\text{M0})_t$	-14.82			
	(24.99)			
$\beta_{10''} - 15 - 44_t \text{ x ssr}_t$			-0.04	
			(0.21)	
$\beta_{11} - 35 - 64_t \text{ x ssr}_t$		-0.12		**-0.25***
		(0.16)		(0.15)
$\beta_{11'} - 35 - 64_t \text{ x } \ln(\text{M0})_t$	**34.57***			
	(18.17)			
$\beta_{11''} - 45 - 64_t \text{ x ssr}_t$			-0.16	
			(0.26)	
$\beta_{12} - > 64_t \text{ x ssr}_t$		**-0.59*****		**-0.80*****
		(0.39)		(0.31)
$\beta_{12'} - > 64_t \text{ x } \ln(\text{M0})_t$	30.59			
	(21.19)			
$\beta_{12''} - 65 - 74_t \text{ x ssr}_t$			**-0.73****	
			(0.30)	
$\beta_{13''} - > 74_t \text{ x ssr}_t$			-1.63	
			(1.23)	
$\beta_{14} - \text{ssp}_t \text{ x ssr}_t$			**0.04****	**0.03****
			(0.02)	(0.02)
$\beta_{14'} - \text{ssp}_t \text{ x } \ln(\text{M0})_t$	-1.17			
	(1.46)			
$\beta_{14''} - \text{sspgdp}_t \text{ x ssr}_t$		-0.01		
		(0.05)		
$\beta_{15} - \text{maruyu}_t$	-0.19	**-0.93***	**-1.07****	**-1.05***
	(0.41)	(0.49)	(0.44)	(0.54)
R^2	0.44	0.52	0.50	0.47
Observations	54	54	54	54

***p < 0,01; **p < 0,05; *p < 0,1

The sign of the monetary policy indicator ($\beta_{9'}$) is now negative indicating that an expansionary monetary policy is negatively associated with the net household saving rate. The bigger the growth rate of M0, the smaller the net household saving rate.

The interaction term of the $ln(M0)_t$ and those aged between 35 and 64 ($\beta_{11'}$) is still highly significant. The portfolio channel of monetary policy now overcompensates the negative effect of expansionary monetary policy on the net household saving rate ($\beta_{9'}$+$\beta_{11'}$). The interaction term of the $ln(M0)_t$ and the third aged group ($\beta_{12'}$) is now statistically insignificant. The results underline the potential existence of an age dimension of the portfolio channel of monetary policy constituting a distribution effect from young to old.

The coefficient on household disposable income inc_t (β_1) is statistically significant and comparable in size to the baseline model specification. The coefficient on the wealth indicator (β_7) is also statistically significant and comparable in size to the baseline model specification. The combined effect of monetary easing and social security spending ($\beta_{14'}$) on the net household saving rate is statistically insignificant now.

Model 2 uses social security spending as a share of GDP instead of as a share of the general government account. The estimated coefficient on the main effect of social security spending ($\beta_{8'}$) now shows a statistically significant and positive sign. This indicates that the sole effect of social security spending on the net household saving rate is in line with the Ricardian equivalence in this model specification. However, the robustness of the main effect of social security spending cannot be secured over the other model specifications. The interaction term with the ssr_t ($\beta_{14''}$) is now statistically insignificant.

The monetary policy indicator and its interaction term with the life-cycle indicator are robust in size and significance to the variations in Model 2. The main effect suggests a one percentage point reduction in the ssr_t decreases the net household saving rate by 0.24 percentage points (β_9). The interaction term with third age group underlines the previous results that the elderly population can more than offset the negative impact of interest rate cuts on the household saving rate. A one percentage point decrease in the ssr_t is on average associated with a 0.35 percentage point increase ((-1) (β_9+β_{12})) in the net household saving rate for the elderly population. The indicator for the ability to save (β_1), the wealth indicator (β_7), and the dummy variable capturing the *maruyu*-system of tax-exempt interest income (β_{15}) are also robust in size and significance to the variation in Model 2.

To introduce variation to the life-cycle indicator, in Model 3 the population is now divided into four age groups. The first age group represents the share of the population aged between 15 and 44 ($\beta_{3'}$). The second age group are those aged between 44 and 64 ($\beta_{4'}$). To capture more variation in the elderly population those aged above 64 are divided into two groups. The third age group are those aged between 65 and 74 ($\beta_{5'}$) and the fourth age group is the share of the population older than 74 ($\beta_{6'}$).

The estimated coefficient for the third age group ($\beta_{5'}$) is statistically significant and negative. The result is in line with the life-cycle hypothesis suggesting that the elderly population exhibits a negative impact on the household saving rate. The interaction term between the ssr_t and the third age group ($\beta_{12''}$) is significant and negative indicating that the population share of those aged between 65 and 74 more than compensates the negative impact of interest rate cuts on the household saving rate. A one percentage point decrease in the ssr_t increases the net household saving rate by 0.54 percentage points ((-1) (β_9+$\beta_{12''}$)). Following the hypothesis that the portfolio channel of monetary policy has an age dimension, the result implies that most of the financial assets is held by elderly households aged between 65 and 74. The interaction term of the ssr_t and the ssp_t ((-1) (β_9+β_{14})) is significant and positive underlining that increased social security spending under the current monetary policy regime might exercises a negative strain on the household saving rate.

Model 4 uses the Nikkei index instead of the savings to income ratio as the wealth indicator. This yields the coefficient ($\beta_{7'}$) to be statistically insignificant. The result suggests that the saving rate of the average Japanese household is not affected by stock market movements. The monetary policy indicator and its interaction terms with the different age groups and social security spending are again robust in size and significance to the variation in Model 4 supporting the validity of the previous results.

Table 3 summarizes the results for the variations of the explained variable. In Model 5, the net household saving rate calculated as the share of net household disposable income is used. The results are robust to the variation in the dependent variable. Model 6 uses real average savings as the dependent variable. The estimation results are not robust compared to the baseline specification. This suggest that explaining the stock of savings is a different exercise than the explanation of the saving rate.

Table 3: Variation of the explained variable

Explained variable	Model 5 net saving rate as % of disposable income	Model 6 real average savings
$\beta_1 - \mathrm{inc}_t$	**9.36e-08****	**3.64e-08****
	(4.00e-08)	(1.74e-08)
$\beta_2 - \mathrm{pih}_t$	7.85e-07	1.17e-07
	(1.11e-06)	(5.54e-07)
$\beta_3 - 15 - 34_t$	0.14	0.17
	(1.29)	(0.55)
$\beta_4 - 35 - 64_t$	1.15	0.24
	(0.88)	(0.47)
$\beta_5 - > 64_t$	-1.17	0.97
	(1.41)	(0.77)
$\beta_6 - \mathrm{wh}_t$[a]	**-0.06*****	0.00
	(0.02)	(0.00)
$\beta_7 - \mathrm{ssp}_t$	-0.17	-0.02
	(0.11)	(0.04)
$\beta_8 - \mathrm{ssr}_t$	**0.29***	-0.05
	(0.17)	(0.08)
$\beta_9 - 15 - 34_t \times \mathrm{ssr}_t$	0.19	-0.02
	(0.29)	(0.09)
$\beta_{10} - 35 - 64_t \times \mathrm{ssr}_t$	**-0.38***	-0.02
	(0.21)	(0.09)
$\beta_{11} - > 64_t \times \mathrm{ssr}_t$	**-0.90****	0.15
	(0.38)	(0.17)
$\beta_{12} - \mathrm{ssp}_t \times \mathrm{ssr}_t$	**0.05****	-0.00
	(0.02)	(0.00)
$\beta_{13} - \mathrm{maruyu}_t$	-1.09	0.31
	(0.78)	(0.57)
R^2	0.52	0.32
Observations	54	54

***p < 0,01; **p < 0,05; *p < 0,1

[a] Model 6 uses the Nikkei index as wealth indicator as the savings to income ratio is a ratio of the dependent variable.

3.5 Conclusion

The above analysis shows that the Japanese economy has gone through major changes over the last six decades. With different growth phases of the economy, household saving behavior also changed markedly. Throughout the 1960s and the early 1970s, Japan's household saving rate belonged to the most elevated in the industrialized world. With the outbreak of several crisis accompanied by crisis mismanagement, the household saving rate dropped significantly.

This study adds to the existing literature by examining the impact of social security spending and monetary policy such as its potential distribution effects on the household saving rate. The empirical analysis suggests that a monetary environment that facilitated debt-financing and thereby helped to increase social security spending negatively impacts the household saving rate. Further, a robust relationship between the monetary policy stance and the household saving rate is found. The results indicate that the BoJ's expansionary monetary

policy stance negatively affected households aged between 15 and 34. Households aged between 34 and 64 could offset the negative impact of low interest rates and large-scale asset purchases. The elderly households aged above 64 hold the lion's share of financial assets and thus benefit from the BoJ's monetary policy driving up asset prices. In addition, the ability to save represented by household disposable income and the wealth dimension of the life-cycle hypothesis represented by the savings to income ratio also contribute to the explanation of the Japanese household saving rate.

There is no robust empirical evidence regarding the life-cycle hypothesis nor the permanent income hypothesis. Yet, a more extensive micro panel dataset would be needed to draw more reliable statistical conclusions.

Chapter 4

Japanese unconventional monetary policy and household saving[65]

4.1 Introduction

The impact of monetary policy on income and wealth inequality has become a rich and growing field of research in recent years (Coibion et al. 2017, Furceri et al. 2018, Auclert 2019, Colciago et al. 2019, Herradi and Leroy 2020). Wealth inequality, in particular, has been shown to increase because of disproportionately high asset price inflation in developed economies (Domanski et al. 2016), which in turn is driven by monetary easing (Bordo and Landon-Lane 2013, Hülsmann 2014, Israel 2017, Duarte and Schnabl 2019). Adam and Tzamourani (2016) show that increasing equity prices primarily benefit the top of the wealth and income distribution in the euro area. Taylor (2020) provides similar and even stronger evidence for the U.S.

Japan is a special case among developed countries in that it had long been regarded as comparatively even in terms of its income and wealth distributions (Moriguchi and Saez 2008). This has changed in recent decades. Lise et al. (2014) have shown that inequality between Japanese households has increased at a relatively fast rate since the mid-1990s. At the same time, the country has the longest track record of monetary easing and unconventional monetary policy measures (Ueda 2012, Dell'Ariccia et al. 2018). This makes Japan a particularly interesting target for studying the relationship between monetary policy and inequality.

Saiki and Frost (2014) have explicitly analyzed the impact of Japanese monetary policy on income inequality between 2002 and 2013 and find that unconventional policy measures of the Bank of Japan have contributed to the rising gap between the top and bottom strata of the income distribution. They analyze quarterly household survey data made available by the Japanese Cabinet Office. Israel and Latsos (2020) find similar results covering the same time span using the annual Japan Household Panel Survey Data (JHPS) compiled by researchers at Keio University in Tokyo. They also show that Japanese monetary policy has contributed to

[65] Chapter 4 is based on the article *Japanese monetary policy and household saving* together with Karl-Friedrich Israel and Nils Sonnenberg published in Applied Economics, Vol. 54, 2022, Issue 21, 2373-2389.

an increasing pay gap between employees with and without university degrees, which suggests that education is an important factor in explaining the heterogeneous effects of monetary policy on income. Taghizadeh-Hesary et al. (2020) also find strong empirical evidence that monetary policy has contributed to rising income inequality in Japan, and that this effect can only partly be compensated by taxation. In contrast, Inui et al. (2017) do not find a persistent impact of Japanese monetary policy on inequality between households in terms of income and expenditure, but their data series end in 2008.

With the economic policy program of Prime Minister Shinzo Abe launched in 2013, the Bank of Japan has doubled down on its policies and continued its aggressive monetary expansion. In this article, the case of Japan is studied in more detail by using the most recent data of the Japanese Panel Survey of Consumers (JPSC) which is also provided by Keio University. The annual data cover the period from 1993 to 2017 allowing us to include the effects of monetary policy during the first years of Abenomics. The focus lies on the impact of monetary policy on Japanese household saving, and more specifically on inequality between academic and non-academic households in terms of their monthly volume of net saving. The monthly flow of household saving is the basis for building wealth over time and it is therefore, alongside asset price inflation, an important factor for understanding the dynamics of wealth inequality.

The existing literature on the evolution of household saving in Japan has identified a general decline in household saving since the mid-1990s, which is in line with the life-cycle hypothesis that households in retirement tend to engage in dissaving (Koga 2006, Horioka 2010, Curtis et al. 2017). As the proportion of Japanese households in retirement grows, the average saving rate declines. However, changes in the age composition of the population can only explain about a third of that general decline in saving, while two-thirds are due to decreases in the average saving rate in specific age groups over time, especially among the elderly (Unayama and Ohno 2017). Latsos and Schnabl (2021) provide evidence that low interest rate policies are another important driver of the general decline in household saving.

The main contribution of this article is to highlight the heterogeneous effects of monetary policy on saving in households with different levels of education, contributing not only to a general decline in saving but also to rising inequality. Potentially heterogeneous effects of monetary policy on saving in different regions are also taken into account.

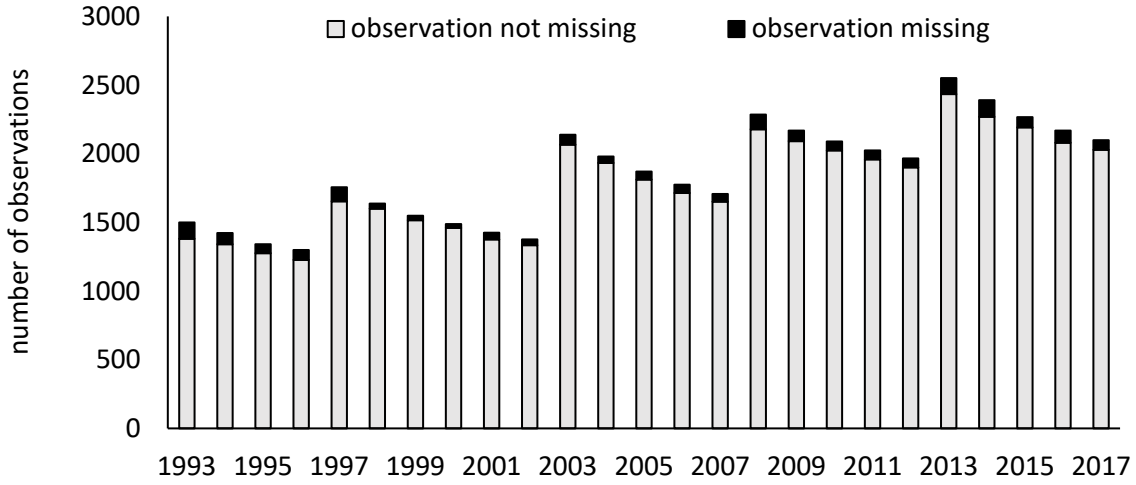
4.2 Data and descriptive statistics

In this study, two sets of empirical data are used. Different indicators of the monetary policy stance of the Bank of Japan are compiled from several data sources. They are matched with comprehensive annual panel survey data on various aspects of household finances. Both sets of variables are presented and discussed in the following sections.

4.2.1 Japanese household survey data

The main source of data on Japanese household finances is the annual JPSC. The JPSC was originally launched in 1993 by the Institute for Household Research and has since been conducted in October each year. Following the dissolution of the Institute for Household Research in December 2017, the panel data research center at Keio University has taken over responsibility for the implementation, management and provision of the survey data.

Figure 42: Number of observations per year for net household saving per month in JPSC



Source: Authors' calculations.

The most recent wave available for research purposes covers the year 2017. The JPSC includes five cohorts from 1993, 1997, 2003, 2008 and 2013. The highest number of people interviewed in one year is n = 2,550 (in 2013). The lowest number of people interviewed in one year is n = 1,298 (in 1996). The structure of the panel is shown in Figure 42.

The sample is selected using a two-stage stratified random sampling process with subjects being stratified into Japan's 47 prefectures. The respondents included in the survey are initially drawn from Japan's female population aged 24 to 34. As a result, in 2017, the highest

observed age of a respondent is 58 years. The JPSC focuses on women mainly because of two reasons. First, with a changing understanding of the role of women in households and society, the survey aims to provide insight into the working conditions and lifestyle choices of women. Second, there has been a long Japanese tradition that women control household finances.[66] Thus, the JPSC is well suited for analyzing household finances and their evolution over two and a half decades.

In this paper, we take a closer look at the heterogeneous development of household saving attributed to different levels of education of respondents and their spouses. Moreover, with respondents being attributable to their respective prefectures, we are able to control for potential spatial effects between the economic and financial center based in the region of Kanto, including Tokyo, and the country's periphery.

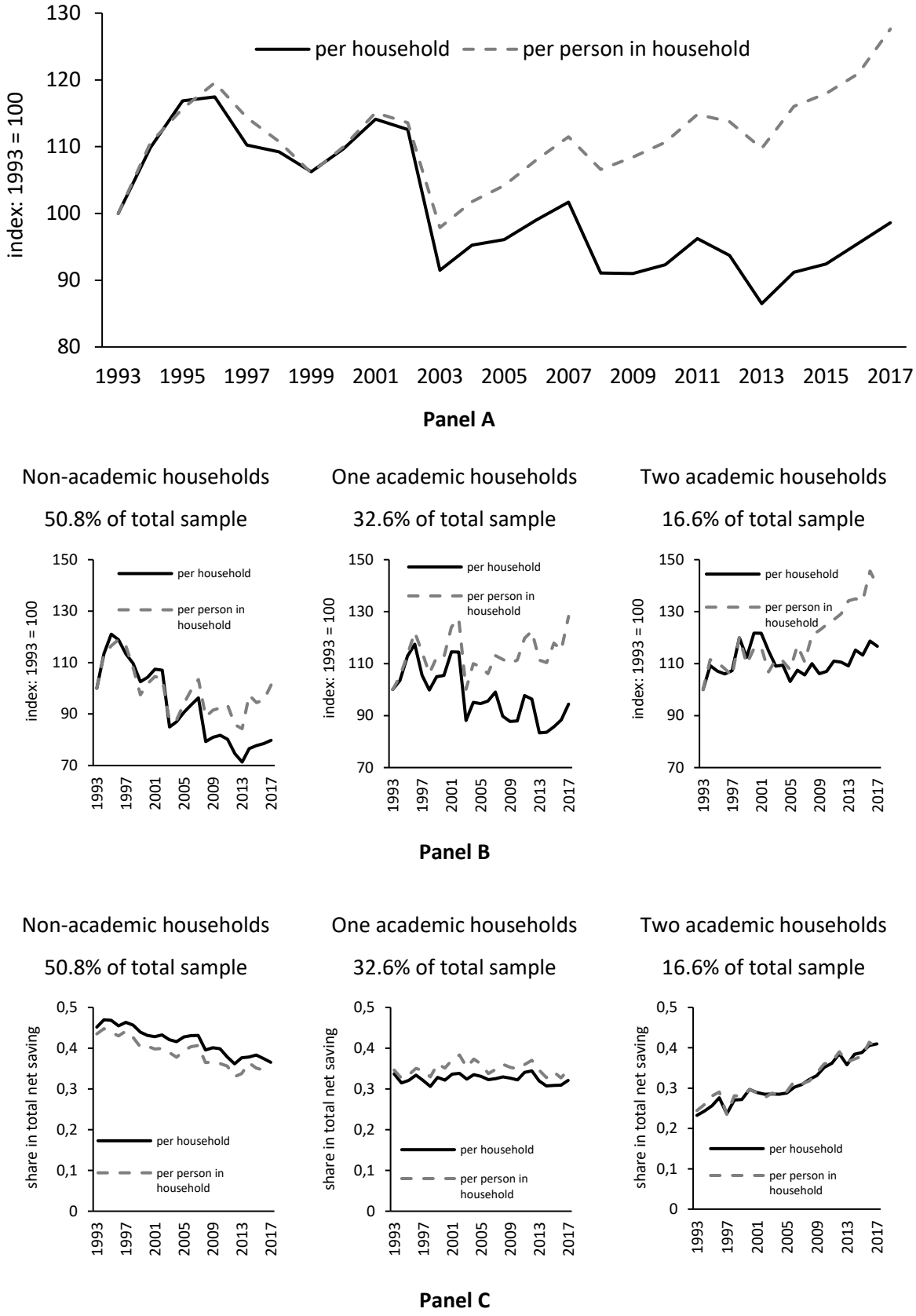
The target variable of the following analysis is net household saving per month. The corresponding question in the panel refers to the amount that the respondent's household saved during the last month, i.e. in September of the respective year. Respondents are classified as being either "academics", i.e. having a university degree, or not. If the respondent is married[67], the education level of the spouse is also taken into account. A three-level factor variable is created describing the education status of the household as either "non-academic" when both respondent and spouse have not obtained university degrees, as "one academic" if either the respondent or spouse have obtained a university degree, but not both, and lastly as "two academics" if both have. Over the entire panel this classification leads to a total number of observations for the saving variable of 22,612 for non-academic households which corresponds to 50.8% of all available observations. 14,490 (32.6%) observations come from households with one academic, and 7,391 (16.6%) from households with two academics.

