Inflation Expectations and Households Portfolio Choice

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Abstract

Do household inflation expectations affect portfolio choice? This paper exploits inflation experience as an instrumental variable for inflation expectations, and links it to household portfolios. I document that households with higher inflation expectations are more likely to invest in equity markets, shifting from safe assets to risky ones. Households can also achieve substantial financial returns and optimize their portfolio. I also document that households' heterogeneous characteristics also contribute to the portfolio re-balance. In addition. I attribute the above findings to the income expectations and nominal rigidity of the deposit rate. These results imply households' portfolio rebalancing behavior in response to increased inflation expectations.

Keywords: Inflation expectations, Household finance, Portfolio choice, Household balance sheet

JEL Codes: D12, D84, D91, E21, E22, E31, E62

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1 Introduction

With the recent rise in inflation expectations worldwide [1], there has been considerable interest in investigating the role of inflation expectations for households decisions. Actually, inflation expectations consistently play a central role for households because they determine households' wage bargaining, durable investment including housing and mortgage choices, and portfolio choices (Bernanke, 2007). Theoretically, intertemporal substitution (Hall, 1988) argues that a higher real interest rate makes households defer spending and visa versa. Nonetheless, empirically it remains an open question. First, it is still controversial whether inflation expectations is able to influence households' contemporaneous consumption (see D'Acunto, Hoang, and Weber (2022), and Burke and Ozdagli (2021) show substantive effects, while Galashin, Kanz, and Perez-Truglia (2020) and Bachmann, Berg, and Sims (2015) show no effect). Second, it is a lack of empirical evidence on the impact of inflation expectations on household's portfolio choice. The portfolio decisions in the consumption Euler equation are simplified as financial assets are fixed and consumers do not need to rebalance between safe assets and risky assets in the model. However, in reality, households have to take portfolio decisions into consideration. In particular, households have an incentive to shift to risky assets as the money supply lowers the real interest rate (Lian, Ma, and Wang, 2019).

In fact, households portfolio decisions are highly correlated with their inflation expectations. Figure 1 plots the annual inflation expectations and equity market participation (public-traded stocks and mutual funds) of Dutch households since 1995[2]. It shows that a household's inflation expectations are persistently co-moving with her equity market decisions, while this pattern remains open to interpretation.

[Insert Figure 1 here]

In this paper, I seek to contribute to the empirical literature of the effect of inflation

[1] urlhttps://www.bloomberg.com/news/articles/2022-01-11/japan-s-inflation-expectations-jump-to-highest-since-2008

[2] The correlation coefficient exceeds 0.56, which is at 1% significant level.

expectations on households' portfolio choice in following steps. First, I investigate the impact of inflation expectations on households' portfolio rebalancing behavior, which is relatively unexplored in the inflation expectations literature. I focus on households' participation and investment in stock market and mutual funds market. Second, I examine the details of households risky portfolio decisions, including performance, risk profile, diversification, etc. Third, I detect the heterogeneous response of portfolio choice and link them to households demographic and social economic characteristics. Finally, I consider the reasons households are willing to react a rise in inflation expectations by holding more risky assets, and I propose an income expectations channel and a nominal saving channel.

Actually, several challenges have led to little work on directly documenting the causal relationship between inflation expectations and household portfolio choices. First, inflation expectations and households' decisions are potentially endogenous. This issue could be driven by omitted variables such as income or age, and the lack of a clear source of variations may induce biased estimates. To address these issues, this paper constructs an instrumental variable based on households' past inflation experience by following Malmendier and Nagel (2016). The cross-sectional variation comes from the dispersion of expectations among age cohorts, and the times series variation comes from different stages of household life cycle. These exogenous variations serve as a powerful instrument to characterize the impact of expectations on households' portfolio decisions. In addition to the instrumental variable method, I also implement three fiscal policy shocks, namely VAT increases, in the Netherlands in 2001, 2012, and 2019. I argued that these fiscal policy shocks were unexpected for households and their portfolio decisions since neither they could not be predicted by governance budget deficits nor they barely influenced financial market.

Another key challenge lies in data availability. To study how households respond to changes in inflation expectations, data on households' inflation expectations and their portfolio decisions are required. I address this challenge by taking advantage of DNB Household survey. DNB Household survey creates a panel data for around 2,000 households and 5,000

household members in the Netherlands. Besides detailed portfolio holdings, the survey has a unique feature that it asks respondents for a set of psychological variables such as subjective beliefs and risk aversion. Since it allows for tracking households' responses on an annual basis, I manage to examine how households update their inflation expectations as well as portfolio choice over time. In addition to detailed asset and beliefs data, the DNB Household Survey also documents household income, demographics, and socioeconomic status.

Exploiting this instrumental variable strategy, I document the impact of an increase of inflation expectations on household's portfolio choice. To further mitigate the confounding effect, household member fixed effects and control for income, wealth, and a large number of observable household characteristics. I find that households are more likely to be involved in risky assets investment in following 4 aspects. First, in response to high inflation expectations, households participate more in equity markets by holding either stocks or mutual funds. Second, both the absolute value of equities and the net equity purchases (defined as the change of the value of equities over a year) increase. Third, the relative weight of risky assets increases compared to households' financial assets and income. Put differently, households re-balance their portfolio away from safe assets toward risky assets. Fourth, I observe households with increased inflation expectations are more likely to enter the equity market if they have not participated before. All of results above reveal that households take more risks in response to inflation expectations, which is also consistent with the theoretical prediction that inflation expectations affect the choice of asset holding composition (Samuelson, 1958).

Next, I highlight the importance of household portfolio composition Strikingly, I find that households' portfolio becomes more optimized when they expect an increase in inflation. If households' are assumed to simply use a "buy-and-hold" strategy, their portfolio can still achieve substantial returns. To examine the portfolio strategy, I find that households reduce the loss due to under-diversification. This is because households invest in mutual funds and expose themselves more to market risk and less to idiosyncratic risk, and hence, the portfolio's Sharpe ratio rises as well. The results are also associated with a open question

whether stocks are be a hedge against inflation (e.g., Bodie, 1976) and this paper suggests that equity market investment manage to hedge inflation risk.

I also test the heterogeneity of households. Individual-level characteristics play an indispensable role since they are relevant for households' understanding of and response to changes in the economic situation. Four individual characteristics, (life cycle) horizon, financial literacy, income, and gender are considered because they contribute to systematic differences in inflation expectations and portfolio decisions. I find much more pronounced responses for households with longer investment horizons, better financial education, higher incomes, and women. Specifically, equity market investment mostly results from relatively high income households (a household member with the annual net income above 20747.81 euro) and women are usually more sensitive to prices changes due to social norms.

Why do households rebalance their portfolios in the face of lower inflation expectations?? One possible channel is that households might believe an expected increase in prices induce higher expected income. This is a reasonable belief because high inflation expectation may boost contemporaneous consumption (demand) and future supply. Households can benefit from more profits from their employers so that the former expects higher incomes in the future. I find that households with both increased inflation expectations and income expectations are more engaged in equity market investment.

Another possible channel is that households would like to maintain the purchasing power of their nominal savings. Given the the nominal rigidity of the deposit rate, high inflation erode the households' purchasing power since the expected real deposit rate decreases, while the return of risky assets is variable and can be adjusted based on inflation expectations. Consequently, when inflation expectations rise, real savings deposit rates fall, leading to households shifting to risky assets. I find that an additional unit equity market investment leads to around 0.4 unit increase of household's liquid wealth, given the inflation expectations.

This paper also has policy implications. It provides unintended consequences for policymakers who aim to use inflation expectations as a policy tool to stimulate consumption.

Actually, besides the intertemporal substitution, households with high inflation expectations would also elevate their risk-taking as households re-balance their portfolios from bank deposits to risky assets.

In the next section, I briefly summarize some studies on the relationship between inflation expectations and economic decisions. Section 3 presents the data sources and the main variables of interest. Section 4 presents the impact of inflation expectations on households' portfolio choice. Section 5 examines the heterogeneity of households. Section 6 provides two channels. Section 7 concludes.

2 Literature Review

Before turning to the main outcomes of household portfolio choice, I briefly summarize recent research on inflation expectations and household choice, and the hedging effect of risky assets.

Inflation expectations and choices of households. There has been a growing literature on inflation expectations and household decisions, particularly with respect to consumption (D'Acunto, Malmendier, and Weber, 2022). First, there is still a debate on whether inflation expectations manage to reshape household decisions. For instance, Galashin, Kanz, and Perez-Truglia (2020) do not find any significant effects on actual consumer behavior measured as household credit card spending or self-reported consumption plans measured as survey data. Using cross-sectional survey data of US consumers, Bachmann, Berg, and Sims (2015) observe no relationship, or a negative relationship between household inflation expectations and consumption intentions for durable goods when the zero lower bound is binding. Coibion, Georgarakos, Gorodnichenko, and Van Rooij (2019) find that when inflation expectations are experimentally manipulated in consumer surveys, inflation expectations have a significantly negative impact on durable goods spending and a moderate negative impact on overall spending for Dutch households. In contrast, an increasing of recent studies docu-

ment inflation expectations can spur household consumption. D'Acunto, Hoang, and Weber (2022) examine two sources of inflation expectations shocks and document an increase in consumption of durable goods following an unconventional fiscal policy shock based on European data. Burke and Ozdagli (2021) study household heterogeneity and argue that only certain types of households' durable goods expenditures can increase in response to inflation expectations, even though nondurable goods expenditures do not respond to inflation expectations. D'Acunto, Hoang, Paloviita, and Weber (2021) find that among Finnish individuals, only individuals with high IQs suggests a positive relationship between their inflation expectations and readiness to purchase durable goods. Duca, Kenny, and Reuter (2021) use cross-sectional survey data from the Euro zone to document that higher expected inflation promotes the readiness to consume in a zero lower bound setting. Vellekoop and Wiederholt (2019) combine inflation expectations from survey data and household balance sheet from administrative data. They argue that higher inflation expectations contribute to more purchases of cars and durable goods, as well as a decrease in household net worth. Additionally, D'Acunto, Hoang, and Weber (2018) find that inflation expectations are positively associated with the readiness to spend on durable goods given an unexpected announcements of consumption tax increases.

