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Abstract

This paper scrutinizes the role of prolonged, expansionary monetary policy on the savings behavior of Japanese households, focusing on the dramatic change of the household savings rate since 1998, from high to low savings. The literature generally attributes this change to the country's shift from high-growth to low-growth and its demographic change. This paper empirically examines changes in the incentives for saving and the ability to save connected to monetary policy. It finds that monetary policy had a significant impact on Japan's household behavior via the interest rate channel and the redistribution channel but not the labor income channel. There is also evidence that rising wealth boosts savings.

JEL Codes: E210, E430, E520.

Keywords: monetary policy, household savings, savings rate, Japan, financial repression.

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1. Introduction

The Japanese household saving behavior has undergone a dramatic change over the past 60 years. After World War II Japanese household savings have been among the highest in the industrialized world, when households saved nearly one quarter of their disposable incomes. Since 1990, however, household savings have dropped significantly. In 2013, net household savings as percent of GDP and of disposable income turned negative, reaching -0.6% and -1.0%, respectively. Since then, they have increased, but remained at a low level. Yet, Japanese household savings are amongst the lowest within the OECD.

The main determinants of the initially high household savings until the 1980s were Japan's rapid post-war economic growth and the subsequently increasing household incomes (Komiya, 1966; Mizoguchi, 1970; Modigliani and Sterling, 1983; Hayashi, 1986). Due to an under-developed social security system, young Japanese households saved for their retirement (Komiya, 1966; Hayashi, 1986). Tax alleviations (*maruyū*) also incentivized private precaution (Komiya, 1966; Horioka, 2009).

Since 1998, Japanese household savings as share of GDP and of disposable income have fallen significantly. To explain this phenomenon, the literature focuses on the country's aging society. As the large group of elderly households has begun dissaving, the aggregate household saving rate has started to decline (Koga, 2006; Horioka et al., 2007; Horioka, 2009). Owing to demographic change, the mounting pressure on the social security system has aggravated the negative trend of household savings (Koga, 2006; Horioka, 2009; Saito, 2015).

The decline in Japanese household savings has come along with a fall of the main interest rate set by the Bank of Japan towards zero since the 1990s. Monetary policy makers admit that prolonged expansionary monetary policy may have a negative impact on savings (Draghi, 2015). Cœuré (2012) stresses that an unexpected fall in the nominal interest rate and the simultaneous increase in inflation hurts savers, but benefits borrowers. Nevertheless, the literature has not yet scrutinized the impact of prolonged expansionary monetary policy on the household saving behavior in Japan in a systematic way. This research aims to close this gap.

2. Household saving in Japan

Research on Japanese household savings dates back to the 1960s, and assesses determinants of the saving rate since 1955. Empirical studies until the 1990s mainly analyzed whether households saved according to their life-cycle or due to precaution. Recent research analyzes the significant drop in the saving rate, focusing on the impact of demographic change on life-cycle savings and the impact of institutional changes on precautionary savings.

2.1. Empirical determinants of Japanese household saving in the past and now

In post-war Japan, high net household saving rates coincided with rapid economic growth from the mid 1950s until the 1990s (Figure 1). In line with the Solow-Swan growth model, the literature widely agrees that economic growth pushed up aggregate household savings as households continued saving high portions of their rising disposable incomes (Komiya, 1966; Mizoguchi, 1970; Hayashi, 1989). Komiya (1966) shows that tax breaks for private savings (*maruyū*) introduced in 1963 encouraged household savings.[1]

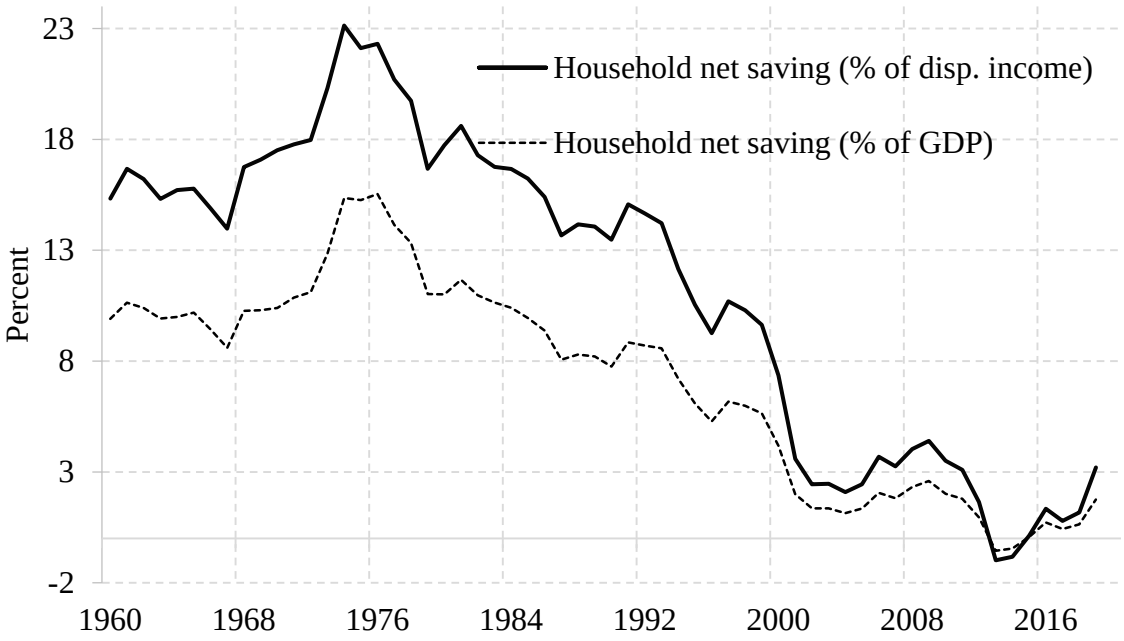
In line with the life-cycle model (Modigliani and Brumberg 1954), the literature finds that Japan's post-war working-age population growth pushed the aggregate saving rate up (Okita, 1957; Modigliani and Sterling, 1983; Horioka, 1990). Hayashi (1989) shows that the initially low level of household wealth also incentivized households to save. In line with the permanent income hypothesis (Friedman 1957), Komiya (1966) and Mizoguchi (1970) found that the saving rate rose due to the growth of bonus payments (transitory income) in the high-growth period.