Average net saving increases with the level of education. Over the entire pooled sample, non-academic households save on average 47,017 yen per month (median of 33,000 yen). This corresponds to an average of 13,153 yen per household member (median of 8,750 yen).

[66] Men are often given a monthly allowance termed "okozukai". According to a survey conducted by the Shinsei Bank, men received an average monthly allowance of 39,836 yen in 2017 (Kudo 2018), which corresponds to about 370 U.S. dollar.

[67] There are 14,000 (31.5%) observations of the saving variable for unmarried women and 30,493 (68.5%) for married women. In 1,312 instances the marital status of a respondent changed from unmarried to married from one year to the next. There are 742 instances in which the status changed from married to unmarried.

Figure 43: Mean household net saving per month and shares in total net saving by education



Source: Authors' calculations. Shares in total net saving are adjusted for changes in relative group size over time. The share in total net saving for group i in year t is multiplied by group

i's size as a share in the total sample over all years and divided by its size as a share in the total sample for the respective year t. This means, for example, that when the relative group size in a given year is 2% bigger than on average, its share in total net saving for that year is adjusted downward by 2%. The adjustment is important because there is a decreasing trend in relative group size for non-academic households from 57.2% in 1993 to 46.5% in 2017. Without the adjustment, the negative trend in the share of non-academic households would be overstated.

Households with one academic save 57,982 yen on average (median of 45,000 yen), i.e. 19,132 yen per household member (median of 12,500 yen). Households with two academics save almost twice as much as non-academic households, on average 90,334 yen (median of 67,000 yen) per month, which corresponds to 28,191 yen per household member (median of 18,000 yen).

Figure 43 contains plots of the annual means of the saving variable indexed to the base year 1993. The indices for the overall sample (Panel (A)) as well the three different education groups (Panel (B)) are shown. Inequality between the different groups has increased as there is a decreasing trend for non-academic households, while for households with two academics monthly net saving has increased. For households with one academic the trend is negative on the household level, but positive per household member. In all cases the index takes on a more favorable trend when corrected by the number of persons living in the household, indicating that average household size has diminished during the sample period. In fact, although instances of an increasing number of household members from one year to the next occur more often than instances of a decreasing number (4,850 times versus 4,405 times), the respondents added to the panel over time live on average in smaller households with every new cohort.[68]

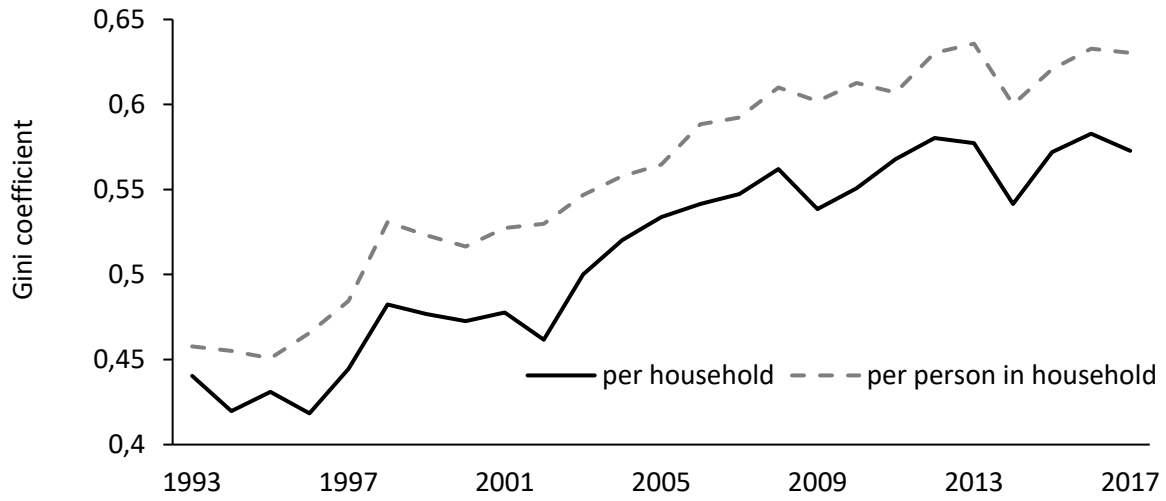
Figure 43 also shows the evolution of the share in total saving of each education group corrected by changes in relative group size over time (Panel (C)). The share in total saving of non-academic households declines, while that of households with two academics increases. For households with one academic the share reveals no trend.

[68] With every new cohort (1993, 1997, 2003, 2008 and 2013) the average household size of the new respondents added decreases: 4.09, 3.53, 3.47, 3.31 and 3.26.

The Gini coefficients[69] for net saving per household and per household member are shown in Figure 44 for respondents aged 30 to 35 each year. Looking at the sub-sample for a fixed age group over time avoids a potential bias that can be expected because of the nature of the data. As the same statistical units are followed over time inequalities that emerge might not be representative of the population as a whole in any given year. It is to be expected that inequalities increase when the same group of people is observed from a relatively young age onward. This might exaggerate trends in inequality for society as a whole. Hence, we focus on the same age group that some individuals leave and others enter from year to year. The corresponding Gini coefficients for the entire sample can be found in Table 8 in the Appendix.

Interestingly, the potential bias does not show up in the data. For households as a whole, the Gini coefficient has increased from 0.44 in 1993 to 0.57 in 2017, for both the sub-sample of respondents aged 30 to 35 and the entire sample. In fact, when we look at saving per household member, the Gini coefficient has even increased more within the sub-sample (from 0.46 to 0.63) than in the entire sample (from 0.48 to 0.62).

Figure 44: Gini coefficient of household net saving per month for respondents aged 30-35



Source: Authors' calculations.

[69] The Gini coefficient is a statistical measure of economic inequality in a population derived from the Lorenz curve. In our case, the Lorenze curve plots the proportion of net monthly saving of the households against the cumulative percentage of the households. The Gini coeffcient is calculated as the ratio of the area between the Lorenz curve and the 45 degree line to the area under the 45 degree line. The Gini coefficient ranges from 0 (perfect equality) to 1 (perfect inequality, where higher values indicate greater saving inequality.

Other indicators of inequality reveal the same pattern. For example, the ratio of the 90th percentile of net household saving to its median has increased from 2.3 to 3.4 between 1993 and 2017. The interquartile range has grown from 55,000 yen to 65,000 yen. The share of the top 10% of households has grown from 29.7% in 1993 to 39.0% in 2017, while the share of the bottom half of the distribution fell from 26.5% to 13.5%.[70]

Inequality between different regions in terms of average monthly saving reveals no clear trend. It has mildly decreased overall as illustrated in Figures 46 and 47 in the Appendix. For these maps the average monthly saving in 8 regions was calculated.[71] The economically strongest region of Japan is Kanto, which consists of the 7 prefectures of Ibaraki, Tochigi, Gunma, Saitama, Chiba, Kanagawa and the capital Tokyo. It is also the region where the average household in the sample saves most per household member. When taken as a whole, households in the regions of Chubu and Chugoku save more than households in Kanto. For most regions, such as Chugoku there are, however, very few observations, often fewer than 100 per year as can be seen in Table 9 in the Appendix. Therefore, larger aggregates are formed to reduce interference of random noise with estimation results. The bottom panels of Figures 46 and 47 show the evolution of average net saving for these broader regional subdivisions.

There is no indication that the trends in different regions deviate strongly from one another. When the sample is divided into the financial and economic center Kanto, which accounts for 32.9% of all observations, and the rest of the country, the two series evolve almost synchronously for both monthly saving per household and monthly saving per household member. As seen before, monthly saving per household member reveals a more favorable trend as average household size has declined over time.

4.2.2 Japanese monetary policy

The expansionary monetary policy stance of the Bank of Japan has been discussed in different contexts (Ueda 2012, Saiki and Frost 2014, Dell'Ariccia et al. 2018, Israel and Latsos 2020).

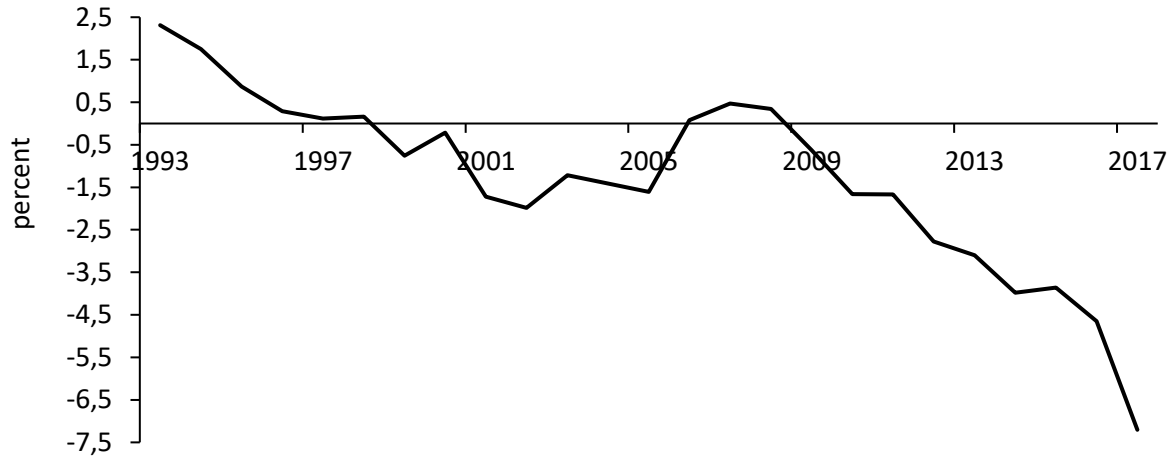
[70] See Figure 48 in the Appendix.

[71] These regions are Hokkaido in the north, Tohoku, Kanto, Chubu, Kinki, Chugoku, Shikoku and Kyushu including the southernmost islands of Okinawa, which are shown in inset maps in Figures 46 and 47 in the Appendix.

Several indicators can be used for specification. The money stocks M0 and M1 as well as their annual growth rates are plotted in Figure 49 in the Appendix.

The monetary base (M0) has grown from 42.9 trillion yen at the end of 1992 to 474.1 trillion yen in 2017. This corresponds to an 11-fold increase over the entire period or an average annual growth rate of 10.1%. The broader monetary aggregate M1 has increased from 152 trillion yen to 711.9 trillion yen over the same period, which corresponds to a much lower average annual growth rate of 4.7%. With the advent of unconventional asset purchase programs, monetary policy measures are better reflected in the growth rate of the monetary base, which translate into sharp increases in the size of the balance sheet of the Bank of Japan. Since 2002, the balance sheet has grown at an average annual rate of 9.2%, while the short-term interest rate set by the Bank of Japan has remained at or close to 0 the entire time. Since 2016, it has been kept at -0.1%.

Figure 45: Krippner's shadow short-term rate of interest, Japan



Source: Krippner.

Our data cover episodes of conventional monetary expansion via interest-rate setting as well as unconventional asset purchase programs. A suitable summary statistic that incorporates both is the shadow short-term rate of interest as suggested by Krippner (2013), which will be abbreviated as shadow short rate. Figure 45 shows the annual averages of the ssr, which

reveal an increasingly expansionary monetary policy stance as the rate is pushed further into negative territory. In 2017, four years into Abenomics, the shadow short rate reached -7.2%.[72]

4.3 Model and estimation results

In order to study the effect of monetary policy on monthly net household saving y_{it} per household member n_{it}, we estimate a two-way fixed effects model[73], including household-level fixed effects γ_i, which account for unobserved heterogeneity across households, and time fixed effects δ_t, which account for unobserved changes over time that affect all households:

$$ln\left(\frac{y_{it}}{n_{it}}\right) = \beta_1 ln\left(\frac{m_{it}}{n_{it}}\right) + \beta_2 Education_{it} + \beta_3 Region_{it} + \beta_4 ssr_t + \beta_5 Region_{it}\ x\ ssr_t + \beta_6 Education_{it}\ x\ ssr_t + \beta' X_t + \gamma_i + \delta_t + \epsilon_{it} \quad (1)$$

The explanatory variable m_{it} corresponds to net monthly income in September of year t of household i. Net income is expected to have a significant impact on housholds' saving. It also captures some important household-specific and time-dependent effects that are otherwise unobservable for us, such as a promotion at work that leads to a pay raise, or a health-related absence from work that leads to a reduction in salary. Both the explained variable and net monthly income are transformed with the natural logarithm to reduce the skewness of their distributions.

In order to capture the effect of education on net saving, the dummy variable $Education_{it}$ is included in the model. It takes on the value 1 if household i in year t had at least one academic (i.e. either respondent or spouse holding a university degree, or both) and 0 otherwise. Spatial heterogeneity in net saving between the economic and cultural center of the country and its periphery is accounted for by $Region_{it}$. It takes on the value 0 if household i in year t was based in the region of Kanto, i.e. in the economic center of the country, and 1 if it was based in the periphery. Hence, the baseline household in the model is a non-academic household located in Kanto. The coefficient β_2 captures the average difference in net saving

[72] Data on the ssr that we use can be downloaded here: https://www.ljkmfa.com/test-test/international-ssrs/. The ssr is our preferred proxy for the monetary policy stance of the Bank of Japan. However, we will use alternative measures in our robustness checks as some caution is warranted (Krippner 2020).

[73] The fixed effects model is preferred over a random effects model as the result of a Hausman test.

for households with at least one academic as opposed to a non-academic household and β_3 captures the average regional difference for a household located in the periphery as opposed to Kanto.

The monetary policy variable included in the model is the average shadow short rate, ssr_t, for year t. The corresponding coefficient β_4 accounts for the effect of monetary policy on net monthly saving of non-academic households in Kanto. The interaction term of the ssr_t and the regional dummy isolates an additional regional effect of monetary policy on households in the periphery. Hence, β_4+β_5 accounts for the effect of monetary policy on net saving in non-academic households in the periphery. The interaction term between the ssr_t and the education dummy isolates a separate effect of monetary policy on net saving by households with at least one academic. Hence, the sum of the coefficients, β_4+β_6, captures the effect of monetary policy on academic households in Kanto, and β_4+β_5+β_6 captures the effect of monetary policy on academic households in the periphery.

Table 4: Estimation results for the baseline model

Explained variable	**Baseline model** $\ln\left(\frac{y_{it}}{n_{it}}\right)$ ln of monthly saving per household member
β1 $-\ln\left(\frac{m_{it}}{n_{it}}\right)$	**0.34*** **
	(0.01)
$\beta_2 - \text{Education}_{it}$	**0.84*** **
	(0.09)
$\beta_3 - \text{Region}_{it}$	**-0.15***
	(0.06)
$\beta_4 - \text{ssr}_t$	**0.02****
	(0.01)
$\beta_5 - \text{Region}_{it}$ x ssr_t	-0.00
	(0.01)
$\beta_6 - \text{Education}_{it}$ x ssr_t	**-0.03*** **
	(0.01)
R^2	0.10
Household fixed effects	Yes
Time fixed effects	Yes
Controls	Yes
Observations	42,202

***p < 0.001; **p < 0.01; *p < 0.05

Two additional control variables are included in the model to account for macroeconomic fluctuations in the Japanese economy. They include the percentage change of the Nikkei index from year $t-1$ to t as well as the percentage change of nominal GDP from year $t-1$ to t. The Nikkei index captures expectations of future economic activity, while nominal GDP

reflects present economic activity. These time-varying control variables are summarized in vector X_t.

The estimation results of the baseline model with robust standard errors, making the inference robust to heteroskedasticity and autocorrelation, are summarized in Table 4. The net monthly income (β_1) is positively associated with net saving and statistically significant. The dummy variables for education (β_2) and region (β_3) are statistically significant, underlining again that saving per household member is on average higher for academic households (+84%) and lower for households outside of Kanto (-15%).

The estimation results do not reveal any heterogeneous spatial effects of monetary policy on household saving. The estimated coefficient of the interaction term between the short shadow rate and the regional dummy (β_5) is not significantly different from 0 and can be ignored in the interpretation of the estimation results. The coefficient of the shadow short rate (β_4) has a statistically significant effect on household saving, in that lower interest rates are associated with a lower volume of saving. More precisely, monetary expansion is associated with reduced saving in non-academic households. The model estimates that a reduction of the ssr_t by one percentage point, reduces monthly saving per household member in non-academic households by 2% ((-1) β_4), both in Kanto and the periphery as spatial effects are insignificant. The interaction term of the ssr_t and the education variable (β_6) is highly significant, too. The estimated coefficient is negative, and its absolute value is higher than that of the ssr_t alone, indicating that a reduction in the ssr_t by one percentage point is on average associated with a 1% increase ((-1) (β_4+β_6)) in saving per household member if at least one academic lives in the household.[74]

This suggests that the adverse effects of expansionary monetary policy on saving are compensated in academic households. Expansionary monetary policy is thus associated with a widening gap between non-academic and academic households in terms of net saving per household member. The model predicts that a reduction of the ssr_t by one percentage point is associated with an increase in the ratio of average saving between academic and non-academic households by about 3%.[75] Given that the ssr_t has been on a downward trajectory

[74] Both coefficients together are highly significant as revealed by an F-test with joint restrictions on both coefficients ($H0$: $\beta_4 = \beta_6 = 0$) is rejected with p-value < 0.01.