Literature on household investment and portfolio decisions in a state of high inflation expectations are less explored. Agarwal, Chua, Ghosh, and Song (2021) exploits a natural experiment in India, "Inflation Targeting Policy", to argue that lower inflation expectations are negatively related to households' risky investment. Leombroni, Piazzesi, Schneider, and Rogers (2020) show that a disagreement about future inflation between younger and older households in the late 1970s helps understand household portfolio choices and financing decisions. Malmendier and Nagel (2016) examine the prediction that investors with higher inflation expectations shy away from fixed rate bonds in the SCF. Armantier, Bruine de Bruin, Topa, Van Der Klaauw, and Zafar (2015) conduct an experiment and respondents participate more in inflation indexed savings vehicles when they expect higher inflation.

One possible reason for those contradictory findings is the lack of an effective identification strategy. Some papers directly use inflation expectations as the independent variable of interest, which results in endogeneity issues such as omitted variables. Recent literature have been implementing identification strategies. For example, D'Acunto, Hoang, and Weber (2018) exploit a expected rise in inflation associated with expectations of a VAT change in Germany as an exogenous variation in inflation expectations. Coibion et al. (2019) apply information as the treatment to a randomly selected subset of survey households in the Netherlands and examine how an exogenous inflation expectations shock affect spending decisions. D'Acunto, Hoang, and Weber (2022) use a difference-in-differences approach based on two shocks, unconventional monetary policy and unconventional fiscal policy to identify the reaction of household inflation expectations.

The hedging effect of risky assets. Inflation expectations and agent's inter-temporal decisions have been studied since Fisher's hypothesis (Fisher, 1930). Expectations of future price (inflation) lead to higher nominal rates of return in long-run equilibrium. To cope with this shock, agents can raise current consumption by saving less for the future or substitute equities for fixed-income assets to obtain better nominal returns. Under the framework of Fisher (1930), asset allocation in risky asset is able to hedge inflation risk.

It is still an open question as to whether stock returns can hedge inflation risk. A strand of literature suggests that stock returns are negatively correlated with (un)expected inflation (Bodie, 1976; Jaffe and Mandelker, 1976; Nelson and Schwert, 1977; Fama and Schwert, 1977; Gultekin, 1983), suggesting that the stocks cannot effectively hedge against inflation risk. Boyd and Smith (1998), Huybens and Smith (1998, 1999), and Schreft and Smith (1997, 1998) emphasize that inflation reduces real asset returns and exacerbates frictions in credit markets, with adverse effects on financial markets and long-run growth. Additionally, hypotheses including inflation illusion (Modigliani and Cohn, 1979), tax hypothesis (Feldstein, 1982), proxy hypothesis (Fama, 1981, 1983), and time-varying risk aversion hypothesis (Brandt and Wang, 2003) are proposed to explain the negative relationship above.

On the opposite, the positive relationship between inflation and stock market return has been documented since 1990s (see Woodward 1992; Phylaktis and Blake 1993; Mishkin and Simon, 1995; Crowder and Hoffman 1996). Boudoukh and Richardson (1994) partially cover the Fisher hypothesis by criticizing earlier studies for testing the Fisher effect using only monthly or quarterly data. Solnik and Solnik (1997) use a panel consisting of stock index returns and inflation rates for eight major economies, and they build a Fisher coefficient that increases with the investment horizon increases to unity. Schotman and Schweitzer (2000) show that the sensitivity of stock returns to unexpected inflation is an important determinant of stock demand in a multi-period context. Hoevenaars et al. (2008) analyze the asset allocation problem of an investor whose liabilities over different time horizons subject to real interest rates and inflation. They consider a wide range of assets, including T-Bills, bonds, credit, equities, commodities, hedge funds, and real estate. The hedging power of the assets is measured by the correlation between nominal asset returns and the inflation rate over various investment horizons. They conclude that T-bills are the best hedge against inflation at all maturities. Bonds, credit, equities and listed real estates are good hedges in the long run but underperform in the short run. Jorda et al. (2019) argue that in the 20^{th} century, risky assets were closely correlated with inflation, while after the 1990s, this trend became less pronounced.

Whether stocks have the hedging effect or not is a crucial assumption in the theoretical models, which leads to different portfolio decisions. For example, Katzur and Spierdijk (2010) consider an investor who allocates her wealth to the S&P 500 index and to a inflation-linked bond that pays real interest rate. They find that inflation risk drives a typical long-term investor to allocate 40% less of her wealth to the index and 40% to the inflation-indexed bond compared to a benchmark investor. In contrast, Aoki, Michaelides, and Nikolov (2019) examine the impact of inflation levels and volatility on money demand and asset allocation in a life-cycle outlook model based on SCF data. They argue that high inflation leads to a shift from safe assets (currencies) to equities, especially for the younger generation.

3 Data and Sample

3.1 Data

DNB Household Survey. The household data is from the De Netherlandsche Bank (DNB) Household Survey. Since 1993, the survey data have been collected annually through CentERdata's Internet panel. Households without a computer and/or access to the Internet are given a basic computer and Internet connection to avoid selection bias. CentERdata represents the Dutch population in terms of observable characteristics. These data not only document detailed information about the financial situation, but also contain various modules about the household's work, accommodation, health, and economic and psychological concepts. The data are therefore widely used in the context of household financial behavior.

The DNB Household Survey includes around 2,000 households with 5000 household members every year. There are several distinctive features of this survey. (1) Household members participate for several consecutive years. On average, each household member participates in at least 8 (8.84) waves, with a median of 7. Since one can follow an individual over time, it is possible to study how the individual reacts to the inflation expectations over time. (2) This survey also records a set of psychological questions in which we can extract risk preferences, subjective expectations, and other desirable economic psychological characteristics. (3) The DNB Household Survey manages to link to other surveys or administrative data. Vellekoop and Wiederholt (2019) document that 88% of DNB households can be merged by adminitrative data from Dutch statistics bureau (CBS). Previous surveys such as van Rooij et al. (2011) can be well merged with the DNB Household Survey.

The DNB Household Survey is arguably one of the most representative sources of questions about household finances since its inception twenty-five years ago. Due to the extensive use of long time series, two issues may arise. First, sampling weights have only been available since 2001. Alessie et al. (2004) use another Dutch household survey, Housing Needs Survey in 1998, to proxy the weights of the pre-2001 period in the DNB Household Survey based on

income and home ownership, since the former has a larger sample. Since the application process to access the Housing Needs Survey is very time-consuming, I use the k-nearest neighbor (KNN) algorithm to match the weights of DNB Household Survey during 2001-2004. The results are robust and the cross validation shows that the error is less than 5%. (2) From 1999 to 2002, the currency was transferred from the Dutch Guilder to the Euro. I use a fixed exchange rate (1 Euro equals to 2.20371 Guilders) to adjust for all asset and income levels until 2003[3].

Household inflation expectations. The DNB Household Survey consists of 6 modules, in which the module "Health and Income" includes several questions about inflation expectations.

Beginning with the 2008 wave, the main quantitative question on inflation expectations is:

"What is the most likely (consumer) prices increase over the next twelve months, do you think?".

Possible answers are: 1%, 2%, 3%, . . . , 10%. This question provides a point estimate of inflation for the following year, which avoids respondents reporting extreme levels of expected inflation, as in the Michigan Consumer Survey (Armantier et al., 2015, and D'Acunto et al., 2018). Households are then asked four questions about their subjective CDF.

Since 2003, DNB Household Survey has been asking households for the upper bound and lower bound of inflation expectations:

"We now would like to learn what you expect will happen to the prices in the next twelve months. What will be the minimum percentage prices could increase over the next twelve months, do you think? If you think prices will decrease, you can fill in a negative percentage by using a minus in front of the number."

"What is the maximum percentage prices will increase over the next twelve months, do you think?"

[3]An alternative method is to use the US dollar as the reference currency. Both methods are consistent, with differences of less than one thousandth of a percent during the transition period

Households are then asked four questions about their subjective CDF based on the linear interpolation of two bounds.

Before 2002, households were only asked for a point prediction but without subjective CDF:

"Do you expect prices in general to rise, to remain the same, or to go down, in the next 12 months?"

"If the answer is rise: By what percentage do you expect prices in general to rise in the next 12 months?"

However, the point projections prior to 2003 differ from the post-2008 estimates because the former question asks households to fill in a number, while the latter only allows households to choose between the 1 and 10 percentiles. To produce consistent point projections for the entire sample period, the point prediction before 2003 is winsorized at 2.5^{th} and 97.5^{th} percentile. The mean of bounds is estimated and winsorized 2.5% in each tail for the years 2003-2007.

Figure 2 plots the cross-sectional distribution of point estimation inflation expectations made in the year 2013. Possible answers in the survey were: 1% to 10%. There is a large cross-section heterogeneity among the household. 50% of households chose 1% or 2%, while around 10% of households answered more than 5% and some households picked 10%. It is consistent with realized inflation (2.5%) in 2013 while with upward biased.