Precautionary savings are seen as a determinant of high Japanese household savings, additionally to life-cycle and permanent income saving motives (Hayashi, 1986; Tachibanaki, 1994; Sato, 1987). The relatively underdeveloped post-war social security system as well as limited consumer and mortgage finance encouraged precautionary household savings (Komiya, 1966; Mizoguchi, 1970; Hayashi, 1989). Given the increase in life expectancy as well as the lack of sufficient institutional retirement

[1] The *maruyū* system exempted a limited amount of private savings from taxation, including the interest income on bank and postal deposits or on government bonds.

provision, elderly households increased their labor force participation and continued saving (Modigliani and Sterling, 1983).

Figure 1: Japanese net household saving rates



Source*:* OECD.

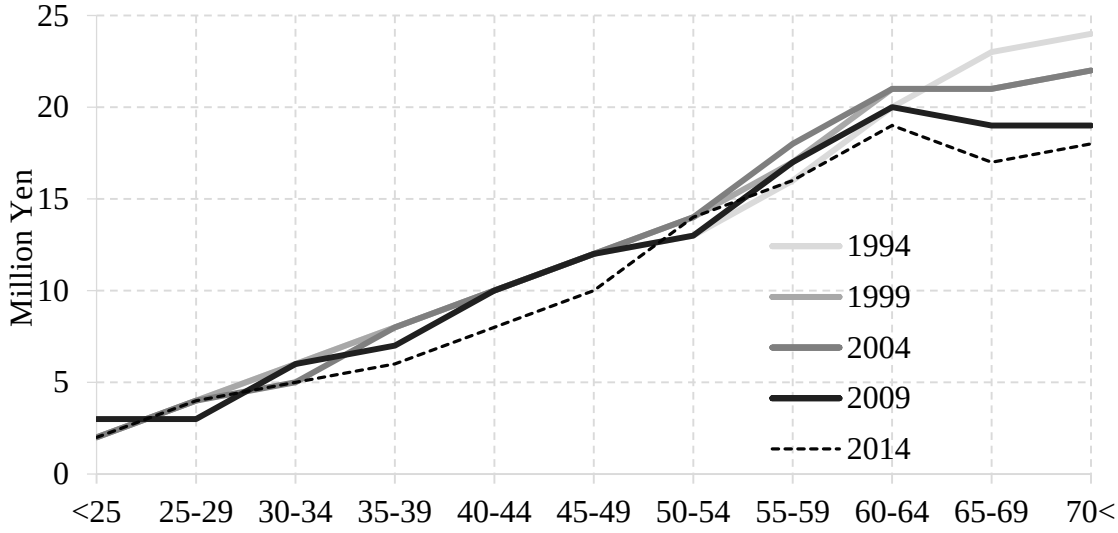
Despite institutional changes over time, such as a strengthened social security system including improved public pension schemes, Japanese precautionary household savings remained relatively high throughout the 1980s and 1990s (Figure 1). During the 1980s, elderly households maintained a high saving rate despite their slowly decreasing labor force participation (Ito, 1992). This may also suggest saving for bequests (Hayashi, 1986; Ito, 1992).

In the early 1990s, shortly after the bursting of Japan's bubble economy, economic uncertainty may have evoked a brief period of precautionary savings (Murata, 2003). Anderson (1990) suggests that due to the Ricardian equivalence[2] the rising public deficit triggered precautionary savings of households as they expected higher taxes and

[2] As households anticipate future tax increases, they save if the government deficit rises or taxes are cut (Ricardo, 1821)

lower government expenditure in the future. Contrary to the life-cycle model, Takayama and Kitamura (1994) showed that precautionary savings rose with income and age, as affluent elderly households saved in expectation of a strained social security system (see Figure 2).

Figure 2: Japanese total net household savings and by age group



Source*:* Ministry of Internal Affairs and Communications (MIC). Household savings by age group are per workers' households, defined as households whose heads are employed as clerks or wage earners by public or private enterprises.

Since 1991, Japan's net household savings have significantly decreased strongly (*Figure 1* and *Figure 2*). In comparison to their peak at 43 trillion yen in 1991, net household savings declined by about 80% to 9.8 trillion yen in 2018.[3] The household saving rate fell from 18.1% to 3.2% of disposable income (8.8.% to 1.7% of GDP) during the same time. Whereas Japanese household savings were amongst the highest in the industrialized world in the 1970s, they have been amongst the lowest within the OECD since 2010. A rebound can be observed since 2016.