[75] The average estimated gap between households with at least one academic and non-academic households is 84%. A reduction of the ssr_t by one percentage point is associated with a reduction in saving by 2% for non-

over the period under consideration, indicating an increasingly expansionary monetary policy stance of the Bank of Japan, the estimation results suggest that monetary policy has contributed to rising inequality between households in terms of their net saving, which is the basis for any household's wealth formation over time.

4.4 Robustness checks

Table 5: Variations of the explained variable and the income variable

Explained variable	**Model 1** $\frac{y_{it}}{n_{it}}$ saving per HH member	**Model 2** y_{it} saving of HH	**Model 3** $\ln(y_{it})$ ln of saving of HH
$\beta_1 - \frac{m_{it}}{n_{it}}$	**0.16***** (0.01)		
$\beta_{1'} - m_{it}$		**0.11***** (0.01)	
$\beta_{1''} - \ln(m_{it})$			**0.31***** (0.01)
$\beta_2 - \text{Education}_{it}$	**7.03***** (1.69)	**23.21***** (4.12)	**1.19***** (0.11)
$\beta_3 - \text{Region}_{it}$	-0.30 (1.33)	-2.67 (3.22)	-0.13 (0.08)
$\beta_4 - ssr_t$	0.23 (0.16)	0.52 (0.44)	**0.03***** (0.01)
$\beta_5 - \text{Region}_{it} \times ssr_t$	-0.04 (0.16)	0.02 (0.44)	-0.00 (0.01)
$\beta_6 - \text{Education}_{it} \times ssr_t$	**-0.38*** (0.16)	**-1.38**** (0.42)	**-0.05***** (0.01)
R^2	0.20	0.09	0.08
Household fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Observations	42,202	42,202	42,202

***p < 0.001; **p < 0.01; *p < 0.05

The estimation results are robust to variations and transformations of the explained variable and the income variable as shown in Table 5. Avoiding the log-transformations of the explained variable and the income variable (Model 1) leads to similar estimation results. A reduction in the ssr_t by one percentage point is estimated to lead to an average increase of the gap in monthly saving per household member between academic and non-academic

academic households and an increase in saving by 1% for households with at least one academic. The ratio between average saving of these two types of households thus increases from 1.84 to 1.84*1.01/0.98 = 1.896, that is by about 3.1%.

households of more than 5%.[76] This model specification suggests again that academic households do not only compensate the adverse effects, but on average benefit in terms of their net saving, as the estimated coefficient of the interaction term with the education variable (β_6 = -0.38) is negative and outweighs the estimated coefficient of the ssr_t (β_4 = 0.23). Although the coefficient of the ssr_t (β_4) is not statistically significantly different from 0, both coefficients are jointly highly significant (p-value < 0.01). If household size is not taken into account (Models 2 and 3 in Table 5), the results remain largely the same. Only the regional control variable (β_3) is not statistically significant anymore.

Table 6: Variations of the education variable

Explained variable	Model 4	Model 5
$\beta_1 - \ln\left(\frac{m_{it}}{n_{it}}\right)$	**0.32*** **	**0.32*** **
	(0.01)	(0.01)
$\beta_2 - \text{Education1}_{it}$ (1 = one academic)	**0.87*** **	
	(0.09)	
$\beta_{2'} - \text{EducationM}_{it}$ (1 = male academic)		**0.91*** **
		(0.09)
$\beta_{2''} - \text{EducationF}_{it}$ (1 = female academic)		-0.44
		(0.68)
$\beta_{2'''} - \text{Education2}_{it}$ (1 = two academics)	**1.54*** **	0.24
	(0.12)	(0.68)
$\beta_3 - \text{Region}_{it}$	**-0.14***	**-0.14***
	(0.06)	(0.06)
$\beta_4 - \text{ssr}_t$	**0.02** **	**0.02** **
	(0.01)	(0.01)
$\beta_5 - \text{Region}_{it} \text{ x ssr}_t$	-0.00	-0.00
	(0.01)	(0.01)
$\beta_6 - \text{Education1}_{it} \text{ x ssr}_t$	**-0.02***	
	(0.01)	
$\beta_6 - \text{EducationM}_{it} \text{ x ssr}_t$		-0.01
		(0.01)
$\beta_6 - \text{EducationF}_{it} \text{ x ssr}_t$		**-0.03** **
		(0.01)
$\beta_6 - \text{Education2}_{it} \text{ x ssr}_t$	-0.02	0.02
	(0.01)	(0.01)
R^2	0.11	0.11
Household fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
Controls	Yes	Yes
Observations	42,202	42,202

***p < 0.001; **p < 0.01; *p < 0.05

[76] This can be seen when the absolute values of the estimated coefficients for the education dummy (β_2 = 7.03) and its interaction term with the ssr_t (β_6 = -0.38) are put into relation with one another: 0.38/7.03 = 0.054 = 5.4%.

Table 6 summarizes the estimation results for variations of the dummy variable for education. This allows us to study the heterogeneous effect of monetary policy on households with different levels of education in more detail. Model 4 uses the three-level variable underlying the bottom panels of Figure 43. Households are classified as non-academic when neither respondent nor spouse hold a university degree. The second group consists of households where either respondent or spouse hold a university degree, but not both. And the third group consists of households where both hold a university degree.

The baseline group are non-academic households. The interaction term of the ssr_t and education remains negative and statistically significant for households with one academic (β_6 = -0.02), but it no longer outweighs the coefficient of the ssr_t without interaction (β_6 = 0.02). The interaction term for households with two academics ($\beta_{6,,,}$) is not statistically significant. This model specification suggests that education helps to compensate the adverse effects of expansionary monetary policy on net household saving at least partly, but academic households do not on average benefit from monetary expansion. The coefficients of the ssr_t and its interaction terms with education are jointly statistically significant (p-value < 0.01).

Model 5 in Table 6 splits households with one academic further into two subgroups: households in which only the respondent, i.e. the woman, holds a university degree and those in which only her spouse holds a university degree. This model specification provides some insight into the gender-specific heterogeneity of the effects of monetary policy on saving in households with different education status. In Model 5 in Table 6 only the interaction term of the ssr_t and the dummy variable for households in which the female respondent holds a degree ($\beta_{6,,}$) is statistically significant and its effect size increases (from -0.02 in Model 4 to -0.03 in Model 5). This indicates that especially the education level of women is associated with compensating potentially adverse effects of monetary expansion on net household saving. This result reflects the fact that Japanese women are traditionally in charge of household finances. Their level of education and financial literacy is therefore particularly important. The subgroup of households in which only the female respondent holds a university degree contains n = 10,256 observations. In 36.1% of the cases the respondent is married. In 13.8% of the cases the respondent is unmarried and lives in a one-person household. The unmarried respondents with university education living in single households

have by far the highest monthly net saving as shown in Figure 50 in the Appendix. There are, however, relatively few observations per year in these subgroups for reliable inference.

Table 7: Variations of the policy variable

Explained variable	Model 6	Model 7
$\beta_1 - \ln\left(\frac{m_{it}}{n_{it}}\right)$	**0.34*** **	**0.34*** **
	(0.01)	(0.01)
$\beta_2 - \text{Education}_{it}$	**0.62*** **	**0.59*** **
	(0.11)	(0.11)
$\beta_3 - \text{Region}_{it}$	**-0.20***	**-0.20***
	(0.09)	(0.10)
$\beta_4 - \ln(\text{M0}_t)$	**-0.09****	-
	(0.03)	
$\beta_5 - \text{Region}_{it}$ x $\ln(\text{M0}_t)$	0.02	
	(0.03)	
$\beta_6 - \text{Education}_{it}$ x $\ln(\text{M0}_t)$	**0.11*** **	
	(0.03)	
$\beta_{4'} - \ln(\text{assets}_t)$		**-0.09****
		(0.03)
$\beta_{5\#} - \text{Region}_{it}$ x $\ln(\text{assets}_t)$		0.02
		(0.03)
$\beta_{6'} - \text{Education1}_{it}$ x $\ln(\text{assets}_t)$		**0.11*** **
		(0.03)
R^2	0.10	0.10
Household fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
Controls	Yes	Yes
Observations	42,202	42,202

***p < 0.001; **p < 0.01; *p < 0.05

Table 7 summarizes estimation results for the baseline model specification with variations of the monetary policy variable. Model 6 uses the natural logarithm of the monetary base M0 instead of the ssr_t. M0 is under direct control of the Bank of Japan and reflects in particular unconventional asset purchase programs. The sign of the interaction term of the natural logarithm of M0 and the education variable is now positive (β_6 = 0.11) and again statistically significant, which confirms the previous results: the more expansionary monetary policy, i.e. the bigger the growth rate of M0, the larger the average gap in net monthly saving between academic and non-academic households.

In Model 7 the shadow short rate is replaced by the natural logarithm of the size of the Bank of Japan's balance sheet. The estimation results are almost identical to those of Model 6. Both model specifications suggest that a 10% increase in the monetary base (or the BoJ's balance sheet), which corresponds to its average growth rate between 1993 and 2017, is associated

with an increase of the ratio of average saving between academic and non-academic households of about 1.1% ((10) (β_6) = 1.1).

4.5 Conclusion

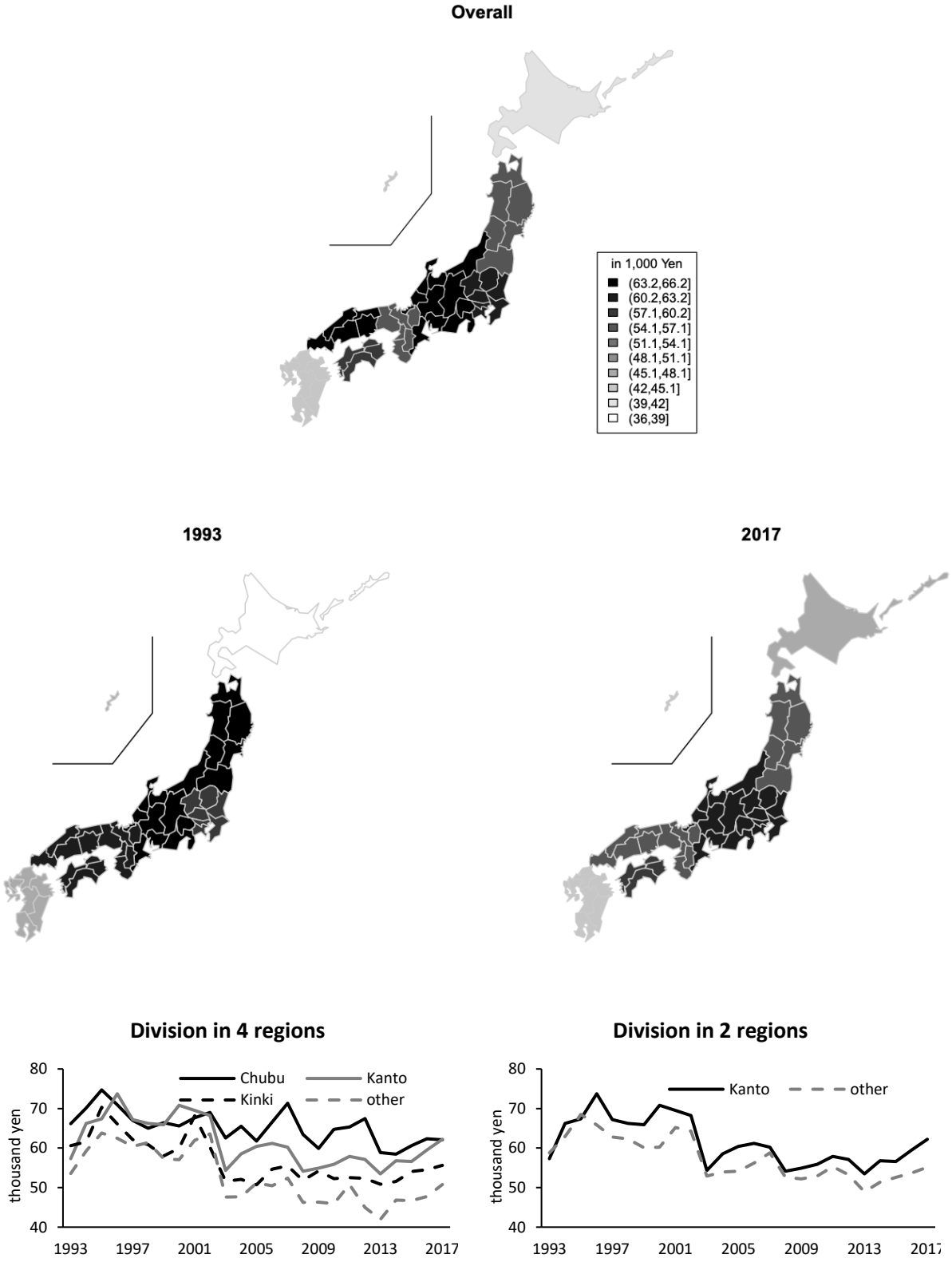
The above analysis shows that inequality in terms of net saving per household as well as per household member has increased in Japan since 1993 according to several conventional measures of inequality. The empirical analysis shows that the increase is statistically associated with expansionary monetary policy measures as specified by the shadow short rate as well as the growth of the monetary base and the Bank of Japan's balance sheet. The increase in inequality materializes through heterogeneous effects of monetary expansion on the saving behavior of households with different levels of education. The estimated baseline model suggests that a reduction of the ssr_t by one percentage point leads to an average increase in the ratio of average saving between households with at least one academic and non-academic households of about 3%. Given that the ssr_t has been on a downward trajectory over the past decades, the estimation results provide evidence that the increasingly expansionary monetary policy has contributed to the rise in inequality in Japan.

The estimation results are robust to different types of variations in the model specification, including log-transformations of the explained variable and the income variable, incorporating and ignoring household size, variations of the classification of households according to education, and variation of the monetary policy variable. The empirical results suggest that the education level of the female respondents of the survey is particularly important (more so than that of their male spouses) for compensating the potentially negative effects of expansionary monetary policy on household saving. This may reflect the fact that Japanese women have traditionally been responsible for household finances. Yet, a more extensive data set would be needed to draw more reliable statistical conclusions.

The analysis provides further evidence for the hypothesis that expansionary monetary policy as conducted in recent years has adverse effects on the distribution of income and wealth. Following the results of Saiki and Frost (2014) and Israel and Latsos (2020), who have found an adverse effect of Japanese monetary policy on income inequality, this paper suggests that it also translates into an adverse effect on wealth inequality through changes in households' net saving and accordingly their ability to build up wealth.

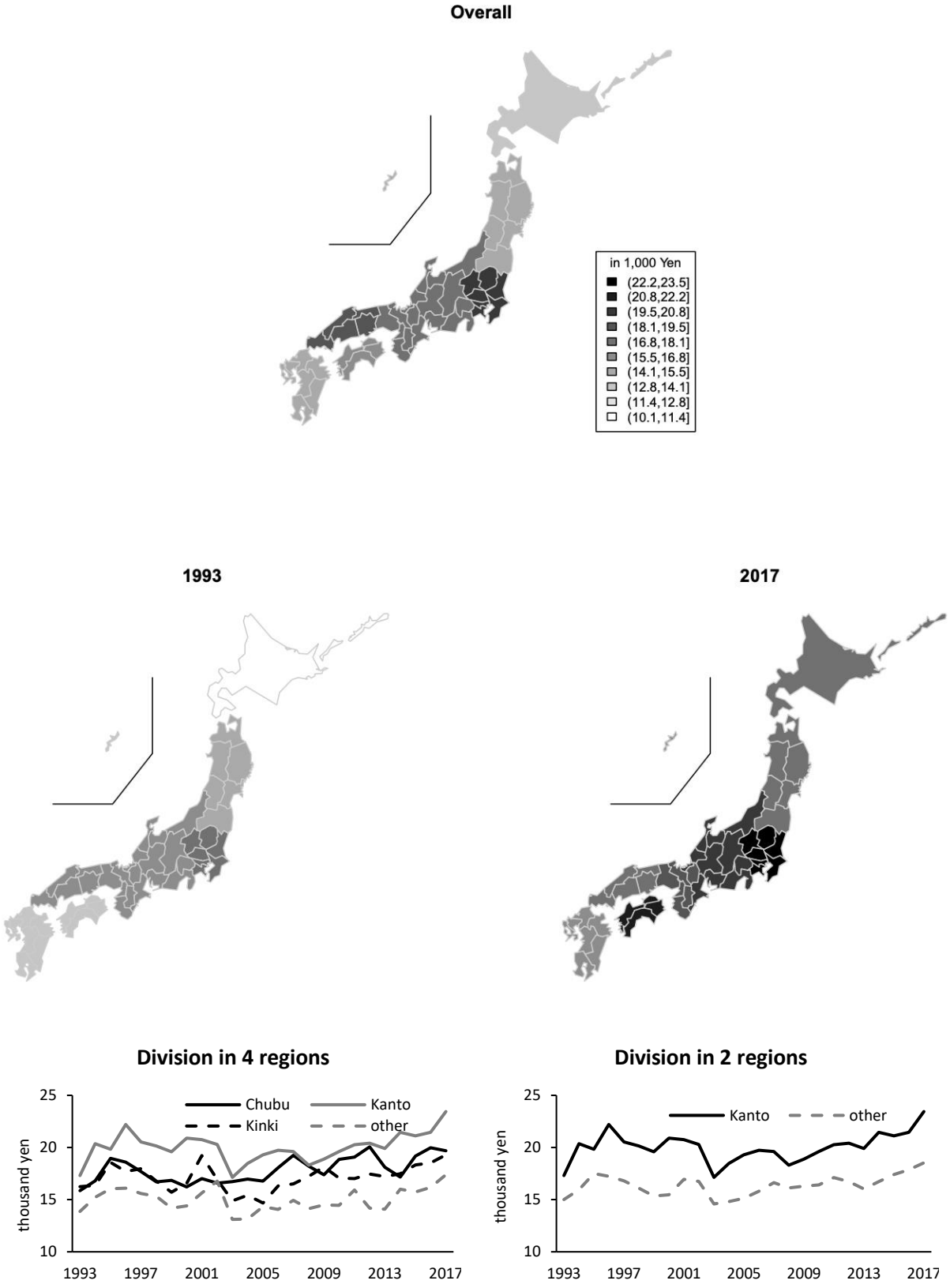
Appendix

Figure 46: Mean monthly net saving per household in 1,000 yen in different regions



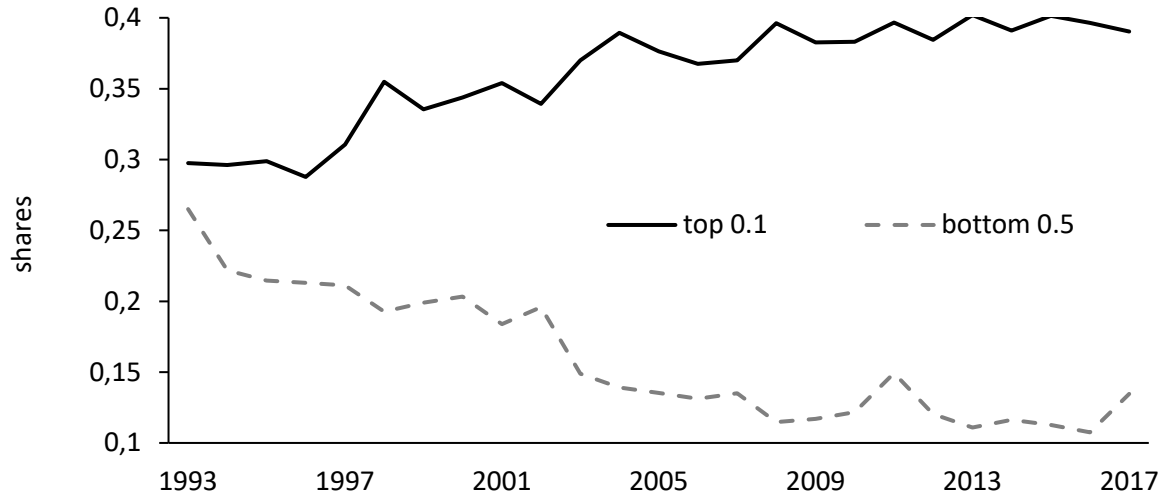
Source: Authors' calculations.