[Insert Figure 2 here]

Figure 3 depicts the dynamics of the cross-sectional distribution of inflation expectations. The cross-sectional distribution of inflation expectations in year t is depicted by the 10^{th} percentage, 90^{th} percentage and the average. The inflation expectations reported for year t refer to the distribution of forecasts made in year $t-1$ for year t. Moreover, the cross-sectional heterogeneity of inflation expectations is large in all years, which is probably because of households' own characteristics.

[Insert Figure 3 here]

Figure 4 compares the dynamics of households' subjective beliefs, rational expectations, and realized inflation. The subjective beliefs and realized inflation measure inflation rate in Netherlands, and rational expectations are from European central Bank's (ECB) Survey of Professional Forecast on 1-year inflation. On the one hand, average subjective beliefs move in the direction of realized inflation, but the upward deviation is highly persistent. This discrepancy is consistent with that documented in D'Acunto et al. (2022) and Vellekoop and Wiederholt (2019), and the upward bias of reported inflation expectations is unlikely to be caused by different questions of surveys. On the other hand, rational expectations not only have the same trend of realized inflation, but also at the similar level.

[Insert Figure 4 here]

Household portfolio data. The main advantage of the DNB Household Survey is that it provides a comprehensive module on financial matters, which is distinct from other household surveys. This survey not only documents main assets and liabilities, but provides every item for asset and liability as well. Therefore, I am able to obtain household's balance sheet. Table 1 presents an overview of the household's assets and liabilities. The structure of these categories is consistent with Von Gaudecker (2015), with some changes thanks up updated questions in recent waves (e.g., cryptocurrencies, cash in the household, etc.). In the balance sheet, there are 28 assets and 12 liabilities whose names are listed in "Level 3". Next, these items are aggregated by their characteristics at "Level 2". Then, the assets are further aggregated according to whether they are safe financial assets, risky financial assets, or non-financial assets in "Level 1". Several items only require households to report overall quantities, and they are rarely held in the household's portfolio. Assets of interest such as equities (funds/stocks) and deposits (savings) are well documented. "Employer-sponsored savings plan" is a special account for mixed investments that was open to new users until 2012, while its value is minor. Thus, I do not consider it when calculating equity market investment.

[Insert Table 1 here]

A desirable feature of the DNB Household Survey is that respondents are asked to report detailed information about their asset allocation - not only the number of stocks/funds, but also their names and the number of units held by the household. The feature makes this survey can be comparable to administrative data. The former can simply help construct some proxies for a household's portfolio, such as the number of stocks held directly or the share of asset allocation. But the latter can be specific to the characteristics of the assets. For example, we could not distinguish a successful diversification strategy is because of just investing a mutual fund or self-selecting a basket of stocks without detailed portfolio compositions.

I follow Calvet, Campbell, and Sodini (2007, 2009) and van Gaudecker (2015) in to construct the risk-return characteristics of household's portfolio. Note that those studies use cross-sectional data and emphasize the overall performance of assets. Thus, risk and return are calculated based on monthly data over the last 30 years. However, this paper aims to detect both cross-sectional and time-series variations. I first confirm whether an asset was still available or delisted in the year in which a household reported, Next, I check whether households correctly report their portfolio in the survey. In fact, around 10 percent of households mix mutual funds and stocks. I manually check every asset they documented and reclassify whether a asset belongs to a stock or a fund. Asset returns are then calculated based on monthly data for the past year because a household was asked to report holdings as of the last day of last year in the survey.

Since the DNB Household Survey only asks households to fill in the name of the stock/fund instead of any unique identifier such as $ISIN$, some incomplete or inaccurate disclosures may occur. To mitigate this issue, I first match stock names to Compustat and then compare them to van Gaudecker (2015), whose dataset can be found in the Centerdata archive. For mutual funds, I match their names to Datastream and then compare them to van Gaudecker (2015) as well.

To study the diversification strategy of household assets, I create a mean-variance frontier

of the household portfolio. The MSCI Europe index is treated as a market portfolio since more than 90% of the assets are from the Eurozone. All returns are excess returns relative to the risk-free rate which is approximated by the one-month Euribor rate. Due to the large number of funds in the sample, the fees are approximated at 50 basis points for mutual funds and 30 basis points for trackers. The Sharpe ratio for each asset is calculated based on the excess return over standard deviation.

Demographic and other control variables. The DNB Household Survey contains a set of demographic variables and I use them as control variables: age, sex, children, employment status, marital status, education, housing, urbanization, etc. I also develop a set of indicators to control for the employment status including regular employment, unemployment, retirement, disability, self-employment, and other. I also generate a set of dummies for education background since the Dutch education system is different from the United States. Students must choose between three streams after graduating from elementary school, and each stream is mostly independent of the others. Urbanization describes the level of the urbanization of a household's location. Moreover, I develop variables to measure household's financial situations, such as income, wealth, and financial constraints. Income is household member's disposable income, which has been calculated in the survey. Wealth is represented by household member's net worth. Financial constraints are measured as the logarithm of total liabilities to total assets. Additionally, household member's risk preference and self-reported financial literacy are Incorporated.

3.2 Summary Statistics

This paper takes advantage of the panel structure and utilizes waves from 1995 to 2020, as a major update of the survey happened in 1995 and became consistent since then. On average, there are 1376 households with 1754 household members per year in the sample[4]. Consistent with the original data, the average household participated in nine waves, with more than

[4]This paper reports all results in the household member level. I also completed all analyses in the household level by implementing household head in the survey and the result are consistent with the former.

half participating in more than seven waves.

Descriptive statistics for household members are reported in Table 2. The Panel A contains household member social economic variables. On average, a household member expects the inflation rate in 12 months will be 2.82%. Fewer than 5% of household members think there will be deflation next year, while more than 25% of household members believe the inflation rate will be beyond ECB target (2%). The average household member expects her income will increase 4.2% in a year.

The sample includes adults varying from 16 years old to 95 years old and is roughly balanced between female and male. The mean household size was 2.56, and the majority of households have a regular job. Most of household members completed high school, while only 29.2% of the sample graduated from college. A household member on average had net income as 20,525 euro, and wealth as 202,897 euro.

[Insert Table 2 here]

Table 3 shows household portfolio holding. The equity market consists of both stock market and mutual fund market. Panel A of Table 3 reports statistics for individual's financial asset market participation. About 20% of households hold risky financial assets, while not every household participates in the stock market. 13% of households hold funds and 9% hold public traded stocks. The summary statistics are consistent with previous papers using the same database (e.g., Dimmock and Kouwenberg (2010)) so the sample is unbiased.

Panel B of Table 3 reports the value of various financial assets. On average, individuals hold twice as many mutual funds as stocks. Risky financial assets consist mainly of equities, while other risky financial assets (e.g., bonds, etc.) only contribute to around 6%. Therefore, an exclusive analysis of stocks and mutual funds has already been representative for the household's risky portfolio allocation.

Panel C of Table 3 focuses on the number stocks and mutual funds a household member holds. Given the household members with risky financial assets, 43.68% have only 1 stock

and 96.36% hold less than 11 stocks; 57.60% have only 1 fund and 95.64% hold less than 6 funds. Even though DNB household Survey only asks respondents to report the names of their top 10 stock holdings and top 5 fund holdings,, the sample already covers more than 95% of stocks/funds holdings.

[Insert Table 3 here]

4 Effects on Households' Portfolio Choice

This section provides an empirical study of how households make portfolio choice in response to changes in inflation expectations. After providing a conceptual framework to guide the empirical analysis, the analysis proceeds in three steps. In the first step, I elaborate on the endogeneity issue between inflation expectations and portfolio decisions. In the second step, I focus on the impact of inflation expectations on the equity market behavior by implementing the "experience effect" as an instrumental variable. In the third step, I investigate whether there is an asset reallocation effect, in which individuals hold more risky assets and fewer safe assets. In a fourth step, I highlight the importance of inflation expectations in portfolio strategies, such as Sharpe ratio or loss of diversification (Calvet, Campbell, and Sodini 2007; von Gaudecker, 2015; Dimmock, Kouwenberg, Mitchell, and Peijnenburg (2020)).

4.1 Conceptual Framework

I guide the empirical analysis through a standard intertemporal consumption framework. The framework predicts that increased inflation expectations will lead to households to tilt their savings allocations toward riskier assets, such as toward equities rather than deposits, to smooth their consumption.

As a household expects a rise in inflation, she is likely to expect higher income. Higher inflation expectation can stimulate current consumption and future supply. Thus, firms can earn more profits and the household can expect income to increase as well. Then,

the household with higher expected income can invest more in the risky assets because she expect to have more liquidity in the future. At the same time, the household' purchasing power might be eroded when she expects an rise in inflation. This is result from the nominal rigidity of deposit rate and the real interest rate reduces. To smooth her consumption, the household needs to invest via risky assets since risky assets provides higher nominal return to maintain the purchasing power in the future.

In the following, I propose two channels to justify the risk-taking behavior. The first channel relies on the interaction between inflation expectations and income expectations. The second channel is based on nominal savings and nominal rigidity.

4.2 Baseline Model

In this subsection, I report results for the baseline models to test the relationship between inflation expectations and portfolio choice.

I relate the measure of household equity market participation to inflation expectations according to the empirical model:

$$Y_{i,t} = \beta \, Inflation \, expectations_{i,t|t-1} + X_{i,t}^{\intercal}\delta + \lambda_i + \epsilon_{i,t} \tag{1}$$

where Y is the dependent variable of interest. Here Y represent variables on portfolio choice. Note that I use the one-year lagged independent variable because of DNB Household Survey asks for inflation expectations for next 12 months while the detailed portfolio for the 31^{st}. December of the last year in each wave. Therefore, using inflation expectations in the last year is able to test whether it is the inflation expectations contribute to household portfolio decisions or not.