Literature in line with the life-cycle model argues that the fall of the productive population (ages 15-64) and the rising number of retired households since 1993 had a negative impact on the household saving rate (Koga, 2006; Horioka, 2009; Saito, 2015; Curtis et. al, 2017). Moreover, the rapid increase of household wealth until 1990 and the

[3] Note that net household savings are a flow variable.

decreasing labor income growth since 1992 possibly discouraged household savings (Koga, 2006; Horioka, 2006, 2009). In line with the permanent income hypothesis, Horioka (2009) suggests that the decline of the ratio of bonus payments to labor income (for regular employees) since 1992 has lowered household savings.

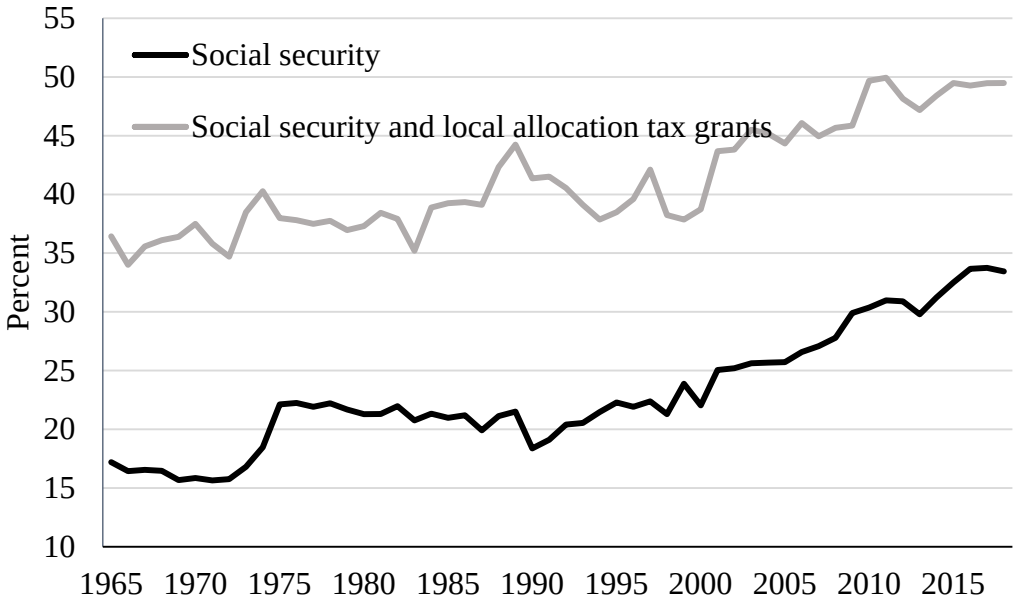
Horioka (2009a) argues that household savings decreased due to the abolition of the *maruyū* tax breaks for saving in 1988 along with as dwindling saving promotion activities of the government. Moreover, improvements in consumer credit options since 1990 may have led households to reduce their precautionary savings. Lastly, savings may have sharply decreased due to significant improvements of public pension benefits (Horioka et al., 2007; Horioka, 2009a).

Due to Japan's intergenerational transfer system - a pay-as-you-go public pension system given an aging population - the burden on young households increased. Accordingly, Horioka et al. (2007) argue that post-baby-boom households (born after 1960) maintained their precautionary savings until the early 2000s, expecting a strain on the system. However, the introduction of a public long-term care insurance program in 2000 and 2004 essentially increased the expected net benefits of households born after 1970 and may have decreased household savings of the working-aged (Takayama, 2003; Horioka et al., 2007; Horioka, 2009a,b).

Figure 3 illustrates the increase in social security subsidies of the government as a share of the general account budget since 1990. These subsidies include payments to the public pension system.[4] While the share of social security subsidies in the government's general account expenditure was 15.6% in 1960 it had doubled to 33% in 2018. In addition, the public transfers within the regional financial equalization scheme (local allocation tax) can be seen as a transfer to higher age groups, as Japan's economically weak prefectures also tend to be overaged.

[4] The mandatory social security pension program for private sector employees is the Kosei Nenkin Hoken (KNH, Employees Pension Insurance). In 1954, the KNH shifted from an earnings-related pension to a two-tier benefits system, of which one tier consists of flat-rate basic benefits and the other of an individual flat-rate contribution. One-third of the KN benefits are financed by subsidy through the general account budget (Takayama, 2003).

Figure 3: Social security and local allocation tax grants as a share of the general account budget



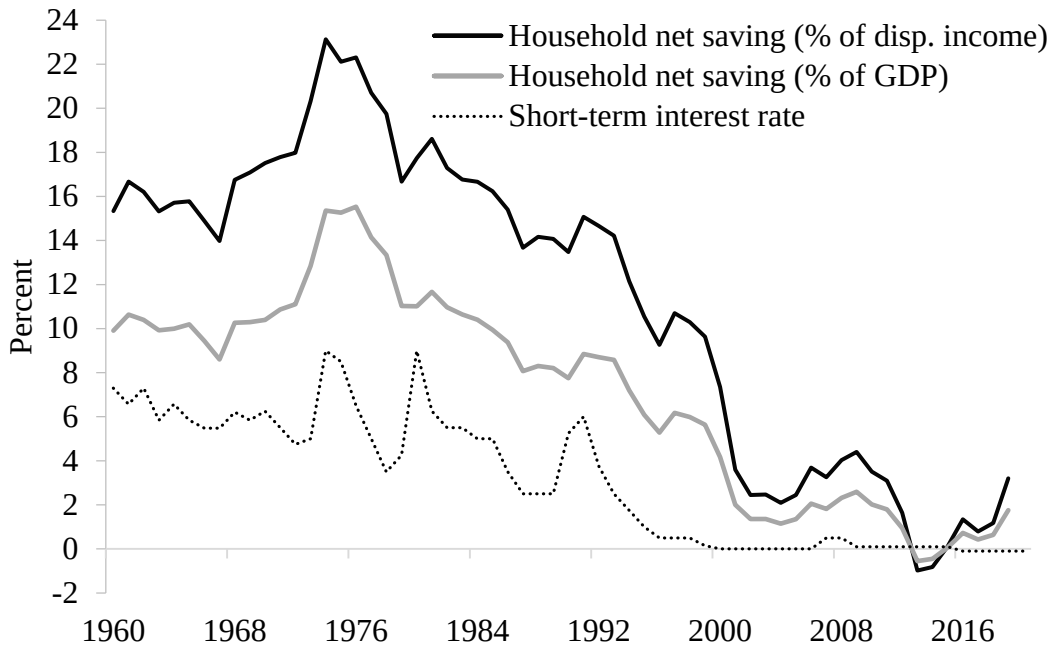
Source: Japan: Ministry of Finance.