Figure 47: Mean monthly net saving per household member in 1,000 yen in different regions



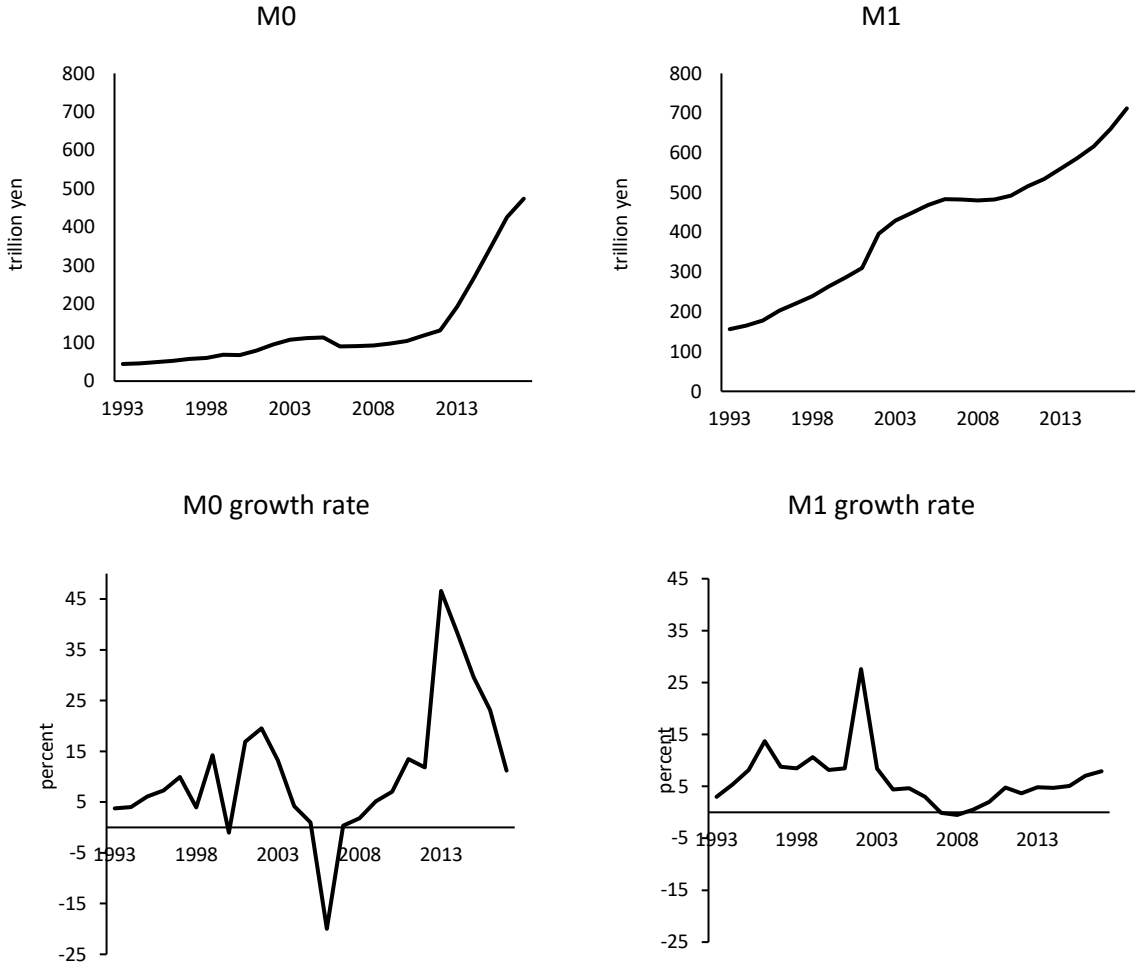
Source: Authors' calculations.

Figure 48: Shares of total net saving per household of bottom 50% and top 10% of the saving distribution



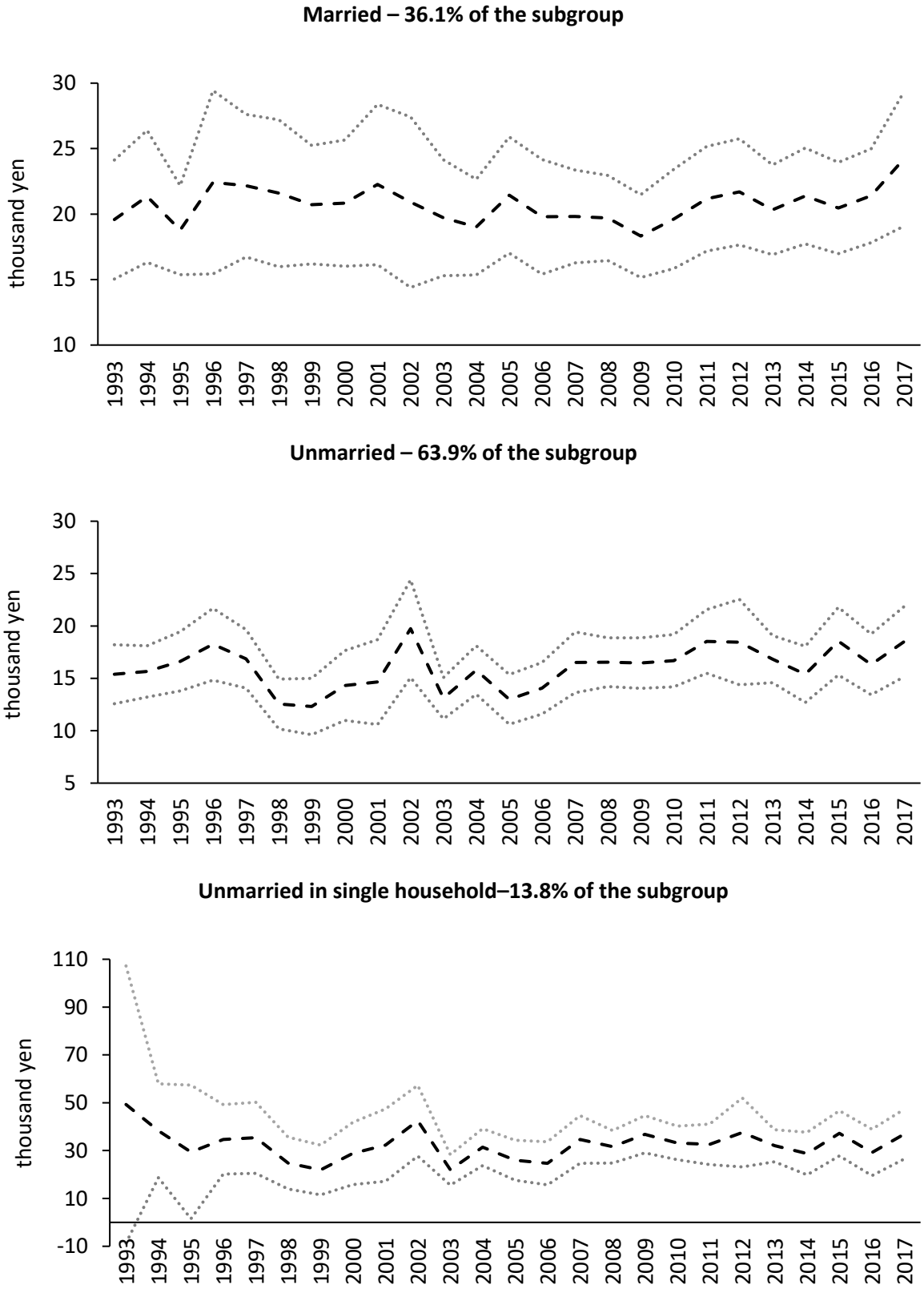
Source: Authors' calculations.

Figure 49: Growth of the Japanese money stocks



Source: Bank of Japan.

Figure 50: Mean and interquartile range of monthly net saving per household member in 1000 yen for cases in which only the female respondent holds a university degree



Source: Authors' calculations. The dashed lines represent the mean, while the dotted lines represent the interquartile range.

Table 8: Summary statistics of net household saving per month in 1,000 yen

	Per household				Per person in household				
year	mean	median	s.d.(σ)	Gini coefficient	mean	median	s.d.(σ)	Gini coefficient	n
1993	58.31	50.00	54.94	0.44	15.79	12.50	16.55	0.48	1,380
1994	64.07	50.00	61.61	0.43	17.46	13.33	18.81	0.47	1,340
1995	68.13	55.00	62.58	0.44	18.27	13.63	19.27	0.47	1,276
1996	68.49	57.00	58.82	0.43	18.88	14.29	20.18	0.47	1,227
1997	64.27	50.00	63.41	0.45	18.06	13.25	20.4	0.49	1,653
1998	63.68	50.00	72.14	0.5	17.49	12.50	21.53	0.54	1,600
1999	61.94	50.00	66.67	0.5	16.75	12.14	21.61	0.53	1,515
2000	63.95	50.00	66.98	0.5	17.37	12.20	20.83	0.53	1,460
2001	66.53	50.00	78.29	0.51	18.18	12.50	24.27	0.54	1,377
2002	65.64	50.00	72.72	0.49	17.94	12.40	23.67	0.53	1,333
2003	53.35	40.00	65.16	0.55	15.46	10.00	21.23	0.58	2,065
2004	55.53	40.00	69.63	0.55	16.07	10.00	21.94	0.58	1,932
2005	56.03	40.00	65.80	0.55	16.45	10.00	22.51	0.59	1,812
2006	57.73	41.00	68.12	0.54	17.06	10.50	23.32	0.58	1,714
2007	59.3	41.00	71.29	0.54	17.6	11.00	23.03	0.58	1,652
2008	53.1	36.00	67.25	0.57	16.83	10.00	23.83	0.6	2,179
2009	53.05	38.00	69.11	0.56	17.13	10.00	25.2	0.61	2,092
2010	53.83	38.50	67.01	0.56	17.47	10.00	24.52	0.6	2,024
2011	56.11	40.00	73.34	0.56	18.13	10.40	25.37	0.59	1,959
2012	54.65	37.00	69.11	0.56	17.96	10.00	26.77	0.61	1,901
2013	50.43	32.00	67.31	0.58	17.33	10.00	26.59	0.63	2,435
2014	53.18	35.00	66.57	0.57	18.32	10.00	29.21	0.62	2,268
2015	53.89	35.00	70.39	0.58	18.63	10.00	27.97	0.62	2,191
2016	55.68	35.00	71.45	0.58	19.1	10.00	28.36	0.62	2,079
2017	57.49	40.00	73.08	0.57	20.15	10.33	30.4	0.62	2,029

Source: Authors' calculations.

Table 9: Average net saving per month in different regions in 1,000 yen

	Kanto			Chubu			Kinki			Kyushu-Okinawa			Tohoku			Chugoku			Hokkaido			Shikoku		
Year	**p.h.**	**p.p**	**n**	**p.h.**	**p.p.**	**n**	**p.h.**	**p.p.**	**n**	**p.h.**	**p.p.**	**n**	**p.h.**	**p.p.**	**n**	**p.h.**	**p.p.**	**n**	**p.h.**	**p.p.**	**n**	**p.h.**	**p.p.**	**n**
1993	57.32	17.31	472	66.16	15.86	255	60.62	16.24	220	47.96	13.75	139	63.33	15	99	61.01	16.31	79	36	10.08	69	63	13.34	47
1994	66.24	20.37	455	70.11	16.81	254	61.54	16.37	221	57.96	16.62	142	63.03	14.95	88	72.27	17.56	75	42.33	11.35	64	58.34	12.75	41
1995	67.37	19.83	425	74.71	18.96	245	70.32	18.58	205	57.36	16.02	140	77.4	17.84	85	74.96	18.39	74	41.66	11.67	62	71.15	14.79	40
1996	73.73	22.21	406	70.94	18.58	243	66.11	17.7	201	58.45	16.54	129	68.38	16.73	82	65.19	16.6	68	49.49	13.4	57	77.1	16.35	40
1997	67.21	20.53	558	67	17.71	327	62.18	17.96	265	55.84	16.01	167	69.15	16.34	116	66.61	17.35	85	40.84	11.31	80	75.02	16.17	53
1998	66.23	20.15	541	64.99	16.71	306	60.88	16.79	265	55.05	14.95	168	70.25	16.84	110	68.74	16.99	86	40.46	10.81	68	78.08	16.57	53
1999	65.87	19.58	499	66.39	16.85	291	58.01	15.72	254	49.42	13.76	163	66.27	14.57	103	71.62	18.27	84	42.53	10.88	64	59.06	12.33	52
2000	70.8	20.89	485	65.55	16.21	280	59.94	16.56	240	51.17	14.12	155	58.36	13.43	100	76.27	18.91	83	40.83	10.65	63	61	14.5	50
2001	69.5	20.75	447	67.64	17.02	267	68.19	19.23	237	51.65	14.11	147	70.85	16.35	93	87.26	22.44	72	37.29	10.31	62	70.48	15.57	48
2002	68.21	20.29	431	69.01	16.57	258	60.2	16.93	226	52.62	15.77	144	74.66	16.79	90	90.24	24.38	71	40.13	10.85	61	66.06	16.13	50
2003	54.34	17.14	712	62.56	16.74	384	51.64	14.88	343	38.28	11.88	223	56.03	12.98	128	60.24	16.42	112	39.41	12.64	90	52.3	12.55	71
2004	58.54	18.48	654	65.5	16.97	370	52.07	15.42	323	40.12	12.29	204	52.58	12.9	123	61.94	17.17	99	38.88	11.45	86	51.8	12.4	70
2005	60.39	19.30	593	61.75	16.77	355	50.7	14.68	314	43.92	12.78	186	53.95	13.47	113	64.89	18.7	97	40.33	12.16	81	59.95	16.32	66
2006	61.19	19.74	549	66.54	18.05	337	54.68	16.31	302	42.16	12.96	179	52.69	13.25	108	66.23	18.29	93	38.63	11.52	79	61.59	15.47	63
2007	60.21	19.61	523	71.34	19.26	328	55.51	16.51	304	47.54	14.89	173	52.77	12.98	100	68.6	19.79	89	36.67	11.8	76	62.85	15.22	53
2008	54.13	18.30	698	63.45	18.2	414	51.81	17.24	399	37.62	12.84	237	50.02	13.77	134	67.83	20.28	120	34.21	11.5	101	48.84	12.61	73
2009	54.92	18.88	673	59.9	17.39	396	54.19	18.14	380	40.49	13.48	222	47.73	13.42	131	58.6	17.94	119	35.06	14.05	98	57.03	14.63	69
2010	55.86	19.62	667	64.72	18.87	375	52.29	17.07	376	42.82	14.53	207	45.61	13.14	121	59.19	17.52	109	32.26	11.77	96	53.88	15.47	69
2011	57.87	20.27	636	65.33	19.08	368	52.51	17.03	366	44.99	15.43	204	56.53	14.58	112	67.22	19.98	109	39.23	14.93	94	48.27	14.46	66
2012	57.14	20.41	625	67.47	20.06	352	52.36	17.46	356	39.7	12.91	196	47.21	12.73	111	60.3	18.8	106	34.51	13.01	89	46.34	14.55	62
2013	53.47	19.91	808	58.83	18.1	438	50.86	17.22	444	35.5	12.6	262	43.05	12.5	148	51.49	16.78	142	39.66	15.4	111	47.46	15.36	78
2014	56.79	21.46	753	58.46	17.16	415	51.54	17.49	418	39.92	14.74	236	49.58	14.28	134	53.53	17.01	133	43.56	16.73	103	56.75	20.47	73
2015	56.58	21.13	727	60.58	19.19	403	54.05	18.32	405	41.44	15.01	231	46.28	13.1	128	56.63	17.37	127	42.03	17.26	101	54.36	17.8	66
2016	59.48	21.45	687	62.37	19.97	388	54.55	18.53	375	38.58	13.37	218	48.98	14.47	119	62.18	20.02	124	43.03	17.56	100	55.78	19.19	65
2017	62.23	23.45	672	62.08	19.68	370	55.66	19.29	368	43.27	15.51	214	56.84	17.9	119	56.74	17.5	121	47.62	18	100	58.44	21.63	63

Notation: p.h. = per household; p.p. = per person in household; n = number of observations.

Source: Authors' calculations.

Chapter 5

The effects of unconventional monetary policy on stock markets and household incomes in Japan

5.1 Introduction

Income inequality has garnered significant attention in recent years due to its potential impacts on economic and societal outcomes. Research has shown that higher levels of inequality can erode trust in institutions, hinder social mobility, exacerbate economic crises, and even contribute to the rise of populism (Rajan 2010, Stiglitz 2012, Perugini et al. 2016, O'Connor 2017, Rodrik 2018, Guiso et al. 2019, Schnabl and Müller 2019). It can also negatively affect economic growth (Cingano 2014) and stability (Ostry et al. 2014).

One country that has seen a notable shift in the income and wealth distribution in recent decades is Japan. In 1980, Japan had the lowest levels of inequality among G7 countries but has since risen to the second highest among G7 countries and the ninth highest among OECD countries (Komiya and Kihara 2021). This increase in inequality has led to the erosion of the perception of a largely middle-class society in Japan (Aoyagi et al. 2015).

Our goal in this paper is to contribute to an explanation of this development. We focus on the distributional effects of monetary policy as one potential driver. While the distributional impact of fiscal policies on income inequality is well-established (Niehues 2010, Bastagli et al. 2012, Muinelo-Gallo and Roca Sagalés 2013, Woo et al. 2013), the relationship between monetary policy and inequality is less clear. Obtaining a better understanding of how monetary policies affect the distribution of income therefore requires more in-depth empirical research.

Our study makes several contributions to the existing literature on the relationship between monetary policy and income inequality. Firstly, we trace the effect of conventional and unconventional monetary policy measures on household income inequality through the portfolio channel by means of local projections. Secondly, using semi-aggregated household survey data, we provide a more nuanced understanding of the drivers of income inequality by examining the direct effects on different income brackets, rather than relying solely on summary statistics of inequality. This approach is similar to that used in recent studies of

Denmark (Andersen et al. 2022) and Sweden (Amberg et al. 2022). Finally, our study covers a longer time period than previous research, including the Bank of Japan's large-scale asset purchases during the COVID-19 pandemic.