The independent variable of interest is inflation expectations, which vary over time across households. I implement four specifications of control variables. The first specification has no control variable, the second specification includes controls used in Vellekoop and Wiederholt

(2019), the third specification includes controls used in van Rooij et al. (2011), and the last specification includes all of control variables. The empirical model uses household members fixed effects to absorb systematic differences across household members. Since a household's portfolio decisions are likely to be correlated with each other over time, standard errors are clustered by household members[5].

Table 4 reports the relationship between inflation expectations during the year and households' portfolio decisions at the end of the same year. The dependent variable is equity market participation in columns 2-5 and the value invested in the equity market in columns 6-9. Equity market participation is an indicator whether a household member participates in the equity market or not this year. The value of investment has been logarithm since the distribution is heavily skewed. [6]. Household members with higher inflation expectations have higher equity market participation. This relationship is statistically significant at 1% and economically meaningful as well. An 1 percentage point increase in inflation expectations is associated with a 0.3% increase in equity market participation. Higher inflation expectations are also related to more investment in equity market.

4.3 Identification Strategy: Experience Effect

The challenge of obtaining unbiased estimators stems from a potential omitted variables issue. I elaborate on two types of omitted variables here. First, individuals with higher income are more likely to lower their inflation expectations and hold more risky assets comparing to a low income class: For one thing, the high income class has access to better investment opportunities. For another, the high income group is less sensitive to inflation rather than the low income group because the latter is constrained by her consumption bundle and has to react to price changes immediately. As a result, this estimated relationship would be biased upward without incorporating income, making it necessary to control for the factor.

[5]I also use household fixed effects and standard errors are clustered by households. The result is consistent.

[6]I find that individuals in the survey sometimes may mix stocks and funds so that I define "equity" to represent both stocks and funds.

Another possible omitted variable is inflation experience. Individuals experienced salient inflation before are likely to under-estimate inflation in the future. At the same time, those households are relatively senior so that they hold less risky assets. Hence, the relationship between risky assets allocation and inflation expectations would be underestimated and it is necessary for the analysis to control for inflation experience.

A legitimate experiment to test the impact of inflation expectations on households' investment requires an unanticipated shock related to inflation expectations but barely affects portfolio decisions directly. I propose to use the experience effect (Malmendier and Nagel, 2016) as an instrumental variable. The experience effect play an indispensable role in household decision making. For example, Basten, Kukk, and Toczynski (2022) find that personally experienced price growth boosts households contemporaneous real spending via forming inflation expectations.

First, the experience effect of inflation satisfies the correlation condition for instrumental variables. Households have experienced a shock before use the experience as a reference to form their subjective belief. For example, an individual who has experienced a stock market crisis is less likely to participate in the stock market for the rest of her lives, both in the broad sense and at the intensive margin (Malmendier and Nagel, 2011). A household member who experienced the 2008 financial and housing crisis is still significantly less likely to purchase a home and is also significantly curbing her spending (Malmendier and Shen, 2018). Figure 5 is a simple time series plot of demeaned inflation expectations from DNB Household Survey. It depicts the expectations of young people (age below 40 years old), middle-aged people (40 to 60 years old) and older people (age above 60 years old), expressed as deviations from the cross-sectional average expectations for each quarter. The Figure argues that the dispersion of inflation expectations between the young and the old is striking: it reaches almost 3% during the high inflation years around 2001 to 2004 in which the young group shows overestimated subjective beliefs while the old group has underestimated beliefs. The reversals in relative beliefs occurred during the financial crisis in 2008 and the pandemic period in since

2020.

The correlation condition is quantitatively confirmed by the first stage of the 2SLS. Table 5 reports the first stage of the 2SLS. Thanks to Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011), I use four model specifications to mitigate the omitted variable problem. In every model specification, past inflationary experience is significantly correlated with inflation expectations. The coefficients range from about 0.894 to 0.965 and are all significant at the 1% level. In addition to the valid t-statistic, the F-statistic for each model specifications is significant and exceeds 30. Thus, the correlation condition is verified and the instrumental variable is unlikely to be a weak instrument.

[Insert Figure 3 here]

[Insert Table 5 here]

the exclusion restriction of the instrumental variable method requires the experience effect can only affect household choice through inflation expectations. This condition cannot be tested directly, and I argue that the experience effect of inflation is a legitimate instrument for household portfolio choice. Firstly, the experience effect is historically dependent. The experience effect is based on previous experience on salient inflation, and hence, it has no direct relationship with formation of beliefs. Specifically, the latter is based on the projection of future. Second, the experience effect is heterogeneous. Individuals at the same age have various views of inflation beliefs, even though what they experience was the same. Third, inflation experience is not directly related to the stock market. Malmendier (2021) argues that it is the stock market experience rather than inflation experience that affects market valuation or market participation. The experience effect of inflation develops as a result of inflation shocks in the past, such as hyperinflation or deflation, rather than stock market shocks.

4.4 Inflation Expectation and Equity Market Participation

So far, the results show that differences in inflation experience generate differences in expectations of future inflation. Thus, to what extent do these differences in expectations affect households' portfolio choices? One feature can be detected is equity market participation.

The model specification is the two stage least square (2SLS). In the first stage, the independent variable is inflation experience and the dependent variable is inflation expectations. The sample for the first stage is in the cohort-year level. In the second stage, the independent variable is inflation expectations which is the fitted value derived from the first stage, and the dependent variable is household portfolio choice

$$Inflation\ expectations_{i,t|t-1} = \beta\ Inflation\ experience_{i,t|t-1} + X_{i,t}^{\intercal}\delta + \lambda_i + \epsilon_{i,t} \tag{2}$$

$$Y_{j,t} = \beta\ Inflation\ \hat{expectations}_{j,t|t-1} + X_{j,t}^{\intercal}\delta + \lambda_j + \epsilon_{j,t} \tag{3}$$

Table 6 reports the effect of inflation expectations on equity market participation. The first two dependent variables are the same as Table 4. The equity is decomposed by fund and stock and the results are reported Panel A, Panel B, and Panel C, respectively. Columns 2-5 show that an increase in household inflation expectations leads to an increase in the probability that households allocate risky assets, including stocks and mutual funds. The coefficient for stock is a bit larger than the coefficient for mutual funds, suggesting households are more likely to invest in stocks over mutual funds. Columns 6-9 report the consistent results that households with higher inflation expectation invest more in risky assets.

The last 4 columns provides an alternative prospective by focusing on market entry. I expect that households are more likely to enter the equity market following an increase in inflation expectations. Consistent with previous papers such as Brunnermier and Nagel (2008) and Giannetti and Wang (2016), entry is a dummy that is set to 1 for households that have not participated in the equity market in the last wave of the survey but participate

in the current wave. For households that participated in the previous round, this variable is set to missing. This effect is economically significant and consistent with equity market participation. Put differently, more equity market participation implies that more households allocate to risky assets.

[Insert Table 6 here]

4.5 Capital Allocation Between Safe Assets and Risky Assets

In addition to risky asset participation, it is curious whether households invest more in risky financial assets as well as less in safe assets. To test this hypothesis, I first construct "Net (Asset) Purchases," which measures the net value of a household's new assets (equities/funds/stocks) allocation over the course of a year. This variable has been logarithm transformed because it is very skewed, as suggested by Giannetti and Wang (2016). Second, to examine the relative weight of stocks in a household's financial portfolio, I create a "Asset income Ratio," which is the ratio of asset (equities/funds/stocks) over income. I use income as a denominator since the income is stable in the short run and can be seen as a safe inflow for households (Zhang, 2021). Since the economic implication is that households reallocate their safe assets to risky assets, I follow Guiso et al. (2008) to develop an "equity-liquidity ratio" which uses financial assets as the denominator.

Table 7 finds an increase in household inflation expectations leads to an increase in holding equity assets rather than safe assets. First, high inflation expectations lead to more risk assets purchases (columns 2-5). In other words, the absolute amount in the equity market increases rather than just re-balancing within the risk assets account. Additionally, net purchase of funds has stronger effect than net purchase of stocks. Second, I test how a household distributes her income and I find that high inflation expectations induce the household to allocate more via risky assets (Columns 6-9). Third, I further consider the saving allocation between safe assets and risky assets. Columns 10-13 reports that households with high inflation expectations shift from safe financial assets to risky financial assets.

[Insert Table 7 here]

4.6 Risky Assets Performance

The DNB Household Survey asks a household to provide not only the number and amount of her assets, but also the name of each stock/mutual fund. Thus, I am able to test the performance of the household portfolio. Since the survey provides data on household portfolio holdings at the end of each year, I assume that households execute a "buy and hold" strategy at the beginning of each year and have a turnover at the end of that year. This assumption is reliable because households in the sample typically hold stocks for several years. I then calculate the return over the holding period. This return is not adjusted by any asset pricing models because whether households can generate α is not of interest. What the households care about is the risk of the portfolio. Therefore, I calculate the market risk exposure, β. I follow Calvet et al. (2007) and von Gaudecker (2015) and assume that assets are priced according to the international CAPM model. The calculation here is based on household's portfolio, so I do not decompose household's stocks and funds. At last, I calculate Sharpe ratio to measure the performance of household portfolio.

The model specification focuses on households with substantial equities, so I exclude households with less than €1,000 in risky financial assets. Panel A of Table 8 documents that high inflation expectations lead to significantly positive holding period returns so that risky assets investment manages to provide positive returns and hedge expected inflation. Panel B of Table 8 reports that households are exposed more to market risk, which is consistent with households holding more funds in Table 7. Panel C shows that an increase in inflation expectations is associated with an improvement in household portfolio's performance.