3. Monetary effects on Japanese household saving

The literature on Japanese household savings in the low-growth period is mainly confined to the impact of demographic change on life-cycle savings, despite alternative explanations. For example, Iwaisako and Okada (2012) argue that the nonlinear movement in the Japanese saving rate challenges research that only relies on the aging population. Monetary effects on Japanese household savings have largely been neglected by the literature.

Firstly, monetary policy may affect household savings via changes in the interest rate, particularly a prolonged zero interest rate policy (interest rate channel). Classical (Smith, 1789; Ricardo, 1821), neoclassical (Solow, 1956 ; Swan, 1956) and Austrian economic theory (Hayek, 1976 [1929]; Mises, 1998 [1949]) as well as the theory of financial repression (McKinnon, 1973; Shaw, 1973) agree that a household's motivation and ability to save are positively related to the interest rate. A falling interest rate discourages saving and tempts households to withdraw savings from deposits which depend on interest payments.

Figure 4: Net household saving and the short-term interest rate



Source: OECD Economic Outlook, IMF – International Financial Statistics, Bank of Japan. Household net savings are a flow variable.

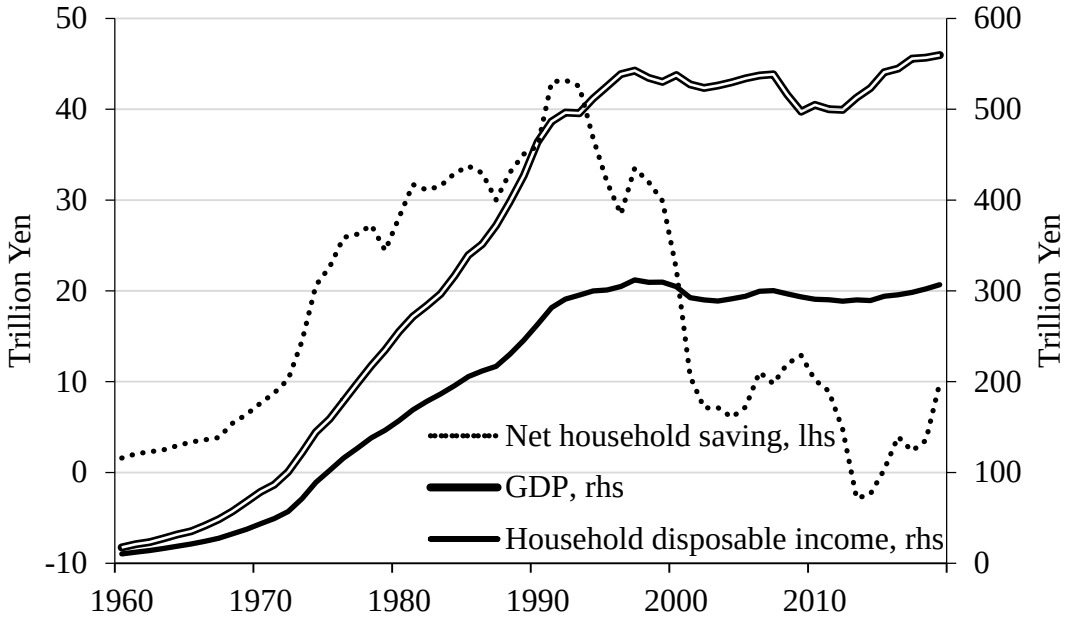
Figure 4 illustrates that the decrease of Japanese net household savings as a share of disposable income and GDP coincides with the falling policy rate of the Bank of Japan until 2015. The co-movement of Japanese net household savings and the interest rate may also reflect a declining ability of households to save. Households have continuously kept around 50% of their total financial assets in cash and deposits (Yoshino and Mizoguchi 2013). The constantly declining interest rates have dampened the return from saving in deposits and thus depressed the ability of households to increase their savings.

Secondly, monetary policy can affect household savings via the effect of prolonged monetary expansions on real wages (labor income channel). Keynes (1936) suggests, that household savings decline in case of falling real incomes. Expansionary monetary policy can reduce real wages due to sticky nominal wages (Christiano et al., 2005) and surprise inflation (Barro and Gordon, 1983). In the Austrian business cycle model, real wages decline during a downswing, after a low-interest rate induced an economic boom (Hayek, 1976 [1929]); Mises, 1998 [1949]). Real wages can also decline, when

persistently low interest rates contribute to a zombification of the industry and thereby to declining productivity gains (Hoffmann and Schnabl 2016).