The following section provides an overview of previous studies on the link between monetary policy and income inequality with a special focus on Japan. We then present and describe our data in section 3 and our empirical model and estimation results in section 4. Section 5 concludes.

5.2 Previous research

Empirical studies on the relationship between monetary policy and inequality have yielded conflicting results. Some research suggests that expansionary monetary policy can reduce income inequality among households. For instance, Coibion et al. (2017) provide respective evidence for the U.S., Mumtaz and Theophilopoulou (2017) for the UK, and Furceri et al. (2018) for various countries. These studies argue that monetary expansion can decrease income inequality through the earnings heterogeneity channel and the job creation channel, as it helps to keep low-income workers employed or improves their ability to find new employment (Draghi 2016).[77]

However, the overall effect of monetary expansion on income inequality is uncertain as higher-income households may disproportionately benefit from increased asset prices. This amplifying effect on inequality can occur through either the portfolio channel or the earnings heterogeneity channel, if high-income households hold a higher proportion of financial assets and therefore receive more capital income (Bernanke 2015, Inui et al. 2017, Yoshino et al. 2020).

There is growing empirical evidence that Japan's income inequality, in particular, has increased in response to unconventional monetary policies. There are three potential explanations for this trend. Firstly, the interest rate was already close to zero when Japan implemented unconventional monetary policies in 2001, limiting the ability of these policies

[77] Coibion et al. (2017), Nakajima (2015) and Inui et al. (2017) give an extensive overview and a detailed description of potential transmission channels through which monetary policy affects inequality. The four major channels are the earnings heterogeneity channel, the job creation channel, the portfolio channel and the savings redistribution channel.

to stimulate investment and job creation through lower rates. Secondly, Japan's lifetime employment practices result in generally low unemployment rates, diminishing the impact of the job creation channel of monetary policy. Finally, expansionary monetary policies may be less effective in an aging society with lower credit demand and higher risk aversion (Iman 2013).

Saiki and Frost (2014) were the first to examine the impact of unconventional monetary policy on the income distribution in Japan. Using data from the Household Savings and Liabilities Survey, which is part of the Family Income and Expenditure Survey (FIES), for the period from Q4 2008 to Q1 2014, the authors found that income inequality as measured by the ratio of the top 20% income share to the bottom 20% income share increased following the implementation of unconventional monetary policy measures by the Bank of Japan. The authors attributed this increase to the portfolio channel, as high-income households in Japan are more likely to hold a higher proportion of their savings in stocks, and therefore benefited more from the resulting increase in capital income.

Inui et al. (2017) investigate the distributional effects of monetary policy shocks on income inequality in Japan using quarterly time series of inequality measures from 1981 to 2008. The study is also based on micro-level household data from the Family and Income Expenditure Survey, specifically the Household Income and Expenditure Survey, which is another subset of the FIES. Inui et al. (2017) use the Gini coefficient and the ratio of the top 10% to the bottom 10% income shares as their preferred inequality measures. They find that, overall, monetary policy shocks do not have a stable and statistically significant impact on income inequality across a subset of Japanese households whose head is employed.[78] Only during the period between Q1 1981 and Q4 1998 they find that expansionary monetary policy shocks increase income inequality among these households. They suggest that this effect occurs through the earnings heterogeneity channel, as there is a procyclical response of earnings inequality following monetary policy shocks.

[78] In contrast to Saiki and Frost (2014), the subset of the FIES that Inui et al. (2017) use covers a longer time period and has a higher frequency, but only includes households where the head of the household is employed and therefore excludes self-employed, company owners, property owners, unemployed, most agricultural workers, etc. It thus only represents about 50% of Japanese households. In contrast, the Savings and Liabilities Survey of the FIES - the dataset that Saiki and Frost (2014) and we use - covers almost all of the representative households in Japan.

El Herradi and Leroy (2020) examine the impact of monetary policy on top income earners in 12 advanced economies, including Japan, over the period from 1920 to 2015. They use local projections to analyze the dynamic responses of the top 1% of income earners' pre-tax national income share to an exogenous shock in the short-term interest rate. Their findings suggest that expansionary monetary policy significantly increases the share of income held by the top 1%, likely due to the stimulation of returns on real and financial assets through the portfolio channel.

Israel and Latsos (2020) use the Japan Household Panel Survey from 2003 to 2014 to examine the impact of unconventional monetary policy on income inequality. They find that expansionary monetary policies had a narrowing effect on the gender pay gap and a widening effect on the education pay gap, possibly through the aggregate demand and labour productivity channels. However, monetary policy had no significant effect on the age pay gap in Japan.

Taghizadeh-Hesary et al. (2020) study the effect of Japan's zero and negative interest rate policy, combined with its tax policy, on income inequality between 2002 and 2017. They find that the increase in the money stock through quantitative and qualitative easing significantly increased income inequality. While tax policies implemented by the Japanese government were able to mitigate this effect, unconventional monetary policies still contributed to a net increase in inequality, as measured by the ratio of the top 10% to the bottom 10% income shares. The authors also observe that the top 20% of income earners in Japan held five times as much securities (stocks and bonds) in their savings portfolios as the second highest quintile (60-80%), suggesting that the earnings heterogeneity and portfolio channels may be particularly relevant in this case, and that an overproportionate stimulation of capital income may be driving the increase in income inequality.

Israel et al. (2022) examine the impact of Japanese monetary policy on household saving patterns over the period from 1993 to 2017. Using data from the Japanese Panel of Consumers, they find that monetary expansion contributed to a widening gap in the ability to save for households with different levels of education. Specifically, the volume of saving for non-academic households decreased, while academic households were able to increase their saving despite the negative effects of monetary expansion. As saving is a key factor in building wealth over time, these developments likely contributed to an increase in wealth inequality,

which can in turn have feedback effects on income inequality through the structure of households' savings portfolios.

Feldkircher and Kakamu (2022) present evidence that contradicts the findings of other studies on the impact of monetary policy on income inequality in Japan. Using grouped income data to estimate the Gini coefficient, they find that monetary tightening led to an increase in income inequality among households whose head was employed. This was likely due to the financial channel and job destruction channel, as tighter financing conditions and increased unemployment disproportionately impacted poorer households negatively. However, it is worth noting that this study relied on highly aggregated data, estimating the Gini coefficient from income data provided in the same unrepresentative subset of the FIES that Inui et al. (2017) use. More recent studies of Denmark and Sweden have demonstrated the benefits of using micro-level data to provide a more detailed analysis of the effects of monetary policy on household income.

Andersen et al. (2022) conduct a study on the impact of monetary policy on income inequality in Denmark using individual-level tax records from 1987 to 2014. They find that higher income households disproportionately benefited from expansionary monetary policy, likely due to their greater exposure to non-labour income channels such as the portfolio channel and the debt channel. They conclude that the different drivers of income had a negative overall effect on the income distribution and that extensive monetary easing increased income inequality in Denmark.

Amberg et al. (2022) use administrative micro-data for all legal residents in Sweden from 1999 to 2018 to examine the impact of monetary policy on the income distribution. They find that expansionary monetary policy has a U-shaped effect on income shares along the distribution, with low-income and high-income households experiencing rising incomes in response to a monetary policy shock, while middle-class incomes remain stagnant. The authors attribute this to the job creation channel benefiting low-income households and the portfolio channel benefiting high-income earners. They also note that the trend in income inequality is similar among advanced industrial countries, suggesting external validity for their findings for other countries. The fact that expansionary monetary policy tends to benefit both low- and high-income households while harming middle-class incomes (at least in relative terms) may have

significant implications for the stability of democratic societies in market economies, as highlighted by Schnabl and Müller (2019).

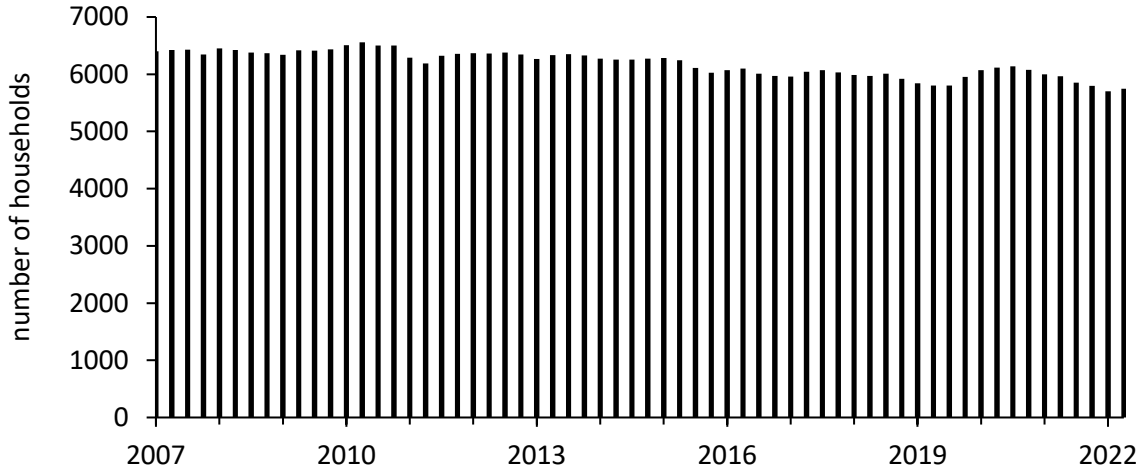
Continuing in the vein of Andersen et al. (2022) and Amberg et al. (2022), we aim to further contribute to the ongoing debate on the relationship between monetary policy and income inequality in Japan.

5.3 Data description

To examine the impact of monetary policy on income inequality in Japan, two data sets are used. The first set includes indicators of the monetary policy stance of the Bank of Japan and various macroeconomic aggregates, which are obtained from multiple data sources. The second set consists of data from the Family Income and Expenditure Survey, which covers various aspects of household finances. Both sets of variables will be discussed in the following sections.

5.3.1 Household income and savings portfolio

Figure 51: Number of households in the survey



Source: Family Income and Expenditure Survey.

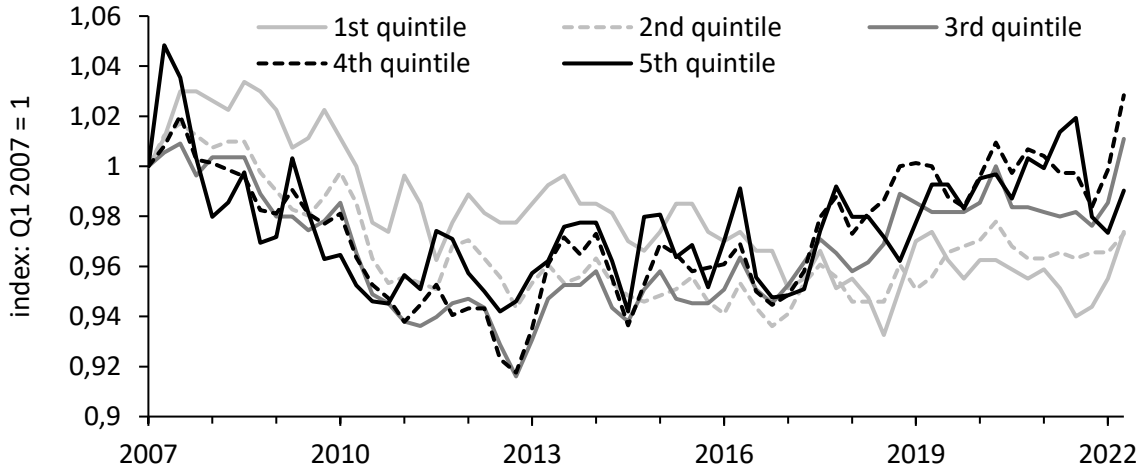
The Family Income and Expenditure Survey[79] provides comprehensive information about the income distribution and savings portfolios of Japanese households. The survey has been conducted annually by the Statistical Bureau of the Ministry of Internal Affairs and

[79] For information on the FIES see https://www.stat.go.jp/english/data/kakei/index.html.

Communication of Japan since 1958, and quarterly data on the income distribution and savings portfolios has been published online since 2007.

The statistical units surveyed are households with two or more persons. The average sample size is 6,186 households, selected using a three-stage stratified sampling method[80] across the entire area of Japan. The sample is refreshed monthly, with 1/6 of the households replaced each month. The survey has a maximum sample size of 6,517 households (in 2010) and a minimum of 5,724 (in 2022). The evolution of the number of households in the survey is illustrated in Figure 51.

Figure 52: Evolution of average annual household income by quintiles



Source: Family Income and Expenditure Survey.

The income variable represents the gross average annual household income.[81] Figure 52 shows the development of absoute household income by quintiles.[82] In Q2 2022, households belonging to the lower half of the income distribution are worse off than in the beginning of the sample (see also Figure 61 in the Appendix for the development of income by deciles). The upper half of the income distribution also suffered losses in the aftermath of the Great Financial Crisis. However, their incomes increased again since 2010. This rise coincides with

[80] In a stratified sample, the population is divided into homogeneous subpopulations called strata based on specific characteristics. Stratifying a sample helps with the generalizability and validity of a study and reduces biases when a population's characteristics are heterogeneous. In the present case these strata are firstly the municipality, secondly the survey unit area, and thirdly the household.

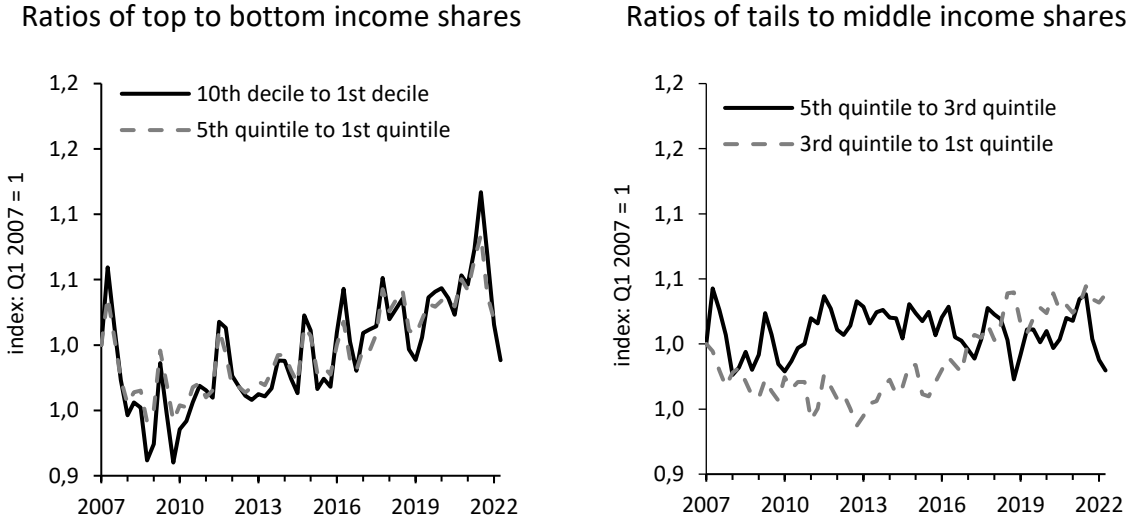
[81] Income sources included are regular income from employment and bonuses, pensions, other annual income.

[82] The gross average annual income over the entire observation period counts 2.6 million yen for the first quintile, 3.9 million yen for the second quintile, 5.3 million yen for the third quintile, 7.2 million yen for the fourth quintile and 12.1 million yen for the fifth quintile.

the BoJ's re-implementation of large-scale purchases of Japanese government bonds (Taghizadeh-Hesary et al. 2020).

The income development of different brackets of the income distribution has been heterogeneous over time. While the upper end of the distribution has experienced income gains, the middle class and lower end have either stagnated or experienced declines. To show these developments, we will present various measures of income inequality.

Figure 53: Indicators of household income inequality



Source: Family Income and Expenditure Survey.

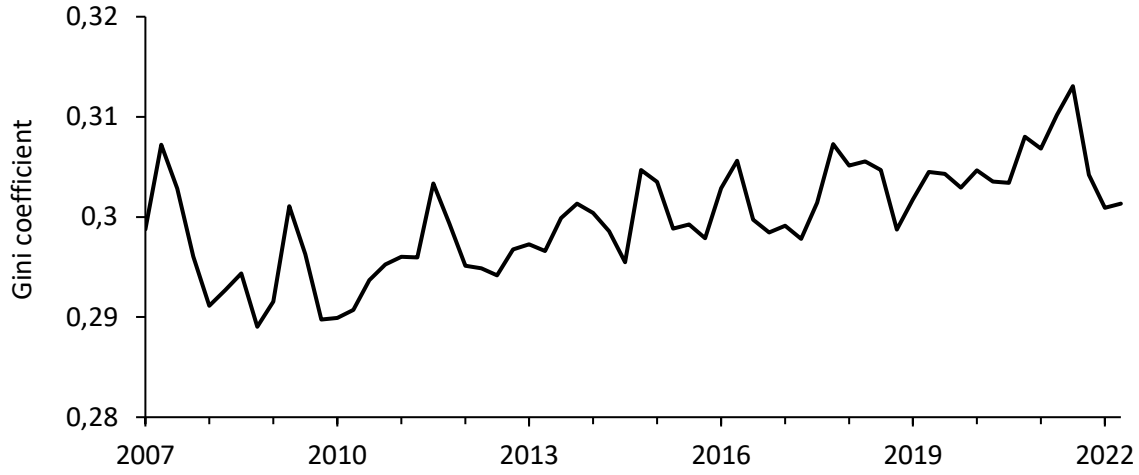
We first compare the development of the tails of the distribution relative to one another (top and bottom) and then look at the development of the tails relative to the center of the distribution. The highest income brackets (top 10% and top 20%) have diverged from the lowest income brackets (bottom 10% and bottom 20%) over the sample period (Figure 53, left panel). The ratio of the top 10% (20%) to the bottom 10% (20%) of the income distribution has increased by 11.6% (8.4%) until Q3 2021, but decreased by 12.8% (6.7%) between Q3 2021 and Q2 2022.[83] The BoJ's purchases of exchange-traded funds and Japan Real Estate Investment Trusts as part of their unconventional monetary policy (Harada and Okimoto 2021) from Q1 2010 until Q3 2021 coincides with a rise in the ratios of 18% (top 10% to bottom 10%) and 13% (top 20% to bottom 20%), respectively. As of Q2 2022, the two

[83] This coincides with a sharp fall in GDP starting in Q2 2021. Between Q2 2021 and Q1 2022 nominal (real) GDP fell by 5.9 (6.3) percentage points. Since Q1 2022 nominal (real) GDP has risen by 1 (0.6) percentage points. See Figure 55.

inequality indicators are 5.2% (top 10% to bottom 10%) and 6.3% (top 20% to bottom 20%) higher than in Q1 2010.

The opposite trend can be seen when examining the bottom of the income distribution in relation to the center of the distribution (Figure 53, right panel). Over the entire sample period, the income share of the middle quintile relative to the bottom quintile increased by 3.8%, and has increased by 6.4% since 2010. In contrast, the top 20% of the income distribution has seen a slightly decreasing trend in relation to the center (Figure 53, right panel). From Q1 2007 to Q2 2022, the ratio between the top quintile and the middle quintile fell by 2%.

Figure 54: Gini coefficient of household incomes



Source: Family Income and Expenditure Survey.