[Insert Table 8 here]

4.7 Is Household Portfolio Choice Optimal?

In addition to the performance and risk profile of household portfolio choices in the presence of changes in inflation, one might be curious know whether household portfolio choice is optimal. One of the most straightforward criteria is return loss, defined as the expected return lost by households not choosing positions on the efficient frontier with the same level of risk as their portfolios (Calvet et al., 2007 and von Gaudecker, 2015). In other words, the return loss is the distance between the efficient frontier and the spot of the household's portfolio under the mean-variance frontier.

The return loss is calculated as as the product of the expected excess return on the market portfolio (MSCI Europe index) μ_t, the risky asset share $\omega_{i,t}$, market risk$\beta_{i,t}$, and the relative difference between the Sharpe ratios of the efficient market portfolio and the household's portfolio:

$$Return\ loss_{i,t} = \mu_t \times \omega_{i,t} \times \beta_{i,t} \times \frac{Sharpe_t - Sharpe_{i,t}}{Sharpe_{i,t}} \tag{4}$$

The quantity $\frac{Sharpe_t - Sharpe_{i,t}}{Sharpe_{i,t}}$ also has an economic interpretation called "diversification loss". It measures the loss of return compared to a frontier portfolio taking the same risk. In other words, this variable represents the loss due to lack of sufficient diversification.

Table 9 presents the diversification loss and return loss separately. In a state of high inflation expectations, the household portfolio choice is likely to make better diversification. The portfolio is closer to the mean-variance frontier and has significantly lower return losses. This is consistent with previous estimations that households participate more in capital market and hold more mutual funds, and also consistent with the argument that the return losses are driven by diversification losses.

[Insert Table 9 here]

The above results suggest that high inflation expectations lead to household participation in risky assets, both in the stock market and the mutual fund market. This suggests that

households' demand for risky assets is driven by high inflation expectations. This effect is obtained after controlling for household demographics and socioeconomic status since they are confounding variables. In addition, households can make better portfolio decisions because their portfolio can generate better returns by taking mainly market risk. And their portfolio is well diversified and closer to the mean-variance frontier. This reveals that households can benefit from investing in risky assets in the face of high inflation expectations.

5 Heterogeneity: Who Reacts to Inflation Expectations?

Earlier studies have identified several individual-level characteristics relevant for households' reactions to macroeconomic changes. Examples of such characteristics include investment horizon (Catherine, 2022), financial literacy (van Rooij, et al., 2011), gender (Ke, 2021), etc. Given the variation of individuals' inflation expectations, I conjecture that those demographic/social economic characteristics can shape the households' inflation expectations and the portfolio decisions.

To access the conjecture, I repeat the IV analysis after splitting the sample across characteristics related to economic sophistication, demographics, and factors leading to systematic differences in inflation expectations.

5.1 The Role of Horizon Effect

(Life cycle) horizon plays an important role in the formation of inflation expectations. Coibion, et al. (2020) argue that expectations can influence economic decisions over different investment horizons. And the empirical results also suggest that the impact of changing inflation expectations may take time to translate into action due to changes in horizon. Theoretically, one strand of literature modifying Merton's (1973) inter-temporal asset pricing model is to incorporate agents' horizon into the utility function. Thus, I conduct a test

to elaborate on the role of horizon.

Intuitively, an individual whose age is close to life expectancy may have a more limited view than others. I followed this idea by dividing the sample into two groups based on the available life expectancy. The life expectancy is conditional life expectancy from CBS[7]. This variable directly measures the available life expectancy at the age of the individual. The threshold for the split sample is 15 years, since the OECD estimates that the available life expectancy of households in retirement is about 15 years. [8].

The model specification is the same as in Section 4.4, in which the dependent variables include market participation, the value of equity investment, and stock-income ratio. The coefficients in Table 10 are the differences between the two groups. In Table 10, each column documents two separated regressions. Households not constrained by the life expectancy exhibit similar behavior compared to the entire sample. However, households constrained by the life expectancy are less likely to participate in equity market and they are more likely to reduce holding in the equity market.

[Insert Table 10 here]

5.2 The Role of Financial Literacy

Several previous studies have provided information on financial literacy and variables related to financial decisions, (e.g., savings, portfolio choice or retirement planning), while DNB Household Survey only provides self-assessed financial literacy:

How knowledgeable do you consider yourself with respect to financial matters?

and respondents are asked to choose one of four answers:

1 not knowledgeable; 2 more or less knowledgeable; 3 knowledgeable; 4 very knowledgeable.

van Rooij et al. (2011) that included financial literacy questions in the DNB Household Survey 2005 and 2006. Since then, papers using the DNB Household Survey (e.g., van Gaudecker (2015), Bucher-Koenen et al., 2021) could also benefit from the paper since the

[7] `https://opendata.cbs.nl/statline/portal.html?_la=nl&_catalog=CBS`

[8] Besides 15 years, I also use 10 years and 20 years as the threshold to rule out the the effect of retirement.

authors very kindly provided the raw data. My financial literacy score measures basic financial knowledge on arithmetic, interest compounding, inflation, time value of money, and the illusion of money [9]. Further, it is curious about the impact of financial literacy on portfolio decisions in the presence of inflation expectations. Therefore, I generate the interaction between inflation expectations and financial literacy. The model specification is:

$$\begin{aligned} Y_{i,t} = \beta_1 \, &Inflation\, expectations_{i,t|t-1} \times Financial\, Literacy_i \\ &+ \beta_2 Inflation\, expectations_{i,t|t-1} + \beta_3 Financial\, Literacy_i + X_{i,t}^{\top}\delta + \lambda_i + \epsilon_{i,t} \end{aligned} \tag{5}$$

and the first stage estimation is

$$\begin{aligned} &\begin{pmatrix} Inflation\, expectations_{i,t|t-1} \\ Inflation\, expectations_{i,t|t-1} \times Financial\, literacy_i \end{pmatrix} = \begin{pmatrix} \gamma_1 \, \gamma_2 \\ \gamma_3 \, \gamma_4 \end{pmatrix} \times \\ &\begin{pmatrix} Experience\, effect_{i,t} \\ Experience\, effect_{i,t} \times Financial \times literacy_i \end{pmatrix} + X_{i,t}^{\top}\delta + \lambda_i + \epsilon_{i,t} \end{aligned} \tag{6}$$

Financial literacy is proxied by the first basic literacy factor from Rooij et al. (2011). Multiple first stages of the Cragg-Donald Wald F-statistic reject the null hypothesis, demonstrating that the IV is not weak. Table 11 shows that households with high financial literacy significantly participate more in the equity market. It is consistent with the argument that households with high financial literacy are more likely to invest in financial markets.

[Insert Table 11 here]

5.3 The Role of Income

Income can lead to systematic difference on inflation expectations, which has been documented as "inflation expectation gap" (Zhang, 2022). This phenomenon is also confirmed in this sample when it is divided into 5 class based on household net income: 2.82% for the lowest income class, 2.79% for the middle income class, and 2.59% for the highest in-

[9] These five questions are detailed in Box 1 of van Rooij et al. (2011)

come class. To keep more observations within each group , I divided the sample into three groups for empirical tests: top income households (top 33.33%), middle class households (33.34%-66.67%), and low income households (66.67%-100%).

Table 12 reports the differences in the reactions of households across income. It is noticeable that inflation expectations only from the high income group result in significant equity market participation and investment. Also, all dependent variables decrease in the order of the income groups. Therefore, this effect is mainly driven by high income households whose annual net income is 20747.81 euro or above.

[Insert Table 12 here]

5.4 The Role of Gender

The last characteristic I consider is gender since women have systematically higher inflation expectations than men (D'Acunto et al. 2021). It is further due to the different role within a household (gender norm). For another, Ke (2018) argue that households in countries with more traditional gender norms are less likely to invest in the stock market because gender norms constrain women's influence over intra-household financial decision making. In this sample, women report incrementally higher inflation expectations than men (2.83% V.S. 2.79%), while equity market participation of men is two times more than of women (0.254 VS 0.123).

Table 13 reports the differences in the reactions of households with different gender. The difference between women and men is substantial: women react severely to inflation expectations than men. The former not only participate more in the equity market, but also invest more.

[Insert Table 13 here]

6 Channels: Why Households React to Inflation Expectations?

I access two potential economic mechanisms in this section, the expected income channel and the nominal saving channel, through households' inflation beliefs to impact their portfolio decisions.

6.1 Income Expectations Channel

As stated in Section 4.1, the expected increase in prices can result in households to expect higher income in the future, and hence, it induces households' to invest more for the future. However, a legitimate experiment to testing this channel requires an unanticipated event to change household's inflation expectations and income expectations, but not affect investment opportunities.

I propose to use fiscal policy shocks, VAT increases in 2001, 2012 and 2019, in the Netherlands. First, the VAT shocks were unexpected, even though it might related to public budget deficit. It is usually assumed that fiscal policy changes is shock for the household sector, while one may argue that government budget deficit may account for VAT increase for countries in European union. It is because Maastricht Treaty imposes an arbitrary cap of 3% on the government budget deficit as a percentage of total GDP. However, the level of the government budget deficit does not directly predict the VAT adjustment in the Netherlands. Figure 6 depicts the dynamics of the Dutch government budget and VAT adjustment policy. the increase in general VAT in 2001 was due to the forecast of government deficit in the following years, even though the government budget was positive in 2000. In 2012, the government deficit had exceeded 3% for several years due to the financial crisis before the increase in general VAT. In 2019, even though the government budget has been positive since 2017, the reduced VAT was still increased. Additionally, a strand of literature including Romer and Romer (2010), Alesina, Favero, and Giavazzi (2015), and D'Acunto, Hoang, and

Weber (2022) argues that the fiscal policy shocks are unpredictable for the household sector.