Iwaisako and Okada (2012) argue that in the late 1990s and early 2000s declining real income growth and income losses due to higher tax deductions and social insurance premiums had a significantly negative impact on household savings. Chen et al. (2007) link declining total factor productivity growth to the decline of the saving rate. Figure 5 shows that, GDP and net household disposable income increased until 1991, coming along with growing net household savings. Japan's low-growth phase starting in 1992 was accompanied by a stagnation of disposable income and a strong decline of real net household savings.

Figure 5: Real net household savings, GDP and net household disposable income



Source: OECD, IMF, DG ECFIN AMECO.

Thirdly, monetary policy may affect the household saving behavior as it redistributes from young to elderly households as well as from the households to the public sector and to enterprises (redistribution channel). Young working-age households have relatively little financial and physical assets. Unconventional monetary expansions increase asset prices, which raise the existing wealth of elderly households (Saiki and

Frost, 2014), thus redistributing financial resources across generations. This may boost (reduce) via a wealth effect consumption (savings) of elderly households, which save more. Also, savings of young people may be discouraged, as asset prices increase (and bank deposits do not deliver interest).

Lastly, unconventional expansionary monetary policy reduces the financing costs of enterprises. This redistributes resources from the private to the corporate sector and boosts the wealth of owners of corporations. At the same time, unconventional monetary expansion (i.e. government bond purchases by the central bank) enables the government to redistribute resources to elderly households via social transfers. Demographic change and the increasing group of retirees as a potent electoral group increases pressure on the government to redistribute resources in this way. Yoshino and Mizoguchi (2013) provide empirical evidence for the redistribution effects of monetary policy on household savings in Japan. They show changes in the Japanese flow of funds with private savings becoming directed from investment to elderly households. This may have reduced savings of elderly people as shown in Figure 2.

4. Empirical estimations

The following tests the relationship between Japan's monetary policy and the household saving behavior, using a large data sample from 1960 to 2018 and assuming that the low interest rate period started in 1991.

4.1. Data and estimation framework

The data span from 1960 to 2018. This long sample period accounts for the shift of the Japanese economy from a high-growth to a low-growth phase. Only annual data are available for the long time span. Due to missing values for some time series, a shorter observation period ranges from 1980 to 2018, which still incorporates the end of Japan's high-growth phase. *Table 3* in the appendix offers a detailed description of the data, including data sources.

The saving behavior of Japanese households is modelled using aggregate net household savings (*nNHHS*) as well as aggregate net household savings as share of GDP (*NHHS_GDP*) and of disposable income (*NHHS_NHHDI*). Nominal net

household savings are deflated using the *CPI* to obtain real net household savings (*rNHHS*). The net household saving rates are calculated by dividing nominal net household savings by nominal GDP (*nGDP*) as well as net nominal disposable income (*nNHHDI*).

Current wage income is provided by the nominal average cash wage per employee (*ncWage*) which is deflated by the CPI (*rcWage*). Transitory income (*bonus*) is approximated by average bonus payments for regular employees since data for average bonuses of all employees are not available. Expected income is approximated by labor productivity growth (*labprod*), which is calculated by dividing GDP by the total number of employees. Japanese household wealth is modelled using net household wealth as share of GDP (*NHHS_GDP*). The impact of monetary policy on household saving behavior is captured via the nominal (short-term) interest rates (*nIR*). CPI inflation is subtracted to obtain the real interest rate (*rIR*).

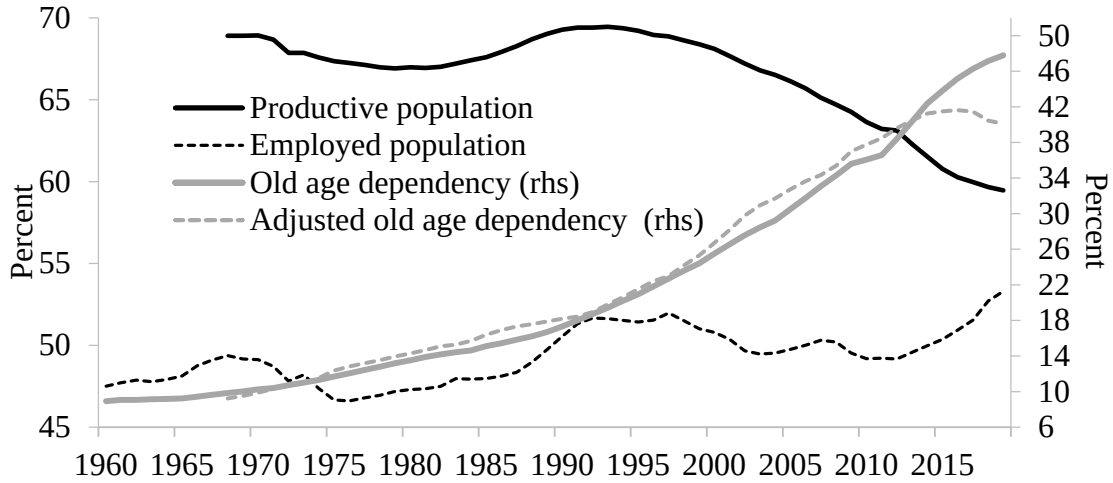
Social security expenditure of the government is taken as share of GDP (*socsec_GDP*). The government deficit is calculated as the difference between general government tax revenues and general government spending as share of GDP (*govdef_GDP*). Savings preferences are proxied by currency and deposits as a share of total household financial assets (*currdep*) or shares and other equity as a share of total household financial assets (*sharequ*).