The Gini coefficient is another measure of income inequality that provides a summary statistic over the entire income distribution, rather than just a comparison of the top and bottom.[84] Figure 54 shows the Gini coefficient for annual household incomes. The trend is similar to the ratio of the top and bottom of the distribution shown in the left panel of Figure 53. The Gini coefficient decreased from 2007 to 2010, and then increased for the rest of the sample period. Like the other inequality indicators, the Gini coefficient decreased by 3.9% between Q3 2021 and Q2 2022. This trend is similar to the trajectory of balance sheet positions

[84] We have calculated the Gini coefficient shown in Figure 54 from income deciles provided in the survey.

reflecting the Bank of Japan's monetary stimulus programs (shown in Table 10 and Figure 62 in the Appendix).

Examining the savings portfolios of Japanese households based on their income levels reveals a high degree of heterogeneity. Our data suggest three key characteristics of these portfolios across the income distribution.

First, the percentage of savings invested in securities tends to increase with household income. For example, the highest income group holds 16.9% of their savings in securities (median over time), while the lowest income decile holds only 8.7% (see Figure 63 in the Appendix).[85]

Second, higher-income households are more likely to invest a larger proportion of their savings in stocks and shares. The highest-income decile allocates 12.5% of their savings to stocks and shares, while the lowest-income households invest only 5.4% (see Figure 64 in the Appendix).

Third, the percentage of savings held in bank deposits tends to decrease with rising income. Demand deposits are the most common type of deposit in households' savings portfolios, followed by time deposits. The lowest income group holds 71.9% of their savings in deposits, while the highest income group holds only 58% (see Figure 65 in the Appendix). Overall, as income increases, households are less likely to allocate a large proportion of their savings to deposits.

Based on these findings, we can conclude that a monetary policy that boosts stock prices through large-scale asset purchases is likely to generate capital gains, particularly for higher-income households. This is because these households tend to have a larger share of their savings invested in stocks and securities, while lower-income households are less invested in stocks and hold a greater proportion of their savings in non-interest-bearing deposits.

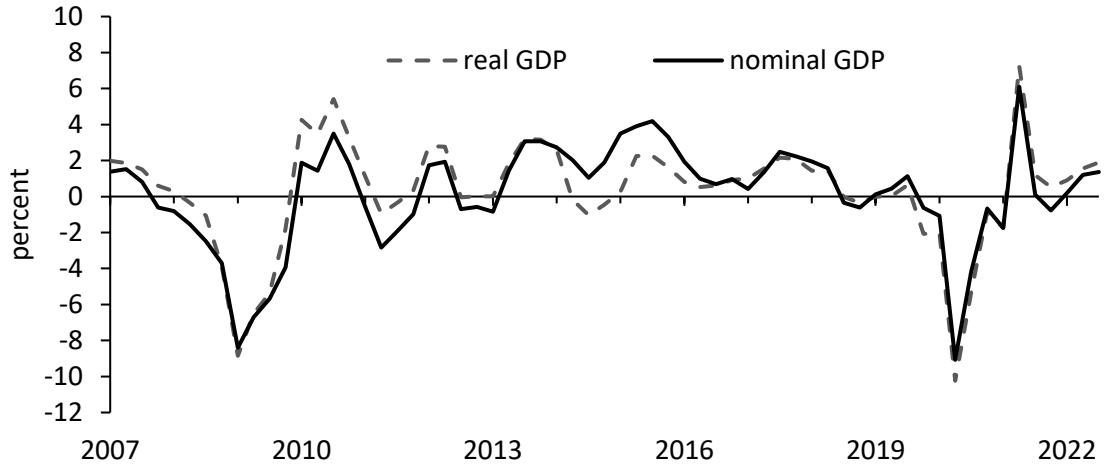
5.3.2 Macroeconomic and monetary environment

Since the burst of the Japanese asset price bubble in 1991, the Japanese economy has faced numerous challenges and recessions. In response to the Asian financial crisis in 1998, the Bank

[85] T-tests show that the securities-savings ratio is statistically different for the highest and lowest two income deciles compared to all other income deciles.

of Japan gradually lowered the deposit facility rate towards zero (Q4 1999) and as the first central bank in the world implemented unconventional monetary policies in 2001. In the wake of the Great Financial Crisis, the Japanese economy contracted by 8.3% year-on-year in real terms in the first quarter of 2009 (see Figure 55). To address this, the BoJ launched its second unconventional monetary policy program, which involved outright purchases of Japanese government bonds, corporate bonds and commercial papers (Saiki and Frost 2014). From Q1 2009 to Q4 2012, the BoJ's holdings of JGBs more than doubled from 4.3 trillion yen to 8.9 trillion yen. In the same time, commercial papers and corporate bonds held by the BoJ increased from 1.6 trillion yen to 4.9 trillion yen, with an average quarterly increase of 331 billion yen. In Q4 2010, the BoJ also began buying exchange-traded funds and Japan Real Estate Investment Trusts. The corresponding balance sheet position increased from 16.4 billion yen to 1.6 trillion yen in Q4 2012 (see Figure 62 in the Appendix).

Figure 55: Economic growth, Japan



Source: OECD. Economic growth is calculated as the year-over-year change of the quarterly GDP. The real value is calculated in 2011 prices.

In 2013, the BoJ announced its goal to achieve a 2% price inflation target. However, inflation remained subdued, averaging about 0.6% per year for both the GDP deflator and the consumer price index from Q1 2013 to Q4 2021 (see Figure 66 in the Appendix). To reach its target, the BoJ implemented expansionary monetary policy measures such as Quantitative

and Qualitative Easing[86], and introduced negative interest rates[87] and yield curve control[88] in 2016. From 2013 to Q2 2022, the BoJ's total assets increased significantly, rising from 164.8 trillion yen to 732 trillion yen, an increase of almost 5.5 times (see Figure 62 in the Appendix).

Table 10: Assets, Bank of Japan

Assets (in billion yen)	Q1 2007	% of GDP	Q2 2022	% of GDP
Gold	441.20	0.08	441.20	0.08
Cash	199.80	0.04	342.60	0.06
Japanese Government Securities	76,445.70	14.11	542,452.70	98.87
Financing Bills, Treasury Bills and Treasury Discount Bills	27,206.50	5.02	14,226.00	2.59
Japanese Government Bonds	49,239.20	9.09	528,226.60	96.28
Corporate Bonds			8,482.50	1.55
Commercial Paper			2,704.10	0.49
ETFs			36,811.10	6.71
J-REITs			657.60	0.12
Loans and Discounts	23,187.70	4.28	131,238.50	23.92
Foreign Currency Assets	5,419.40	1.00	8,425.80	1.54
Others	716.30	0.13	729.50	0.13
Total	112,740.90	20.81	732,730.60	133.56

Source: Bank of Japan.

The expansion of the Bank of Japan's balance sheet is most evident in its holdings of Japanese government bonds, loans and discounts, and exchange-traded funds (Table 10). The BoJ's JGB holdings have increased to 96.3% of GDP, or 528.2 trillion yen, while its loans and discounts now account for 23.9% of GDP. The BoJ's ETF position is valued at 36.8 trillion yen, making it the single largest shareholder of the Japanese stock market (Komiya and Kihara 2021). In fact, the BoJ's ETF holdings make up a significant portion of the Japanese ETF market, at around

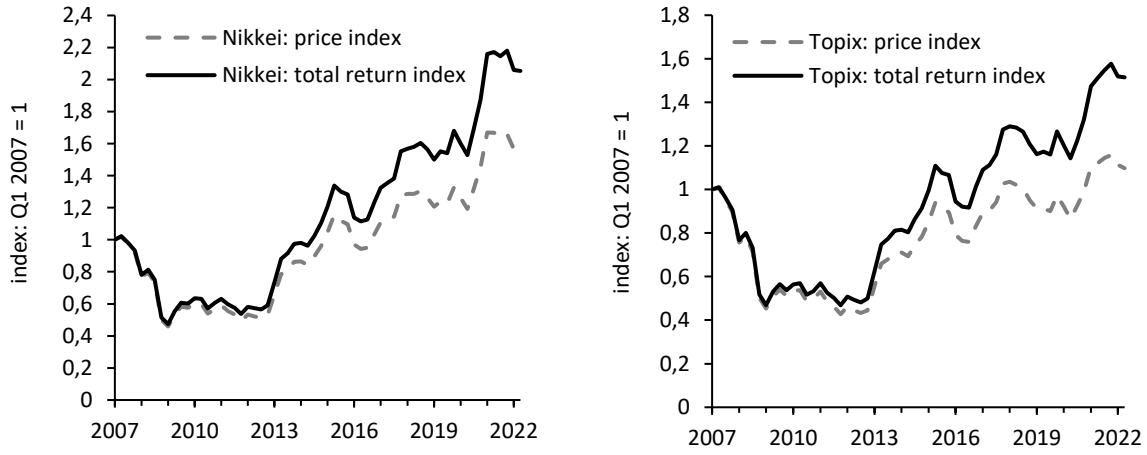
[86] The quantitative dimension refers to the expansion of the monetary base. The qualitative dimension refers mainly to the guidelines for asset purchases such as JGBs, ETFs and J-REITs. In September 2016, the BoJ announced to purchase ETFs and J-REITs "so that their amount outstanding will increase at annual paces of about 6 trillion yen and about 90 billion yen, respectively" (BoJ 2016).

[87] The negative interest rate policy was implemented through a three-tier system. Tier 1: The Basic Balance (interest rate: 0.1%) corresponds to the average of all commercial banks' deposits at the Bank of Japan in 2015 minus the minimum reserves. Tier 2: The Macro Add-on Balance (interest rate: 0.0%) corresponds to the minimum reserves plus deposits at the Bank of Japan associated with Bank of Japan lending programs. Tier 3: The Policy Rate Balance (interest rate: -0.1%) corresponds to all commercial bank deposits in excess of the other two items. In the case of increasing deposits beyond levels 1 and 2, the Bank of Japan may apply a multiplier to avoid too large an increase. The share of negative-rate deposits in total commercial bank deposits at the Bank of Japan was only about 5% in 2022 (Schnabl and Sepp 2022).

[88] To control the yield curve, the BoJ announced to purchase JGBs at "an annual pace of increase in the amount outstanding of its JGB holdings at about 80 trillion yen" so that the 10-year JGB yields remain around 0% (BoJ 2016).

80%, and around 8% of the entire Japanese stock market (Harada 2021). The BoJ's share of JGBs has even surpassed 50% of the total JGBs (Nikkei Asia 2022). In July 2022, the BoJ announced that it would intensify its approach to yield curve control by "purchasing 10-year JGBs at 0.25% every business day through fixed-rate purchase operations" to keep 10-year JGB yields around 0% (BoJ 2022). This policy has resulted in a drying up of the 10-year JGB market as the BoJ is offering higher prices than any market participant is willing to pay. In October 2022, there were four consecutive days where no JGBs were traded (Fujikawa 2022).

Figure 56: Japanese stock price indices



Source: Refinitiv, Nikkei, Tokyo Stock Exchange.

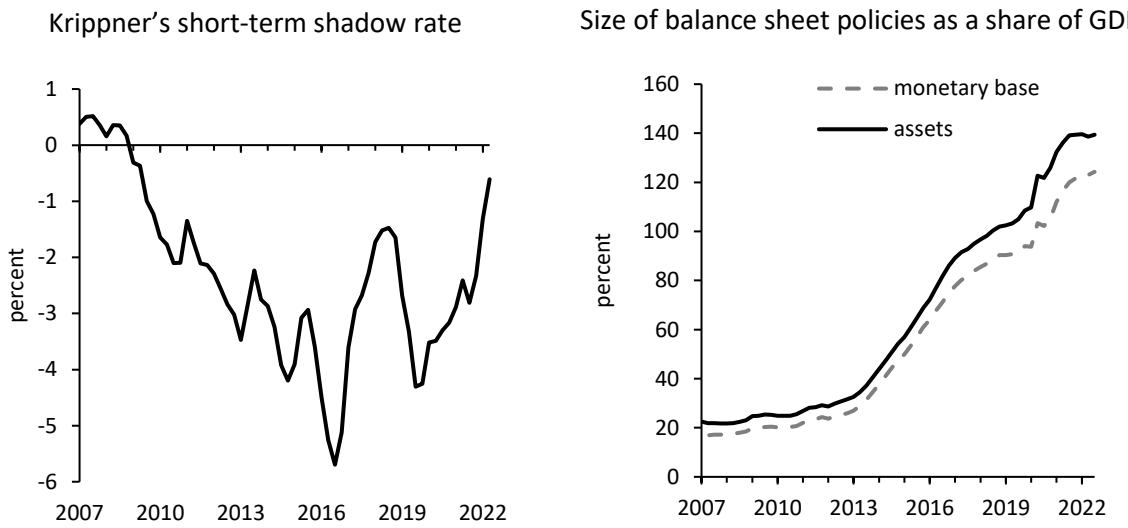
The most important stock market indices in Japan are the Topix and the Nikkei (Figure 56). These indices do not fully reflect the economic conditions described above. During the Great Financial Crisis, the indices fell, then stagnated until 2013, when the BoJ ramped up its asset purchase programs. During the COVID-19 pandemic, the indices fell from Q4 2019 to Q2 2020, but then rose sharply again as the BoJ increased its asset purchases to counter the impact of the crisis. In Q2 2022, the Nikkei total return index stood 110% above its value in Q1 2007. In contrast, the Topix only increased by 51%.[89] While the real economy and aggregate incomes have remained stagnant, the stock market has seen significant growth in comparison. Harada and Okimoto (2021) studied the effect of the BoJ's ETF purchases on the stock market and

[89] The Nikkei includes the biggest 225 Japanese companies, while the Topix measures the performance of more than 2000 Japanese companies.

found that the aggregate effect of large-scale ETF purchases on the Nikkei 225 was around 20% of the index value as of October 2017.

The Krippner short-term shadow rate of interest is a useful summary statistic that incorporates both conventional and unconventional monetary policy measures of the BoJ (Figure 57). Krippner (2020) translates the influence of asset purchases on the yield curve into changes in the short-term interest rate. This is particularly useful because the overnight rate is often constrained by the zero lower bound, making it difficult to compare the effects of unconventional monetary policy measures with those of conventional interest rate cuts. In 2016, the BoJ's balance sheet expansion is reflected in a lowering of the short-term shadow rate to almost -6%.[90]

Figure 57: Monetary policy indicators, Japan



Source: Bank of Japan, Krippner.

The monetary policy measures implemented by the BoJ in recent years may have contributed to a disconnect between the stock market and the real economy. These measures may also have had a negative impact on income inequality due to the heterogeneous nature of savings portfolios among different income groups. In the following section, we will examine the

[90] Afterwards the change in monetary policy by the Fed had ripple effects on bond yields around the globe. This is also true for Japan. Although the Bank of Japan kept expanding its balance sheet the shadow short-term rate rose to -1.5% by 2018.

extent to which BoJ monetary policy has affected both the stock market and various income brackets within the income distribution.

5.4 Empirical model

In this study, we use local projections [91] (Jordá 2005) to estimate three pass-through equations. The first equation examines the cumulative effect of changes in the short-term shadow rate on the Nikkei and Topix stock market indices. The second equation investigates the impact of an increase in these stock indices on household incomes. The third equation estimates the direct effect of changes in the short-term shadow rate on household incomes. To assess the distributional impact on household incomes, these pass-through equations are applied to all income quintiles.

We expect unconventional monetary policy measures, such as large-scale asset purchases of Japanese government bonds and exchange-traded funds, to increase household capital income through the portfolio channel. However, drawing on the findings from Section 3.1, which highlight the significant differences in the portfolio structures of Japanese households across different income groups, we expect that the impact will vary based on the amount of stocks held in household savings portfolios and their corresponding position in the income distribution.

Unlike other studies (i.e. Inui et al. 2017, Andersen et al. 2022, Amberg et al. 2022), we do not explicitly identify exogenous monetary policy shocks in our pass-through estimates. Therefore, our results should be interpreted as dynamic correlations between the variables studied and cannot be considered as cause-and-effect relationships in isolation. We suspect that persistent monetary expansion, whether expected or unexpected, may lead to changes in households' saving habits and portfolio structures over time. Some households may be better able to make the necessary adjustments than others (Israel and Latsos 2020, Israel et al. 2022). In this way, monetary expansion may have structural effects on the distribution of

[91] Local projections (such as vector autoregressions) is a method for the estimation of impulse responses to study the propagation of structural shocks. While vector autoregressions are more efficient, local projections are more robust to model misspecifications (Plagborg-Moller and Wolf 2021).

income and wealth, even when correctly anticipated, that is, even without any monetary policy shocks.[92]

Moreover, identifying monetary policy shocks in Japan is particularly challenging. For example, Andersen et al. (2022) rely on an identification strategy based on Denmark's fixed exchange rate system, arguing that the monetary policy conducted by the European Central Bank (ECB) is exogenous to Denmark's inflationary dynamics and economic activity. However, this exogeneity depends on the divergence of business cycles and inflationary dynamics in the euro area and Denmark.

Amberg et al. (2022) use high-frequency data and a "poor man's sign restriction" approach (Jarocisnki and Karadi 2020) to identify monetary policy shocks. This approach is based on a surprise series and an inverse relationship between stock market movements and interest rate shocks. If the movement is inverse, it is assumed to be related to a change in monetary policy that differs from previous expectations. The monetary surprise is then regressed on the actual change in the repurchase rate, and the resulting monetary shock series is equal to the fitted values of this regression. However, Amberg et al.'s (2022) income data is only available at an annual frequency, requiring them to transform the identified monetary policy shocks to the same frequency. While similar aggregation methods have been used in the literature (i.e. Gertler and Karadi 2015, Hanson and Stein 2015), the underlying process is complex and the weighting scheme can be arbitrary.[93]

Since the yen is floating freely and the Bank of Japan's monetary policy is primarily focused on responding to domestic inflationary dynamics and economic activity, we cannot assume exogeneity of the BoJ's monetary policy and replicate the approach used by Andersen et al. (2022). Furthermore, our data on household income is only available at a quarterly frequency, so aggregating high-frequency monetary shocks would introduce the aforementioned issues present in Amberg et al. (2022). Therefore, we adopt a different approach and estimate the pass-through equations via local projections without identification of monetary policy shocks.

[92] This is connected to the idea of asymmetric monetary policies, where monetary policy is eased over-proportionately during downturns and only hesitantly tightened during upswings (Schnabl 2011).

[93] It is unclear whether shocks that occur at the beginning of the year have a different impact on annual income than shocks that occur later in the year. Amberg et al. (2022) sum up the high-frequency shocks, implying that they believe the effect of shocks on annual household income is the same regardless of when they occur within the year.