[Insert Figure 6 here]

Second, the fiscal policy shocks are independent of monetary policy for the Netherlands. The Netherlands does not have monetary power since the central bank, Dutch National Bank (DNB), is a member of the European Central Bank (ECB). Put differently, ECB is able to take decisions on monetary policy for the entire Euro zone, while DNB herself cannot make any monetary decisions. This separation between the fiscal decision and monetary decision explicitly rules out any increase in nominal interest rates to offset price pressures from the implementation of a higher VAT. Moreover, there is no agreement on VAT for European countries. The general VAT rate varies from 17% (Luxembourg) to 27% (Hungary).

Third, the financial market is rarely affected by unconventional fiscal policy shocks in the Netherlands during the sample period. Figure 7 depicts the dynamics of returns on a set of financial assets, including bank deposits (callable at notice and with an agreed maturity), government bonds, and stock market indices. The stock market index for the Euro Zone is the STOXX 600 index. All of returns on financial assets in the Netherlands are highly consistent and correlated with those of the Euro zone. The returns between the Netherlands and other European countries are very similar regardless of the presence or absence of fiscal shocks. Therefore, investment opportunities are unlikely to be affected by the VAT shocks.

[Insert Figure 7 here]

To determine whether VAT shocks are responsible for the rise in inflation expectations in the Netherlands. I propose to use the difference-in-differences analysis inspired by Poterba (1996), Besley and Rosen (1999) and D'Acunto, Hoang and Weber (2022). It is necessary to show that the pre-trends are (mostly) parallel and that the divergence only occurs after the shock. Figure 8 provides graphical evidence in support of the parallel assumption. The treatment group and control group are monthly inflation expectations from European Commission Consumer Inflation Expectations. European Commission Consumer Inflation Expectations are available since January 1985 and cover 33 countries. The aggregated time

series are free to download. The question No.6 is related to 1-year inflation expectations:

By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months? They will...

and respondents are allowed to choose 1 among 6 possible answers:

Increase more rapidly (++); Increase at the same rate (+); Increase at a slower rate (=); Stay about the same (-); Fall (- -); Don't know.

Therefore, I create an indicator which equals 1 when a household expects inflation to increase in 12 months. The treatment group is Dutch households and the control group is German households. Figure 8 plots average expected increase in inflation around the VAT shocks in the Netherlands. Before the VAT shocks, the expected increase in inflation in the Netherlands and Germany were parallel (December 2000, September 2012 and December 2018). After the announcement of fiscal policies, there was a clear upward trend in inflation in the Netherlands, revealing a significant increase in inflation. After the increase, expected increase in inflation reverts to its pre-announcement level. At the same time, the trend in Germany remains the same as the pre-announcement period.

[Insert Figure 8 here]

Figure 9 plots the dynamics of inflation expectations and income expectations around the VAT shocks. The announcement of the fiscal policy affected both inflation expectations and income expectations, but in a different way. All three announcements induced a large increase in inflation expectation, and income expectations only increased in 2001 and 2019 but not in 2012. Actually, the dynamics between inflation expectations and income expectations were positively correlated, while the relationship became negative in 2012. I conjecture the latter relies on countercyclical nature of income expectations. During a recession period, high inflation expectations lead to an increase in the cost of raw materials. However, contemporaneous consumption cannot be stimulated. Firms have to reduce labor costs to maintain the profit due to lack of demand, which decreases income expectations. On the opposite, high inflation expectations boost contemporaneous consumption and further

increase demand during an expansion period. Firms earn more profits so that households expect income will increase in the future.

[Insert Figure 9 here]

Table 14 reports the effect of interaction between inflation expectations and income expectations. I construct a dummy which equals to 1 if income expectations are non-negative. In the state of high inflation expectations, a household with positive income expectations shift their assets away from asset assets to risky assets. Households with positive income expectations participate two times more in equity market than households with negative income expectations. The households also invest much more if their income expectations are positive. The relative weight between risky asset and income (safe asset) is higher for households who expect better income in the future.

[Insert Table 14 here]

6.2 Nominal Saving Channel

Another channel I consider is the nominal return channel. A household expect an increase in inflation may realize her real value of wealth will shrink in the future since she has to pay more to smooth her utility. Thus, The household may prefer risky assets over safe assets because the deposit rate is fixed. As a result, the household's nominal wealth increase since she obtains higher return from risky assets compared to safe assets.

To test this channel, I construct two measures for nominal wealth, liquid asset and liquid networth. The liquid asset is the value of financial assets at the end of a year , including checking and saving accounts, and the value of risky financial assets such as bonds, stock, funds, etc. The liquid networth is the difference between the value of liquidity assets at the end of a year and liquid liabilities at the end of the same year. The liquid liabilities consist of sum the other loans, consumer loans, and credit line facilities.

I estimate empirical models of the following form:

$$
\begin{aligned}
Y_{i,t} = {} & \beta_1 \, Inflation\, expectations_{i,t|t-1} \times Equity\, Market_{i,t-1} \\
& + \beta_2 Inflation\, expectations_{i,t|t-1} + \beta_3 Equity\, Market_{i,t-1} + X_{i,t}^{\top}\delta + \lambda_i + \epsilon_{i,t}
\end{aligned}
\tag{7}
$$

and the first stage estimation is

$$
\begin{aligned}
&\begin{pmatrix} Inflation\, expectations_{i,t|t-1} \\ Inflation\, expectations_{i,t|t-1} \times Equity\, Market_{i,t-1} \end{pmatrix} = \begin{pmatrix} \gamma_1 \, \gamma_2 \\ \gamma_3 \, \gamma_4 \end{pmatrix} \times \\
&\begin{pmatrix} Experience\, effect_{i,t} \\ Experience\, effect_{i,t} \times Equity\, Market_{i,t-1} \end{pmatrix} + X_{i,t}^{\top}\delta + \lambda_i + \epsilon_{i,t}
\end{aligned}
\tag{8}
$$

The dependent variable $Y_{i,t}$ is the either the liquid asset or the liquid networth of household member i in year t. The main variable is the interaction between inflation expectation of household member i in year $t-1$ and (log-transferred) equity market investment of household member i in year $t-1$. Consistent with previous model specifications, I also take various sets of control variables and household members fixed effects into consideration. Stand errors are clustered by household members.

The results are reported in Table 15. Panel A presents a positive relation between the liquid asset and the interaction term. Roughing speaking, given either inflation expectations, an additional equity market investment results in 0.2 liquid asset increase. The effect is more pronounced for liquid networth. Specifically, Panel B reports an additional unit equity market investment results in more than 0.4 unit increase in liquid networth, which is statistically significant at the 5% level.

[Insert Table 15 here]

7 Conclusion

Recent years have been witnessing a high inflation problem around the world. This paper seeks to contribute to the growing body of literature studying the impact of inflation ex-

pectations on household behavior and, in particular, how households portfolio decisions. By exploiting the inflation experience as an instrumental variable, I find that Dutch households switch to risky assets in the face of a rise in inflation expectations over the last 25 years. This also lead to households more efficient portfolio decisions by households, increasing the Sharpe ratio of portfolios and reducing losses due to under-diversification. Thus, households' nominal wealth increases as a result of the "risk-taking" strategy. Moreover, this behavior is more pronounced for households who have a positive income expectations or in the relatively high income class.

This paper is among one of the first to examine the impact of inflation expectations and portfolio choice. The above findings are consistent with "reach for yield" hypothesis (Borio and Zhu, 2012), in which households shift their portfolio from risk-free to risky assets as an increase in inflation expectations directly reduces their real deposit rates. This paper also has an implication to policymakers who aim to use inflation expectations as a policy tool since it is important for them to have a better understanding of both household's consumption and portfolio reactions. For example, The latest monetary policy of U.S. Federal Reserve including committing to temporarily tolerating inflation rates above 2%, is expected raise inflation expectations. However, this paper finds such a policy change may also lead to unintended consequences of households' "risk-taking" behavior.