The demographic structure is typically represented by the old-age dependency ratio and the productive population ratio. However, the ratios are downward- and upward-biased, respectively, as they do not include elderly employees aged 65+. The productive population as a share of the total population fell from 68.9% in 1968 to 59,5% in 2019, peaking at 69.5% in 1993 but decreasing steadily ever since. Similarly, the old age dependency ratio increased from 8.8% in 1960 to 47,8% in 2019.[5] Yet, the employed population as a share of the total population has remained at around 50% since 1990, displaying a recent upward trend which is significantly driven by increasing old-age employment (see Figure 6). The adjusted old age dependency ratio (depend_adj), which

[5] The productive population measures the working age population (ages 15-64) as a share of total population, whereas the employed population measures all employees as a share of total population. The old age dependency ratio measures the old age (65+) as a share of the working age population, whereas the adjusted old age dependency ratio measures the not-employed old age as a share of total employees.

measures only the *"de facto not employed"* old age as a share of total employees, has stagnated since 2010 currently remaining around 40%.

Figure 6: Japanese productive and employed population and old age dependency



Source: World Bank WDI, MIC, OECD.

In accordance with the high- and low-growth phases of Japan's economy, a structural break can be identified for the year 1998, marking the outbreak of the Japanese financial crisis. The Chow test confirms these identifications for all variables at high levels of significance. DF-GLS unit root tests around the structural breaks do *not* reject the null hypothesis (the time series is a non-stationary random walk, possibly with a drift) at high levels of significance (against the alternative that the time series is trend stationary) for all variables, except for the year on year percentage change in real net household savings growth, in real household income (*rcWage*), and in labor productivity. Thus, *NHHS_GDP*, *NHHS_NHHDI*, *nIR*, *rIR*, *bonus*, *NHHW*, *depend_adj*, *socsec_GDP*, *govdef_GDP*, *currdep*, and *sharequ* are first differenced.

In line with the empirical literature on household saving behavior and taking into account the transmission channels of monetary policy, the following equation is estimated:

$$HHsavings_t = \alpha_t + \beta_1 nIR_t + \beta_2 rcWage_t + \beta_3 bonus_t + \beta_4 labprod_t + \beta_5 NHHW_t + \beta_6 depend\_adj_t + \beta_7 socsec\_GDP_t + \beta_8 govdef\_GDP_t + \beta_9 savings\_pref_t + \varepsilon_t \quad (1)$$

where the regressand $HHsavings_t$ is either the year on year change in real net household savings ($rNHHS$) or the differenced household savings rate as percent of GDP ($NHHS\_GDP_t$) or as percent of net household disposable income ($NHHS\_NHHDI_t$). In line with the life-cycle model and permanent income hypothesis, the regressors include household income and wealth. The coefficients for current labor income (β_2 and β_3) as well as expected labor income (β_4) should have a positive sign as households save to accommodate expected rising future consumption alongside rising lifetime income. In contrast, a negative sign is expected for a household's wealth endowment (β_5) since households are assumed to save less with rising wealth.

The aging of the society (β_6) as well as the extent of the social security system (β_7) are both expected to have a negative sign assuming that an aging economy is characterized by dissaving and a well-developed social security system renders precautionary household savings unnecessary. According to the Ricardian equivalence, the coefficient for the government deficit (β_8) is expected to have a positive sign as household saving rates increase with rising government deficit (as percent of GDP). The savings preference (β_9) is approximated either by currency and deposits as a share of total household financial assets (*currdep*) or shares and other equity as a share of total household financial assets (*sharequ*), with an expected positive sign. Households with an increasing share of equity or currency and deposits in their savings portfolio would have a higher saving rate.

In order to identify the impact of monetary policy on household savings, the interest rate (*interest rate channel*), real labor income (*labor income channel*), and the government deficit as percent of GDP (*redistribution channel*) are included in the regression. The expected signs for all these regressors are positive (coefficients $\beta_{1,}$ β_2, β_3, β_4 and β_8, respectively). Accordingly, households should decrease their savings as a declining interest rate lowers their incentive to save. They should also decrease their savings along their decreasing ability to save, when their real labor income falls. Lastly,

they should increase their (precautionary) savings alongside a rising fiscal deficit as they expected higher taxes and lower government expenditure in the future (Ricardian equivalence).

4.2. Estimation results

Table 1 and Table 2 report the estimation results for the household saving rate as percent of GDP (*NHHS_GDP*) and of net household disposable income (*NHHS_NHHDI*), respectively, for the sample period from 1960 until 2018. The regression results do not change for the sample from 1980 until 2018. Changing the regressand to a measure of real aggregate net household savings does not change the results in terms of signs and significance of the coefficients. For reason of parsimony, these results are not reported here.

Models (1) through (6) capture the potential effects of monetary policy on the household saving rate as percent of GDP. Models (1) through (3) test the benchmark, which includes measures for the three monetary transmission channels as well as household income and wealth. They also include the ageing of the society. Models (4) through (6) include structural factors, such as measures for economic and financial uncertainty as well as measures for the saving preference and the development of the social security system.

Table 1 and Table 2 show that monetary policy has a highly significant and positive effect on the household saving rate via the *interest rate channel* in all of the six models and for both regressands. The coefficient for the nominal interest rate (*nIR*) is significant at the 1% level. Accordingly, a one percentage point cut in the interest rate reduces the household saving rate as percent of GDP by up to 0.43 percentage points on average, whereas it reduces the saving rate as percent of net household disposable income by up to 0.65 percentage points on average (model 6).