5.4.1 Pass-through estimates via local projections

The first equation examines the relationship between our measure of monetary expansion, the short-term shadow rate (ssr_t), and the Japanese stock market (s_t). The ssr_t is reported at a daily frequency and converted to a quarterly frequency by taking the unweighted average over the period of the corresponding quarter. The equation is controlled for gross domestic product (GDP_t) to account for the overall economic activity. The stock market and GDP variables are transformed using the natural logarithm, so the first differences approximate quarterly growth rates. The ssr_t is used in its raw level, so the associated coefficient can be interpreted as a semi-elasticity.[94] The local projections are estimated for nine forecasting horizons ($h \in [0:8]$), allowing us to estimate the cumulative dynamic effect up to two years after the initial direct effect.[95]

$$(s_{t+h} - s_{t-1}) = \alpha + \beta_1 ssr_t + \beta_2 (GDP_t - GDP_{t-1}) + \varepsilon_{t+h} \text{ for } h = 0, \dots, 8 \qquad \textit{(1)}$$

The Nikkei index is initially used to measure the stock market movements, but the analysis is replicated using the Topix index as an alternative measure of the overall performance of the Japanese stock market.

In the second step, we estimate the cumulative impact of a change in the stock market index on Japanese households' income. Unlike in the first equation, we use annual growth rates rather than quarterly growth rates to account for the fact that it takes time for changes in the stock market to affect household income.[96] The estimation results of a model based on quarterly growth rates is presented in the Appendix (Table 15). It becomes apparent that significant effects only arise after one year, highlighting the importance of the time lag in the manifestation of capital gains in actual household income.

[94] A semi-elasticity is the percentage change in the dependent variable to an absolute change of the independent variable.

[95] An interest rate cut at time t is associated with a direct contemporaneous effect, which corresponds to $h = 0$. The interest cut in t also has an effect on the dependent variable in the following periods $h + 1$. For instance, $h = 1$ shows the effect after the lapse of one additional quarter, $h = 2$ shows the effect after two additional quarters, and so on. The effects are given as a change from the base period.

[96] Although dividends are typically realized on a regular basis, the realization of capital gains depends on household transactions and can take more time. Additionally, a company's dividend policy may change over time.

$$(y_{i,t+h} - y_{i,t-4})$$
$$= \propto_i + \sum_{j=0}^{3} [\beta_{j+1,i} (s_{t-j} - s_{t-4-j}) + \beta_{j+5,i} (GDP_{t-j} - GDP_{t-4-j})]$$
$$+ \varepsilon_{t+h} \; for \; i = 1, \dots, 5 \text{ and } h = 0, \dots, 4$$

(2)

Household incomes are denoted as ($y_{i,t}$), where i corresponds to the position in the income distribution. As we consider the quintiles of the distribution, i runs from 1 to 5. The stock market is denoted by (s_t). Equation 2 also includes the gross domestic product (GDP_t) to control for the economic activity. We use local projections to estimate the cumulative effect for up to 2 years after the initial state of the stock market ($h \in [0:4]$) for all income quintiles. The left-hand side of the equation is given in absolute income levels, hence it corresponds to the absolute income gain from the base period to the forecast horizon. The variables on the right-hand side are transformed by applying the natural logarithm and then differences to the previous year's quarter are calculated to approximate annual growth rates.

These two-step pass-through estimations reflect our assumption for a transmission mechanism from monetary expansion over the stock market to the incomes of households of single income groups.

$$(y_{i,t+h} - y_{i,t-1}) = \propto_i + \beta_{i,1} ssr_t + \beta_{i,2} (GDP_t - GDP_{t-4}) + \varepsilon_{t+h} \text{ for } i = 1, \dots, 5 \text{ and } h = 0, \dots, 8$$

(3)

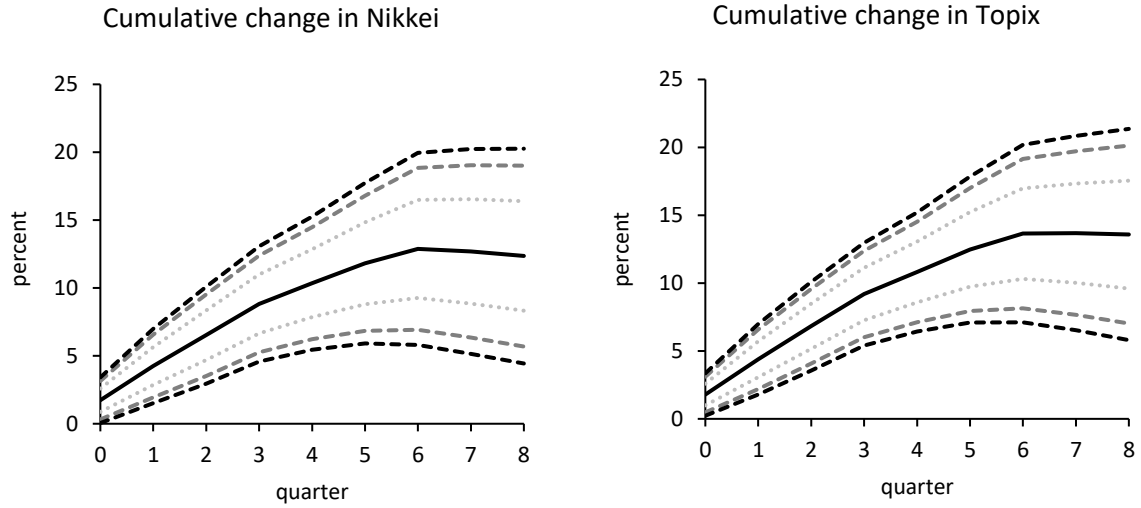
Equation 3 directly estimates the cumulative effect of a change in the short-term shadow rate (ssr_t) on household income ($y_{i,t}$). Again, the equation includes the gross domestic product (GDP_t) to control for the aggregate level of economic activity. The left-hand side is equal to the absolute income gain between the base period and the forecast horizon. GDP is transformed to quarterly growth rates by applying the natural logarithm and calculating the difference to the first lagged value (one quarter back in time). The ssr_t is added in levels, thus the related coefficient can be interpreted as a semi-elasticity. As in the first step, the local projections are estimated for nine periods ($h \in [0:8]$) hence the cumulative effect is estimated for up to two years.

5.4.2 Results

Figure 58 shows the cumulative effect of a one-percentage point decrease in the ssr_t on the Nikkei and Topix total return indices estimated on the basis of Equation 1. The results using the performance indices of the Nikkei and Topix are very similar (see Figure 68 in the Appendix).

A one-percentage-point decrease in the short-term shadow rate is associated with a direct effect (on impact) of a 1.7% increase of the total return Nikkei index (Figure 58, left panel). The value is significantly different from zero. The 95%-confidence interval ranges from 0.05% to 3.4%. Over the next quarters the effect steadily increases. After four quarters, the effect reaches 10.4%, with the 95%-confidence interval ranging from 5.5% to 15.3%. From the fourth quarter onward, the effect does only increase slightly. After eight quarters the estimated effect is equal to 12.4%, with a 95%-confidence interval between 4.4% and 20.3%. The effect for the broader stock market index Topix has a similar trajectory (Figure 58, right panel). After 4 quarters the effect equals 10.8%, with the 95%-confidence interval ranging from 5.7% to 21.4%. Again, the effect in the subsequent quarters increases only slightly to 13.6% with a 95%-confidence interval of 5.8% to 21.4%.

Figure 58: The effect of a one-percentage-point decrease in the short-term shadow rate on Japanese stock market total return indices

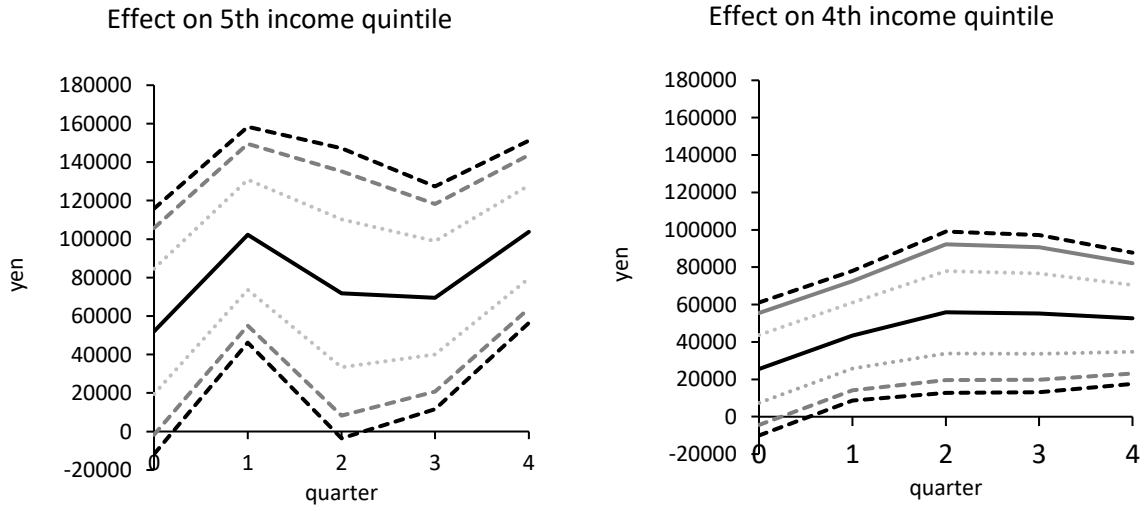


Source: Authors' calculations. The black dashed lines represent the 95% confidence band, the dashed gray lines represent the 90% confidence bands, and the dotted lines represent the 65% confidence band.

The estimation of the second equation complements the first equation to trace the transmission mechanism (portfolio channel of monetary policy) through which monetary expansion affects household incomes. We estimate the effect of a 10% increase in the stock market index on the annual income for each quintile up to two years into the future. The magnitude of the increase in the stock market is in line with the findings of the first pass-through estimation, where the impact of a one percentage point decrease in the ssr_t is roughly associated with a 10% increase in the stock market after 4 quarters (Figure 58).

The direct effect of a 10% increase in the stock market over one year on the income of the top 20% income earners (5th quintile) is equal to 52,028 yen per year (Figure 59), but the coefficient is only significant for the 65%-confidence interval. Though after one quarter the effect doubles to 102,280 yen with the 95%-confidence interval ranging from 46,178 yen to 158,381 yen. After four quarters (two years), the effect reaches 103,784 yen with the 95%-confidence interval ranging from 56,437 yen to 151,132 yen. The average income level of the 5th quintile over the period Q1 2007 to Q2 2022 is 12 million yen hence the relative effect ranges from 0.5% to 1.2%.

Figure 59: The effect of a 10% annual increase in the stock market (Nikkei) on top income brackets (coefficient β_1 in Equation 2)



Source: Authors' calculations. The black dashed lines represent the 95% confidence band, the dashed gray lines represent the 90% confidence bands, and the dotted lines represent the 65% confidence band.

The effects for the other quintiles are summarized in Table 11. For the lowest income brackets (1st and 2nd quintile), the effect is insignificant for all periods. For the second highest income bracket (4th quintile), we obtain a significant positive effect on the income development. The effect equals 52,637 yen after two years and the 95%-confidence interval spans from 17,557 yen to 87,716 yen. Hence, the effect in absolute terms is half as big as for the top 20% income bracket. The average income for the 4th quintile over the period Q1 2007 to Q2 2022 is around 7 million yen hence the relative effect ranges from 0.2% to 1.2%.

For the middle income bracket (3rd quintile), we find a positive effect of 23,735 yen after two years. The 95%-confidence level ranges from 1,529 yen to 45,941 yen. The average income for the 3rd quintile over the period Q1 2007 to Q2 2022 is equal to roughly 5 million yen hence the relative effect ranges between 0.03% and 0.9%. The results are in line with the descriptive statistics from section 5.3. The higher the share of stocks and shares in the savings portfolio (which is correlated with the position in the income distribution), the higher the effect of an increase in the stock market index on income.

Table 11: The effect of a 10% annual increase in the stock market (Nikkei) on all income quintiles

	After 1 quarter			After 4 quarters		
Quintile	**Coefficient**	**95%-Confidence Interval**		**Coefficient**	**95%-Confidence Interval**	
1	878	11,330	-9,574	-2,409	4,867	-9,685
2	6,750	20,813	-7,313	8,012	16,853	-829
3	15,865	36,763	-5,033	**23,736***	45,942	1,530
4	**43,414***	78,101	8,726	**52,637***	87,716	17,558
5	**102,280***	158,382	46,178	**103,785***	151,133	56,437

Source: Authors' calculations. *p < 0,05

A specification based on quarterly growth rates as opposed to annual growth rates is estimated as a robustness check. The respective adaptation of Equation 2 and the estimated effects are given in the Appendix (Figure 67). There is again a time lag between a stock market increase and its impact on household income. The effects of a 10% quarter-to-quarter increase in the stock market after 4 quarters (one year) and after 8 quarters (two years) are summarized in Table 12. The size of the effect is broadly in line with the model based on annual growth rates. On a 5%-confidence level we find significant positive effects for the 5th, 4th and 3th quintile, while the effects for the 2nd and 1st quintiles are insignificant.

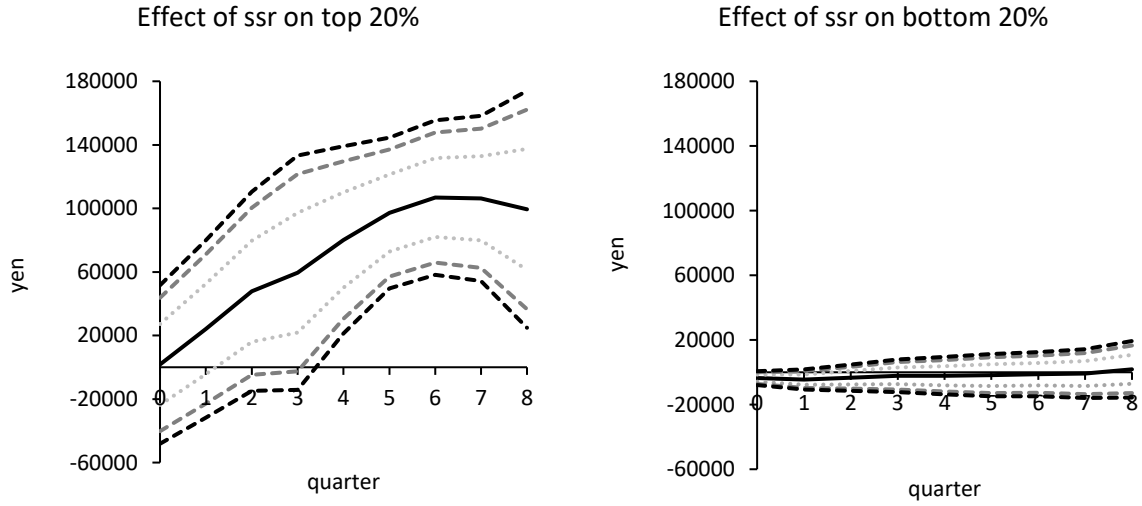
Table 12: The effect of a 10% quarterly increase in the stock market (Nikkei) on all income quintiles (Equation 4 in the Appendix, note to Figure 67)

	Effect after 4 quarters			Effect after 8 quarters		
Quintile	**Coefficient**	**95%-Confidence Interval**		**Coefficient**	**95%-Confidence Interval**	
1	-3,641	10,594	-17,875	3,182	23,789	-17,424
2	10,759	24,270	-2,752	14,003	47,788	-19,783
3	**30,373***	55,708	5,038	**39,946***	76,883	3,009
4	**71,719***	109,890	33,549	**69,311***	128,151	10,471
5	**125,017***	176,128	73,906	**105,991***	208,101	3,880

Source: Authors' calculations. *p < 0,05

Both models (based on quarterly and annual growth rates) are re-estimated by using the broader stock market index Topix. The results are very similar and can be found in the Appendix (Table 14 and Table 15).

Figure 60: Pass-through of a change in the ssr on the top and bottom income bracket



Source: Authors' calculations. The black dashed lines represent the 95% confidence band, the dashed gray lines represent the 90% confidence bands, and the dotted lines represent the 65% confidence band.

In the third step, we directly estimate the impact of a change in the short-term shadow rate on different income brackets. Figure 60 (left panel) shows the cumulative pass-through of a one-percentage-point decrease in the ssr_t on the top 20% of the income distribution. After four quarters (one year), the effect is equal to an increase of 80,100 yen with a 95%-confidence interval ranging from 21,150 yen to 139,050 yen. After eight quarters (two years)

the effect is equal to 99,382 yen with a 95%-confidence interval spanning from 24,790 yen to 173,973 yen.

Table 13: Effect of a 1 percentage point decrease in the ssr on all income quintiles

	After 4 quarters			After 8 quarters		
Quintile	**Coefficient**	**95%-Confidence Interval**		**Coefficient**	**95%-Confidence Interval**	
1	-2,135	9,439	-13,709	1,813	19,321	-15,695
2	**15,397***	25,236	5,558	**25,210***	41,416	9,004
3	**28,523***	48,128	8,918	**56,703***	84,441	28,966
4	**50,340***	75,375	25,305	**82,798***	120,257	45,339
5	**80,100***	139,050	21,150	**99,382***	173,973	24,790

Source: Authors' calculations. *p < 0,05

With respect to the average income, the effect size ranges from 0.2% to 1.4%. In contrast, the effect on the 1st quintile of the income distribution is insignificant for all periods even when a 65%-confidence interval is considered. For the 2nd, 3rd and 4th quintile there are lower effects in magnitude than for the 5th quintile, but the effects are statistically significant and positive at a confidence level of 5%. The effect increases for subsequent quarters and is highest after 8 quarters (two years). Table 13 summarizes the estimated effects for all quintiles.

These results show that an increasingly expansionary monetary policy can have a systematic effect on income inequality. When asset purchases increase bond prices, decrease bond yields, depress interest rates on bank deposits and lead to stock price increases, households who hold these assets in their savings portfolios receive relative income gains. In Japan, the impact is greater for higher-income households who invest more in the stock market. Lower-income households, who have less invested in these assets, do not see significant income gains. Our results confirm earlier studies, such as Saiki and Frost (2014) or Israel and Latsos (2020).

5.5 Conclusion

The expansionary monetary policies implemented by the Bank of Japan over the past decades have likely contributed to rising income inequality. These policies, particularly unconventional asset purchase programs, have led to increased stock market performance, which has

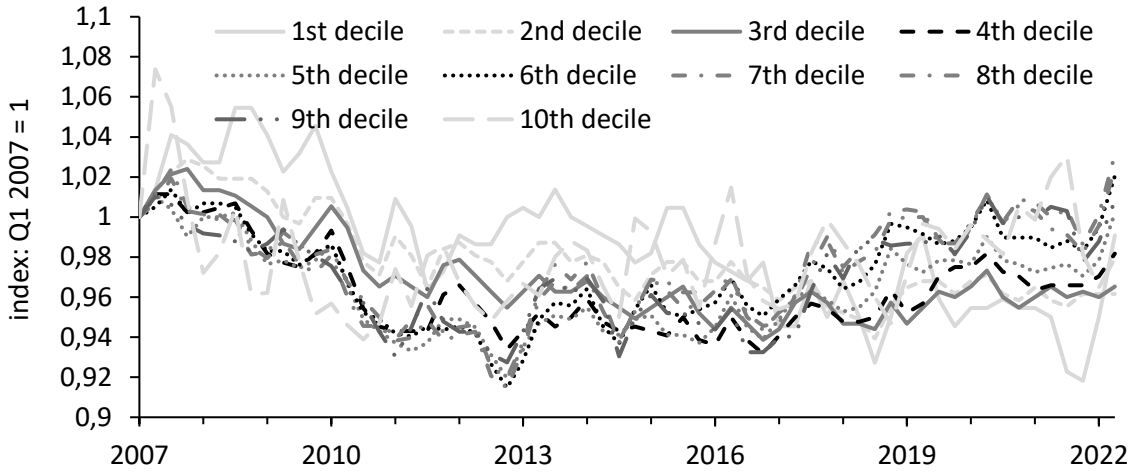
disproportionately benefited high-income households that tend to hold a larger share of their savings in stocks. Low-income households, on the other hand, have largely held their savings in demand and time deposits, and therefore have not benefited as much from these policy measures.