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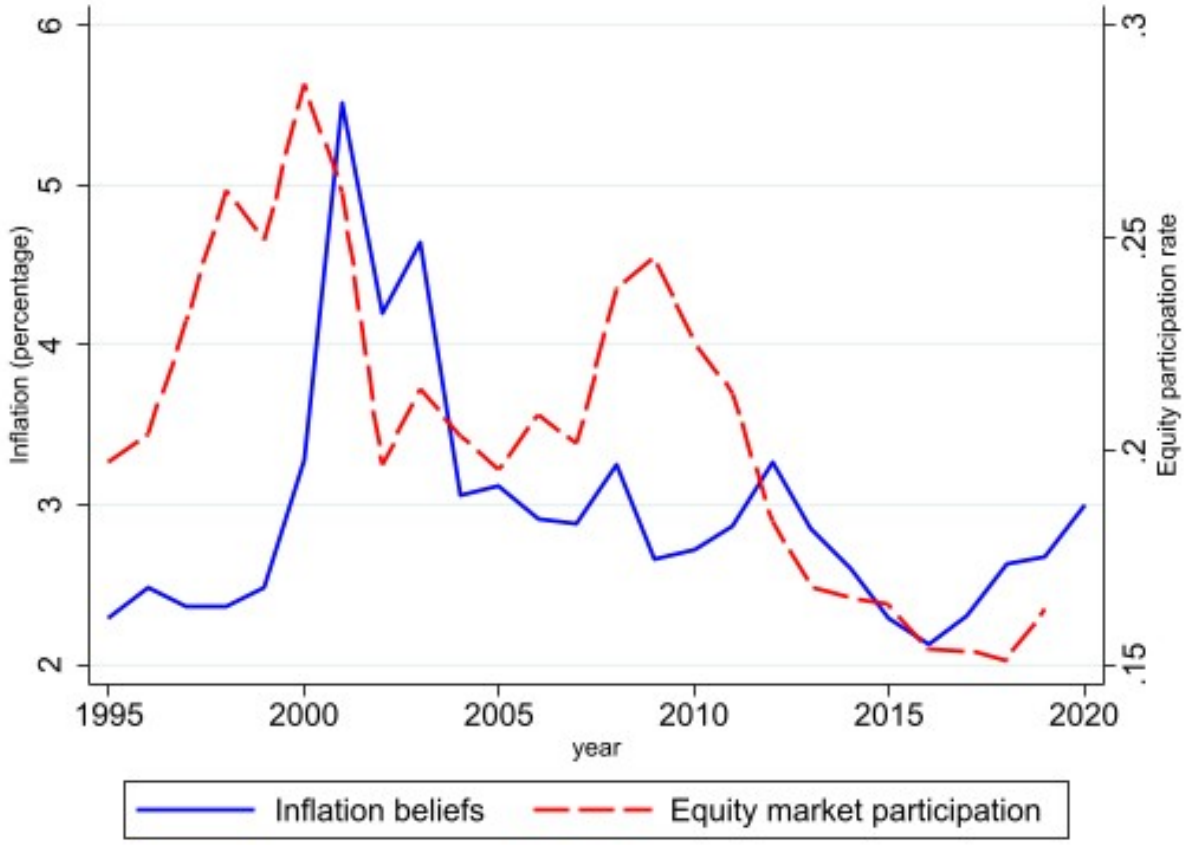
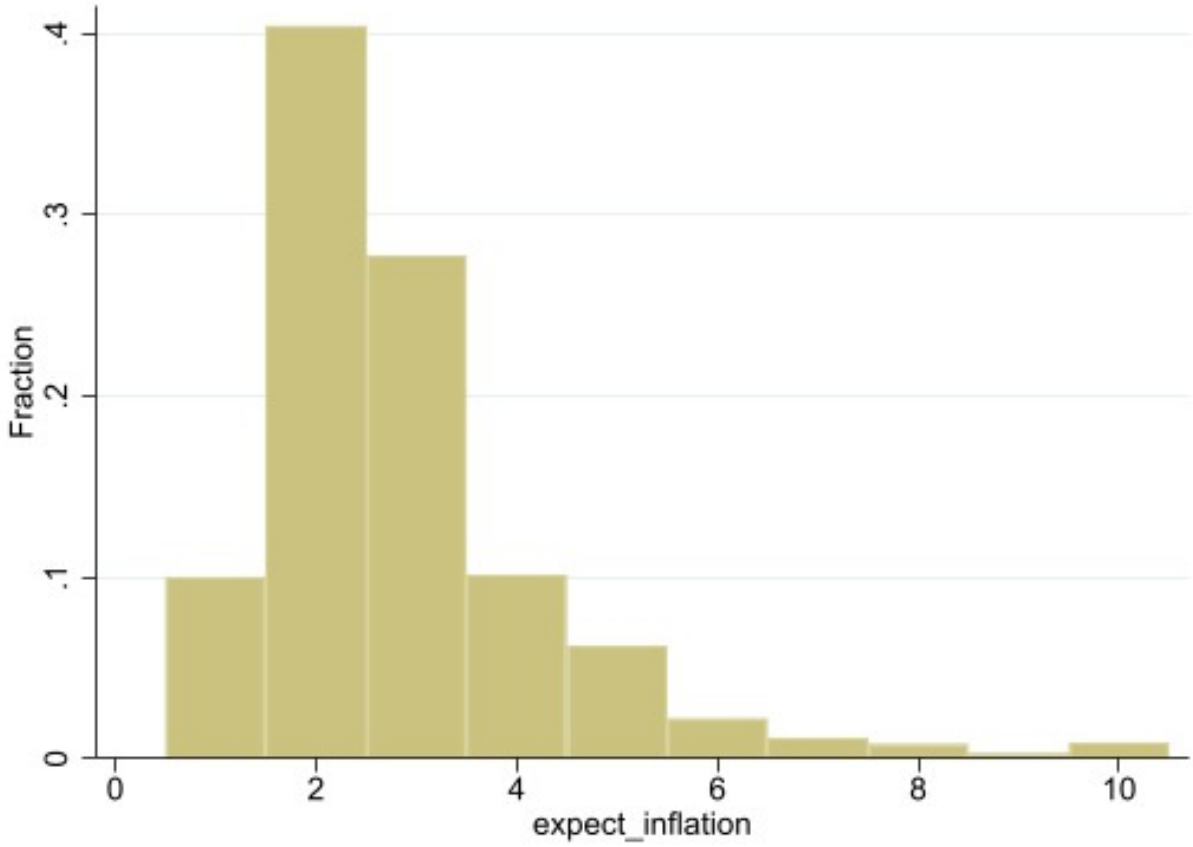
Figure 1: Inflation Expectations and Equity Market Participation



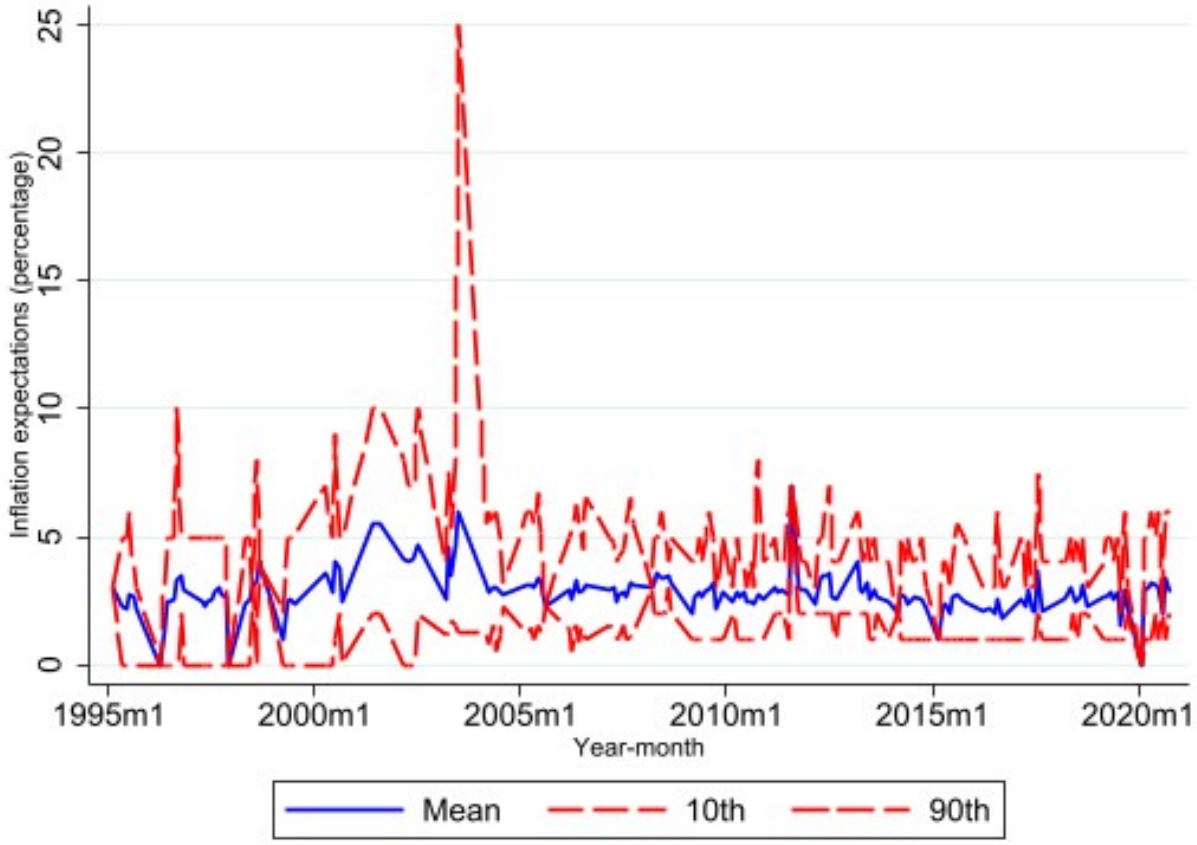
Notes: This Figure depicts the annual average dynamics of inflation expectations and equity market participation in Netherlands. The sample period is 1995-2020.