Similarly, fiscal policy has a significantly positive effect on the household saving rate via the *redistribution channel*. This is evidence in favor of the Ricardian equivalence, similar to Anderson's (1990) findings but contrary to Saito (2016). The coefficient for the government deficit (*govdef_GDP*) is significant at the 1% level for all models and for both regressands (*Table 1* and *Table 2)*. The consistently positive sign indicates that the household saving rates increase with rising government deficit (as

percent of GDP). A rising government deficit is linked to higher household savings. In particular, a one percentage point rise in the government deficit increases net household savings as percent of GDP and of disposable income by 0.181 and 0.286 percentage points on average, respectively (models 6).

Table 1: OLS estimation results – net household savings as % of GDP 1960-2018

NHHS_GDP	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
nIR	0.33*** (0.10)	0.32*** (0.10)	0.33*** (0.10)	0.33*** (0.10)	0.39*** (0.10)	0.43*** (0.11)
rcWage	-0.01 (0.07)		-0.03 (0.07)	-0.01 (0.08)	-0.07 (0.07)	-0.10* (0.06)
bonus		-0.00 (0.01)	-0.01 (0.01)			
Labprod	0.07 (0.05)	0.07 (0.04)	0.08 (0.05)	0.08 (0.05)	0.11** (0.05)	0.11 (0.07)
NHHW	0.04*** (0.01)	0.04** (0.01)	0.04** (0.02)	0.04*** (0.01)	0.04*** (0.01)	0.04*** (0.01)
govdef_GDP	173.52*** (30.15)	171.10*** (31.10)	169.62*** (30.86)	174.24*** (31.61)	165.51*** (27.10)	181.02*** (27.25)
depend_adj	-1.03*** (0.25)	-1.04*** (0.21)	-1.01*** (0.24)	-1.04*** (0.27)	-1.04*** (0.27)	-0.93** (0.42)
rGDP				0.01 (0.03)	-0.00 (0.03)	-0.03 (0.04)
socsec_GDP					-0.10 (0.08)	-0.10 (0.08)
Sharequ						0.03 (0.03)
Constant	0.60*** (0.21)	0.60*** (0.20)	0.59*** (0.21)	0.61** (0.23)	0.72*** (0.26)	0.60 (0.43)
Prob > F	9.84***	10.45***	8.60***	9.72***	9.90***	23.46***
Obs.	36	36	36	36	36	33

Note: Newey-West robust standard errors are reported in parentheses. The significance of coefficients is reported at the 10%, 5%, and 1% level, indicated by *, **, ***, respectively.

Monetary policy does not appear to have a significant impact on the household saving rate via the *labor income channel*. The coefficients for household income (*rcWage*), bonus payments (*bonus*) and labor productivity (*labprod*), which represents

expected household income, are insignificant for all models and for both regressands. Models (1) – (3) show that the results for the income channel do not change if transitory income (*bonus*) is used as proxy for real income instead of real cash wages (*rcWage*, which excludes overtime, bonus payments and social transfers), or if both payment measures or only one of the two are included in the regression model. This also holds for models (4) – (6) so that, for reason of parsimony, the results reported for models (4) – (6) only include the real cash wage (*rcWage*) and labor productivity (*labprod*).

Net household wealth (*NHHW*) has a significantly positive effect on the household saving rate as percent of GDP and net household disposable income throughout all model specifications. The coefficient is significant at the 1% level for all models and both regressands, except for models (2) and (3) where it is significant at 5%. The results concerning the significance of variables remain unchanged for all models and both regressands if household wealth is included as percent of household disposable income or GDP. The household saving rate as percent of GDP and of disposable income increases with rising household wealth.

Given the significantly positive effect of household wealth on household saving rates, it appears that this coefficient captures a household's ability to save (instead of the coefficients of household labor income). This suggests that monetary policy may have affected the household saving behavior via an additional channel: the *wealth channel*. Bordo and Lane (2013) show that monetary easing, particularly unconventional policy, has a positive impact on asset prices, including house, stock and commodity prices, increasing financial household wealth. However, given an unequal distribution of wealth among households, such positive changes do not affect all households equally. The wealth channel seems to be particularly strong in the course of the Abenomics (since 2013), which has lifted Japanese asset prices again and thereby may have boosted savings.

Regression models that include structural factors such as real GDP (*rGDP)* and government expenditure for social security (*socsec_GDP*) mostly yield insignificant results for the coefficients, without changing the sign and significance of the coefficients of the monetary transmission variables as well as household wealth. The coefficient for economic uncertainty, measured by real GDP growth (*rGDP*), has the

expected (negative) sign in models (5) and (6), but is insignificant for household saving decisions. These results do not change if unemployment is used as a measure of economic uncertainty. Moreover, the coefficient for financial household uncertainty, measured by the public social security expenditure (*socsec_GDP*), has the expected negative sign, but is also insignificant. Similarly, a household's savings preference is also insignificant for its saving behavior, but has the expected sign (*Table 1* and *Table 2*). While insignificant for all models and both regressands, the coefficient for shares and equity as percent of total financial assets (*sharequ*) in model (6) has a positive sign.