Our findings suggest that, to the extent that rising inequality is a concern, monetary policy as conducted in Japan and many other countries may need to be reevaluated in terms of its cost-benefit performance. While expansionary monetary policy can have positive short-term effects on employment, it is important to consider its potential impacts on the income distribution.

Overall, our study adds to the growing body of research on the distributional effects of monetary policy and highlights the need for a more nuanced understanding of the mechanisms through which these policies affect income inequality. Further research could explore the distributional impacts of other policy measures, such as fiscal policies, and their potential interactions with monetary policy. For example, if expansionary monetary policy leads to increased asset prices and boosts capital income over-proportionately, lower taxes on capital income as compared to labour income can amplify the adverse distributional effects of monetary expansion.

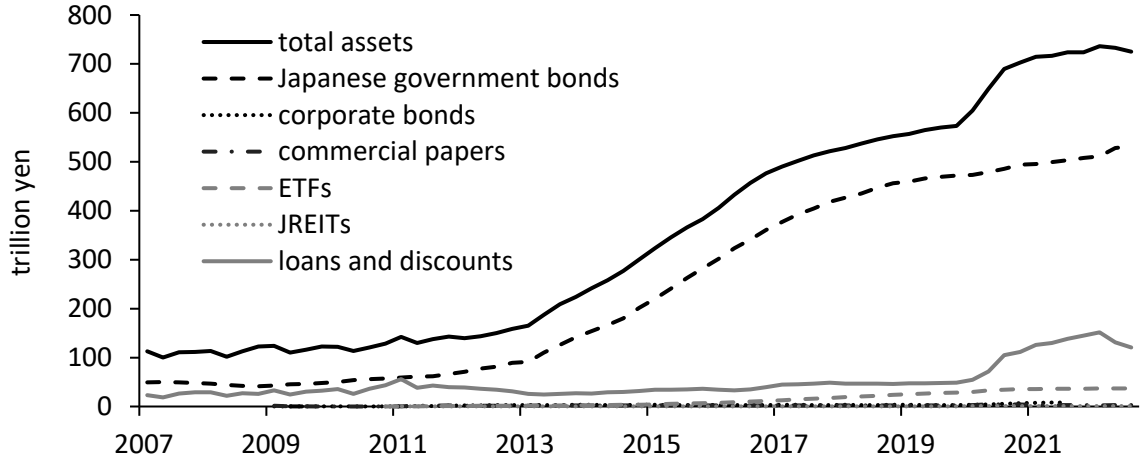
Appendix

Figure 61: Evolution of average annual household income income by deciles



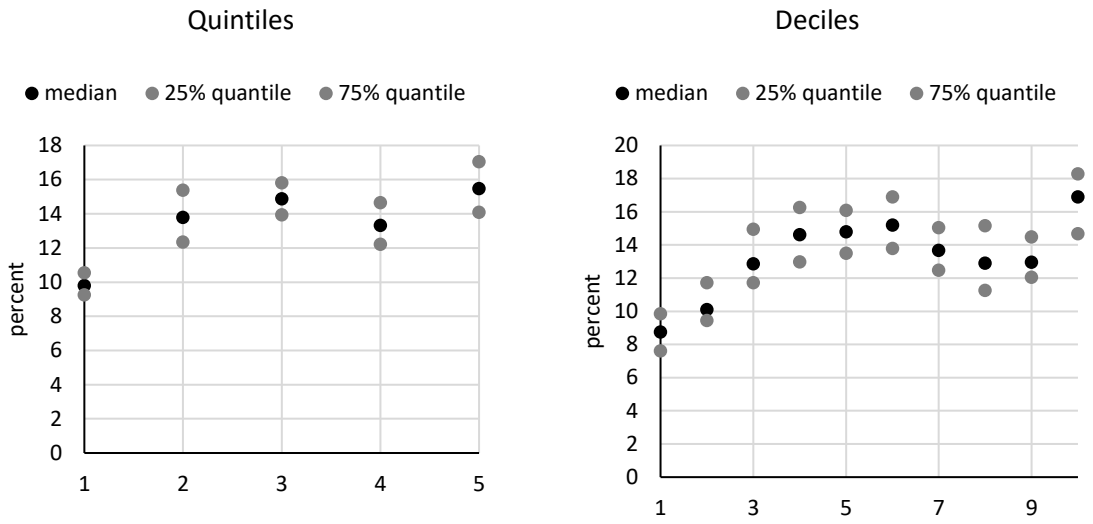
Source: Family Income and Expenditure Survey.

Figure 62: Selected balance sheet positions, Bank of Japan



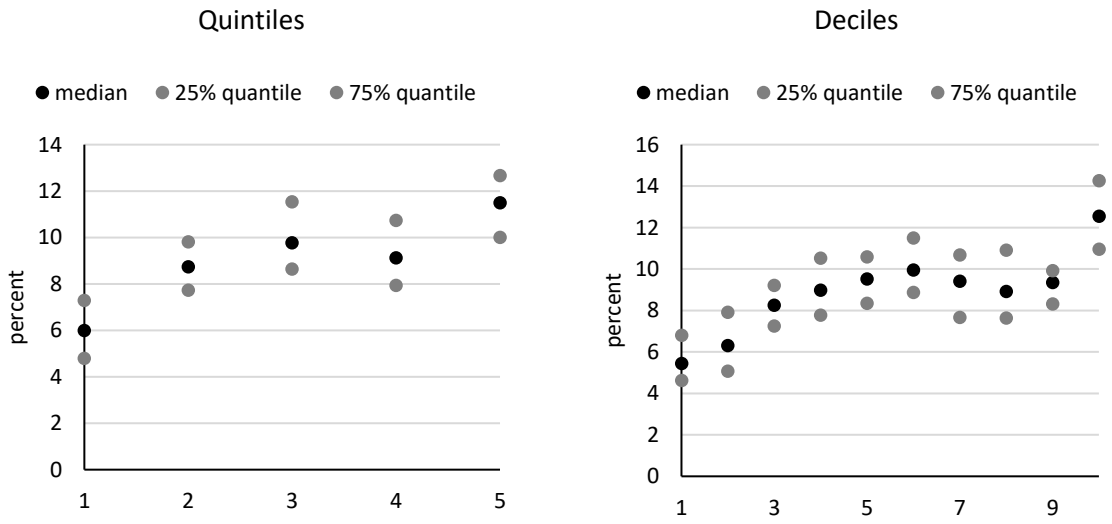
Source: Bank of Japan.

Figure 63: Proportion of securities in overall savings by income level



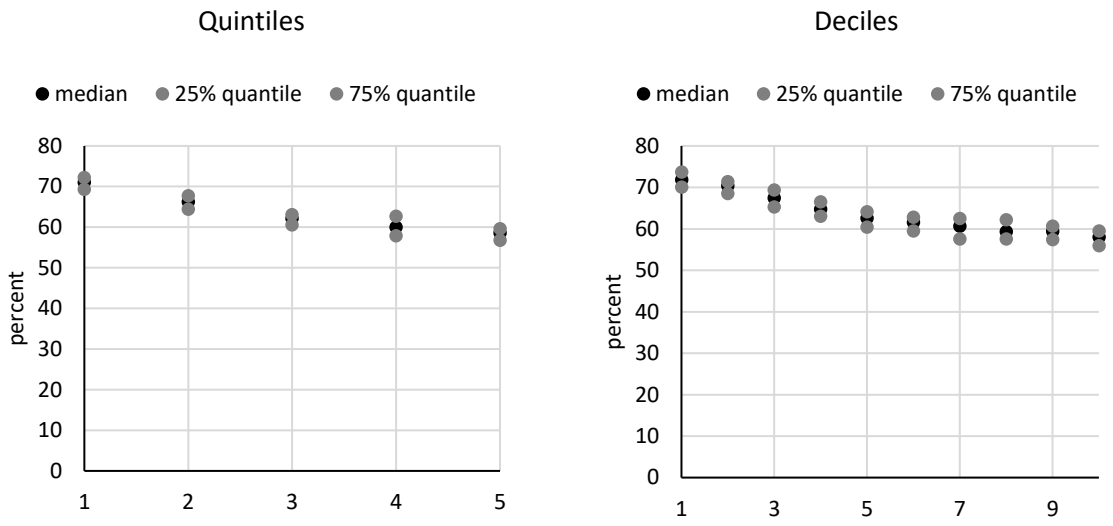
Source: Family Income and Expenditure Survey.

Figure 64: Proportion of stocks and shares in overall savings by income level



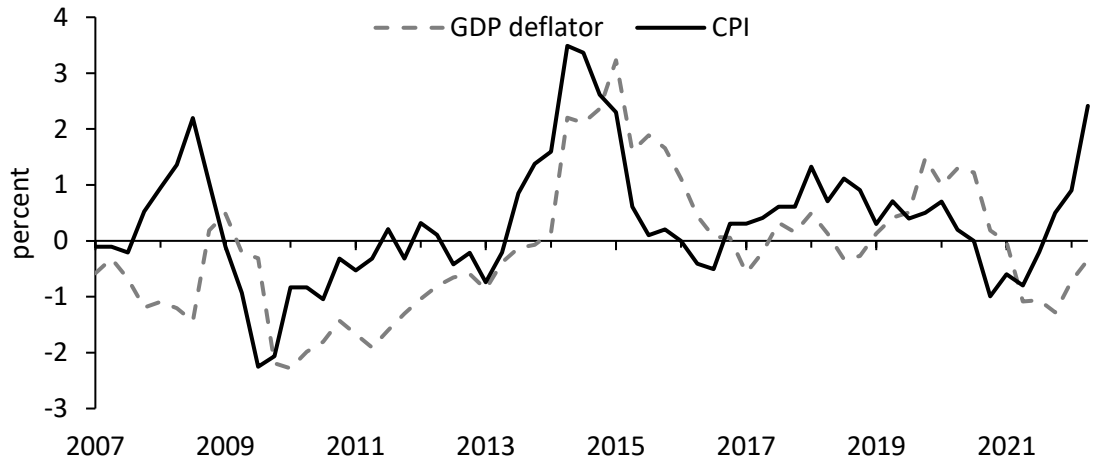
Source: Family Income and Expenditure Survey.

Figure 65: Proportion of deposits in overall savings by income level



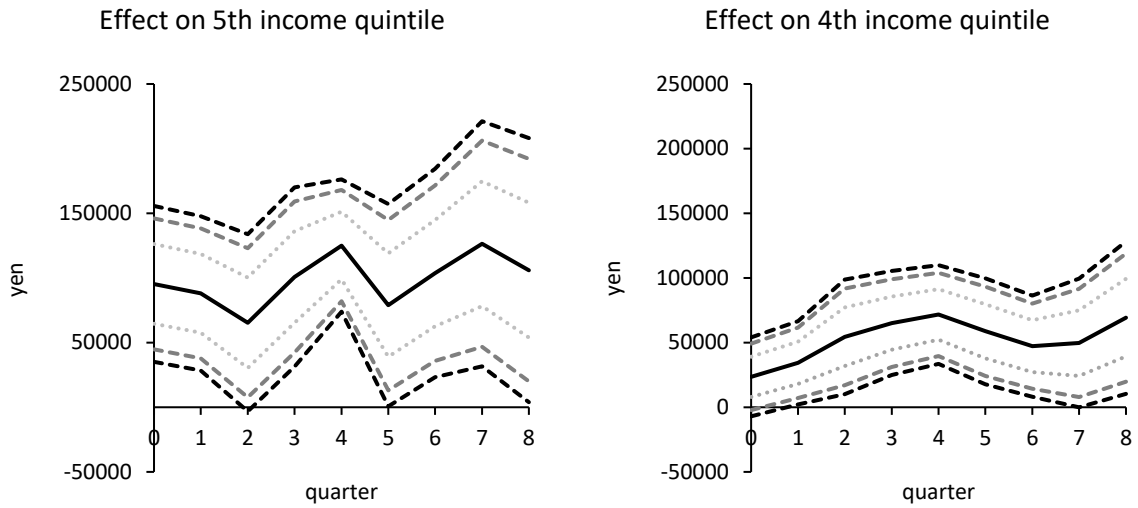
Source: Family Income and Expenditure Survey.

Figure 66: Price inflation, Japan



Source: OECD, Statistics Bureau, Ministry of Internal Affairs and Communication.

Figure 67: The effect of a 10% quarter-to-quarter increase in the stock market on top income brackets



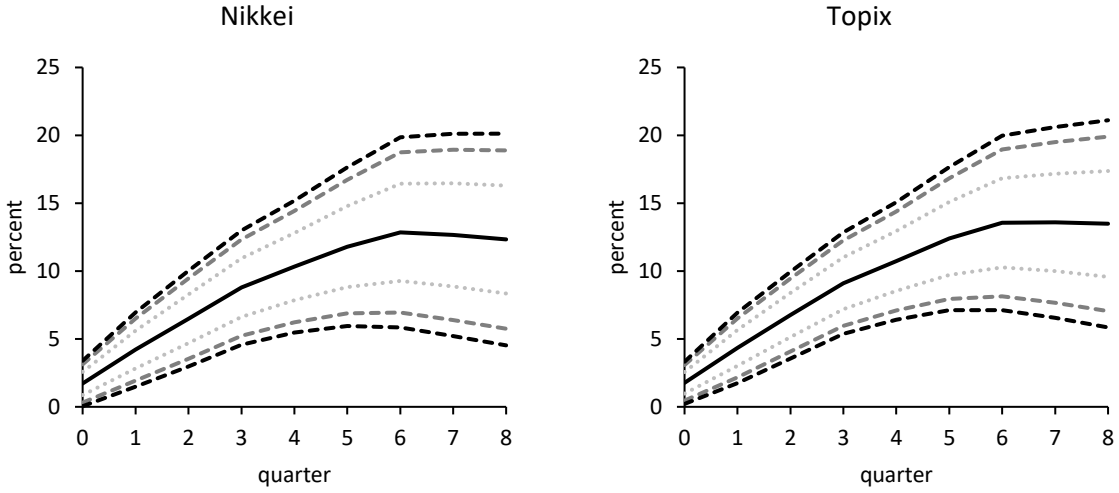
Source: Authors' calculations. The black dashed lines represent the 95% confidence band, the dashed gray lines represent the 90% confidence bands, and the dotted lines represent the 65% confidence band.

Equation 4: Estimation equation from the pass-through from 10% stock market gains on incomes:

Note: The above estimations are based on the following equation, which is an adaptation of Equation 2, where annual growth rates have been replaced by quarterly growth rates:

$$\left(y_{i,t+h} - y_{i,t-1}\right) = \propto_i + \beta_{1,i}(s_t - s_{t-1}) + \beta_{2,i}(GDP_t - GDP_{t-1}) + \sum_{j=2}^{3}[\beta_{j+1,i}\left(s_{t-j} - s_{t-1-j}\right) + \beta_{j+3,i}\left(GDP_{t-j} - GDP_{t-1-j}\right)] + \varepsilon_{t+h}\ for\ i = 1, \dots, 5\ and\ h = 0, \dots, 8 \quad (4)$$

Figure 68: The effect of a one-percentage-point decrease in the short-term shadow rate on Japanese stock market performance indices



Source: Authors' calculations. The black dashed lines represent the 95% confidence band, the dashed gray lines represent the 90% confidence bands, and the dotted lines represent the 65% confidence band.

Table 14: The effect of a 10% annual increase in the stock market (Topix) on all income quintiles

	After 1 quarter			After 4 quarters		
Quintile	**Coefficient**	**95% Confidence Interval**		**Coefficient**	**95% Confidence Interval**	
1	1,509	12,467	-9,448	-1,748	7,402	-10,899
2	6,498	21,016	-8,021	7,780	17,772	-2,212
3	13,057	33,952	-7,838	21,557	44,807	-1,693
4	**37,307***	71,105	3,510	**51,262***	89,969	12,555
5	**99,280***	160,666	37,894	**106,428***	160,358	52,498

Source: Authors' calculations. *p < 0,05

Table 15: The effect of a 10% quarterly increase in the stock market (Topix) on all income quintiles

	Effect after 4 quarters			Effect after 8 quarters		
Quintile	**Coefficient**	**95% Confidence Interval**		**Coefficient**	**95% Confidence Interval**	
1	-3,226	11,523	-17,975	3,668	25,055	-17,719
2	10,150	24,572	-4,273	14,199	49,308	-20,911
3	**28,694***	53,847	3,542	**42,120***	82,175	2,065
4	**71,939***	109,887	33,990	**70,830***	133,989	7,670
5	**123,522***	176,866	70,179	98,637	205,822	-8,548

Source: Authors' calculation. *p < 0,05

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Declaration of academic integrity

I hereby declare that I have composed this dissertation myself and without inadmissible outside help, in particular without the help of a doctoral consultant (*Promotionsberater*). I have used no other sources and aids than those stated. I have indicated all text passages that are incorporated, verbatim or in substance, from published or unpublished writings. I have indicated all data or information that is based on oral communication. All material or services provided by other persons are indicated as such.

Leipzig, September 25th, 2023

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Distributional Effects of (Un)conventional Monetary Policy in Japan

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Presentation:

This dissertation studies distributional effect of (un)conventional monetary policies on Japanese household and corporate finances. It puts a special focus on household saving(s) and household income. The dissertation consists of four independent essays.

In the first essay (co-authored with Gunther Schnabl) “Low Interest Rate Policy and Savings Culture in Japan: Implications for Economic Policy” the change in the savings culture in Japan during more than 30 years of low, zero and negative interest rate policies is examined. It is shown how the Bank of Japan’s persistently loose monetary policy changed the household and corporate savings culture in Japan.

The second essay “Japanese Monetary Policy and Determinants of Household Saving” analyzes determinants of the household saving rate in Japan between 1960 and 2019. It finds that the zero-interest rate policy and unconventional monetary policies of the Bank of Japan have significantly contributed to the decline in the Japanese household saving rate.

In the third essay (co-authored with Karl-Friedrich Israel and Nils Sonnenberg) “Japanese Unconventional Monetary Policy and Household Saving” the impact of expansionary monetary policies on household saving in Japan between 1993 and 2017 is analyzed. It shows that monetary expansion has to a widening gap in the wealth distribution through an adverse effect on non-academic households.

The fourth essay (co-authored with Karl-Friedrich Israel and Nils Sonnenberg) “The Effects of Unconventional Monetary Policy on Stock Markets and Household Incomes in Japan” studies the distributional effects of monetary policy on Japanese household incomes. It is shown that the Bank of Japan’s unconventional monetary policy has contributed to a widening gap in the income distribution through the portfolio channel of monetary policy.