Table 2: OLS estimation results – net household savings as percent of net household disposable income 1960-2018

NHHS_NHHDI	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
nIR	0.50*** (0.16)	0.48*** (0.14)	0.50*** (0.16)	0.50*** (0.15)	0.59*** (0.16)	0.65*** (0.17)
rcWage	-0.07 (0.12)		-0.10 (0.11)	-0.06 (0.12)	-0.16 (0.11)	-0.22** (0.10)
bonus		-0.00 (0.02)	-0.01 (0.02)			
labprod	0.10 (0.08)	0.07 (0.08)	0.10 (0.08)	0.10 (0.09)	0.16 (0.10)	0.14 (0.13)
NHHW	0.06*** (0.02)	0.06** (0.02)	0.06** (0.02)	0.06*** (0.02)	0.06*** (0.02)	0.06*** (0.02)
govdef_GDP	274.13*** (49.55)	272.72*** (50.38)	267.77*** (50.00)	276.19*** (50.83)	262.43*** (43.67)	286.05*** (45.73)
depend_adj	-1.57*** (0.43)	-1.64*** (0.38)	-1.54*** (0.42)	-1.61*** (0.47)	-1.61*** (0.47)	-1.29* (0.71)
rGDP				0.02 (0.04)	-0.00 (0.04)	-0.04 (0.06)
socsec_GDP					-0.16 (0.12)	-0.15 (0.13)
sharequ						0.05 (0.05)
Constant	0.90** (0.37)	0.93** (0.35)	0.89** (0.37)	0.94** (0.41)	1.12** (0.47)	0.79 (0.72)
Prob > F	9.01***	9.86***	7.90***	8.49***	8.90***	19.69***
Observations	36	36	36	36	36	33

Note: Newey-West robust standard errors are reported in parentheses. The significance of coefficients is reported at the 10%, 5%, and 1% level, indicated by *, **, ***, respectively.

In contrast, the demographic development (*depend_adj*) of the economy has a highly significant and negative coefficient for all models and both regressands. The coefficient for the old-age-dependency ratio is significant at 1% for all models, excluding models (6). On average, a one percentage point increase in the old-age-dependency ratio lowers the household saving rate as percent of GDP and of disposable income by 0.93 and 1.29 percentage points, respectively (models 6). This is in line with the literature that investigates Japanese household saving using the life-cycle model but not in line with the secular stagnation hypothesis.

5. Outlook

This paper scrutinizes the role of prolonged, expansionary monetary policy on the savings behavior of Japanese households, focusing on the dramatic change of Japanese household savings behavior since the 1990s, from high to low savings. Existing literature generally attributes this behavioral shift from a high-growth to a low-growth economy and its demographic change. This paper adds to the existing literature by examining changes in the incentives for saving and the ability to save connected to monetary policy.

The empirical results of this paper indicate that monetary policy has played a significant role in the change of the Japanese household saving behavior during the investigated time frame. The significant impact of monetary policy on Japan's household saving behavior has been threefold, via the interest rate channel, the redistribution channel, and the wealth channel. In contrast, monetary policy does not appear to have had a significant impact on the household saving rate via the labor income channel. There is no evidence in favor of the secular stagnation hypothesis, which argues that households save more in an ageing society.

Future research may extend this analysis investigating whether and to what extent the impact of monetary policy on the household saving behavior varies at times of conventional versus unconventional expansionary monetary policy. Moreover, research may apply this analysis to other industrialized economies, such as member states of the European Union, that have experienced similar shifts from a high-growth to a low-growth economy and demographic change, as well as prolonged phases of expansionary

monetary policy.

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Appendix:

Table 3: Data Description

Acronym	Description	Sample period	Source
Bonus	Average bonus payments (of regular employees in enterprises with more than 30 employees).	1970 – 2017	Ministry of Health, Labour and Welfare, Japan.
currdep	Currency and deposits as share of total financial assets of households.	1980 – 2014	Annual National Accounts, OECD.
depend_adj	Adjusted old-age dependency ratio (unemployed old-age as share of total employees).	1968 – 2017	Ministry of Internal Affairs and Communication (MIC), Japan.
govdef_GDP	Government deficit, calculated as the difference between general government tax revenue and spending, as share of GDP.	1981 – 2018	Oxford Economics; DG ECFIN AMECO.
labprod	Labor productivity, calculated as real output (GDP) per employee in yen.	1960 – 2017	International Financial Statistics (IFS), International Monetary Fund (IMF); OECD Economic Outlook.
ncWage	Nominal average cash wage (per employee) in million yen.	1960 – 2018	OECD Economic Outlook.
rcWage	Real average cash wage (per employee) (Index 2010=100)		
nGDP	Nominal gross domestic product in trillion yen.	1960 – 2018	IFS, IMF.
nIR	Nominal Bank of Japan short-term main policy rate (percent).	1960 – 2018	Bank of Japan.
nNHHDI	Nominal net household disposable income in trillion yen.	1960 – 2018	OECD Economic Outlook.

nNHHS	Nominal net household savings in trillion yen.	1960 – 2018	OECD Economic Outlook.
NHHS_GDP	Net household savings (as share of GDP).	1960 – 2018	OECD Economic Outlook; IFS, IMF.
NHHS_NHHDI	Net household savings (as share of net household disposable income).	1960 – 2018	OECD Economic Outlook.
NHHW_GDP	Net household wealth (as share of GDP).	1970 – 2016	OECD Economic Outlook; IFS IMF.
rGDP	Real GDP (Index 2010 = 100).	1980 – 2018	IFS, IMF; DG ECFIN AMECO.
rIR	Real short-term interest rate (percent).	1961 – 2018	Bank of Japan; DG ECFIN AMECO.
rNHHDI	Real net household disposable income in trillion yen.	1960 – 2018	OECD Economic Outlook.
rNHHS	Real net household savings (Index 2010 = 100).	1960 – 2018	OECD Economic Outlook.
Sharequ	Shares (and other equity) as a share of total financial assets of households.	1980 – 2014	Annual National Accounts, OECD.
socsec_GDP	Social security government expenditure as share of GDP.	1966 – 2017	Ministry of Finance, Japan.