Figure 2: Cross-Sectional Distribution of Inflation Expectations



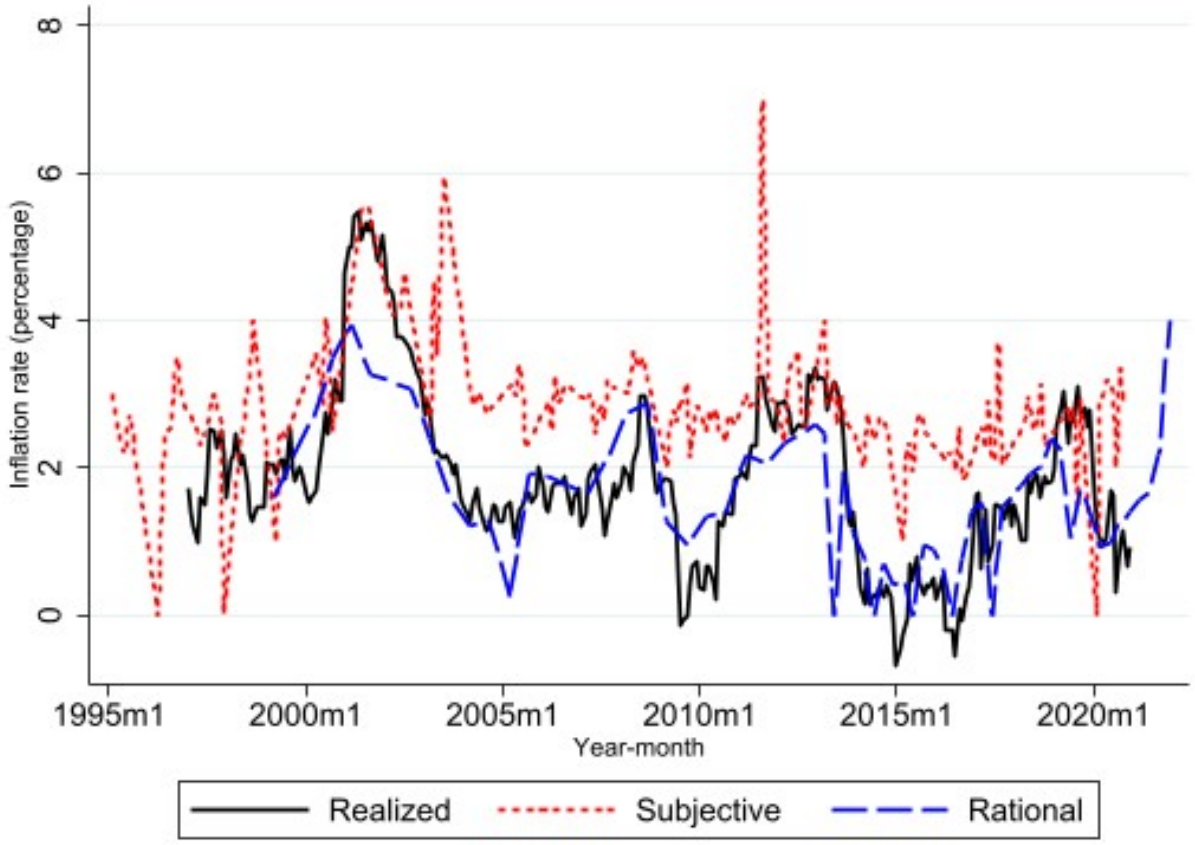
Notes: This Figure depicts the cross-sectional variation of inflation expectations in 2013.

Figure 3: The Dynamics of Cross-Sectional Distribution of Inflation Expectations



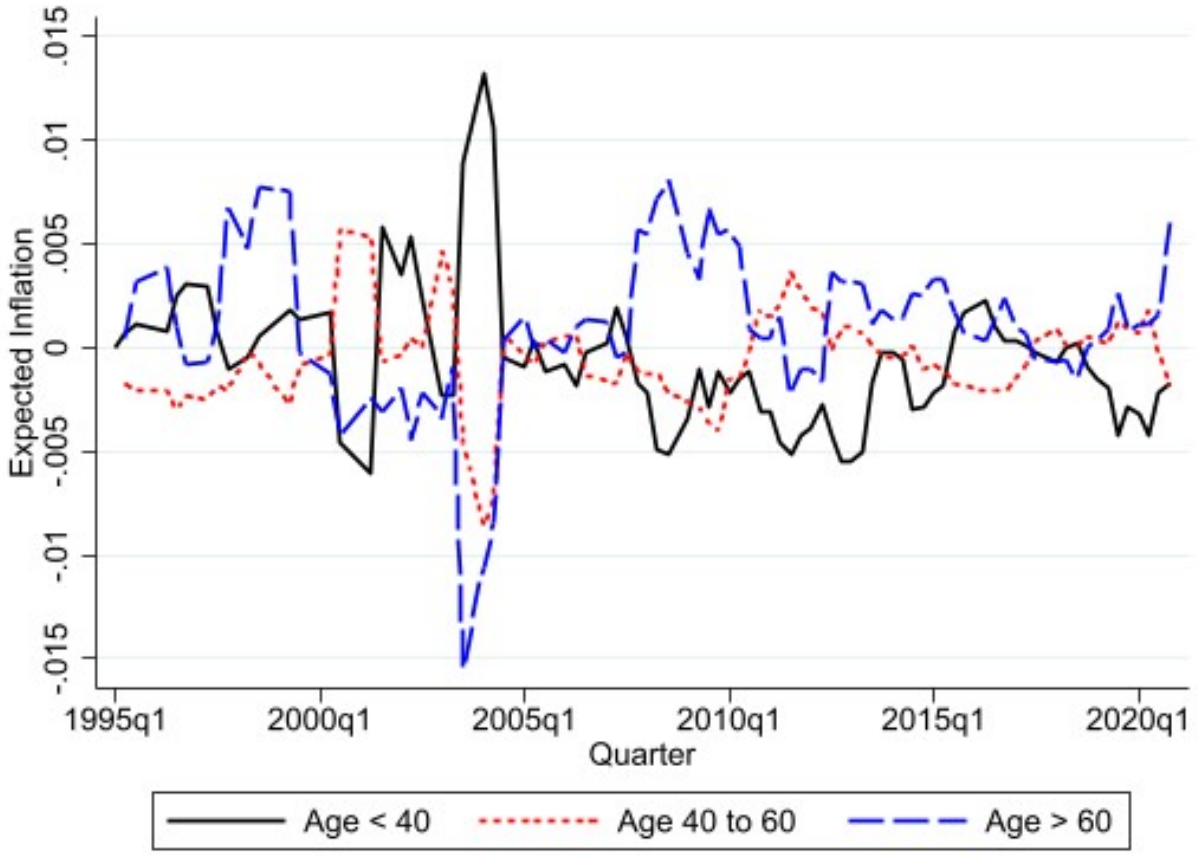
Notes: This Figure depicts the monthly dynamics of inflation expectations in the Netherlands. Two red dash curves and a blue curve represent 10 percentile, 90 percentile and the average of inflation expectations. The sample period is 1995-2020.

Figure 4: Subjective Beliefs, Rational Expectations, and Realized Inflation



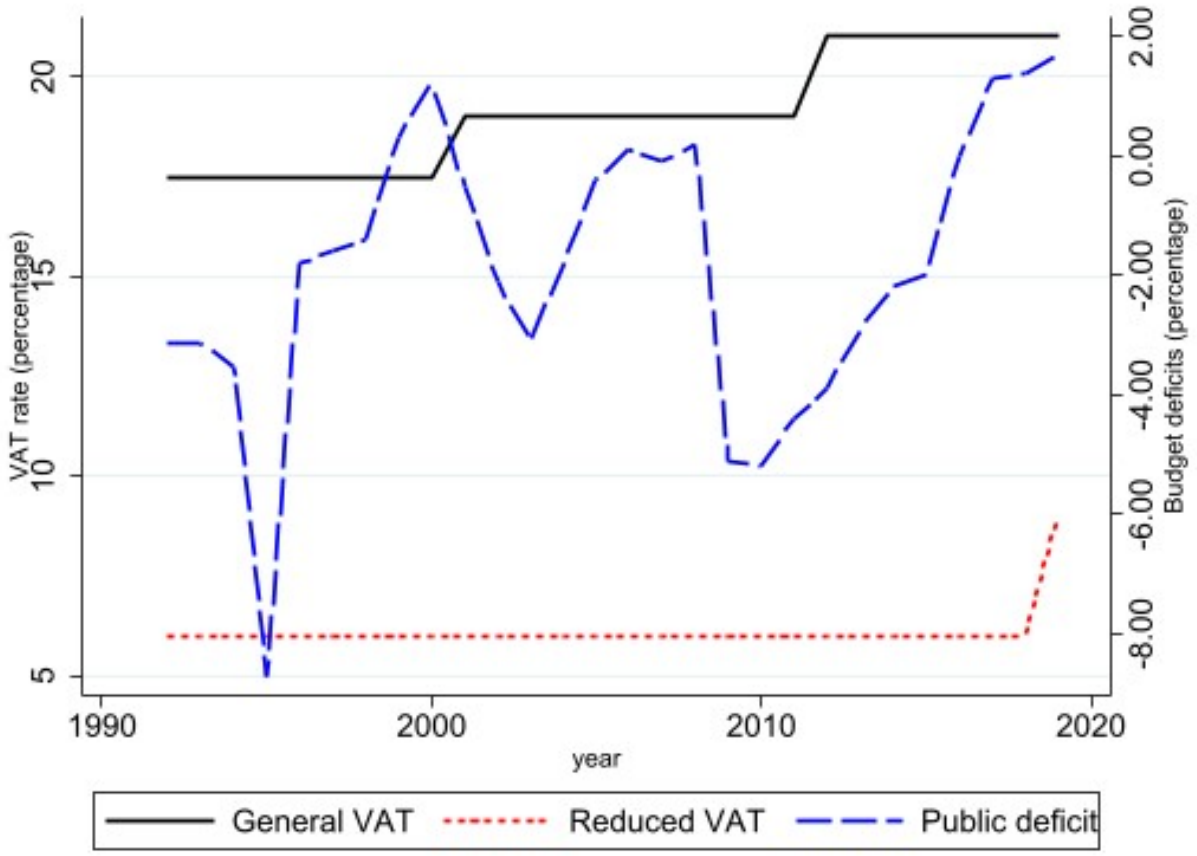
Notes: This Figure compares the monthly dynamics of households' subjective inflation beliefs, rational inflation expectations, and realized inflation. The red dot-dash curve, the blue dash curve, and the black curve represent subjective beliefs, rational expectations, and realized inflation, respectively. The sample period is 1995-2020.

Figure 5: Inflation Expectations by Age Group Relative to Cross-Sectional Mean



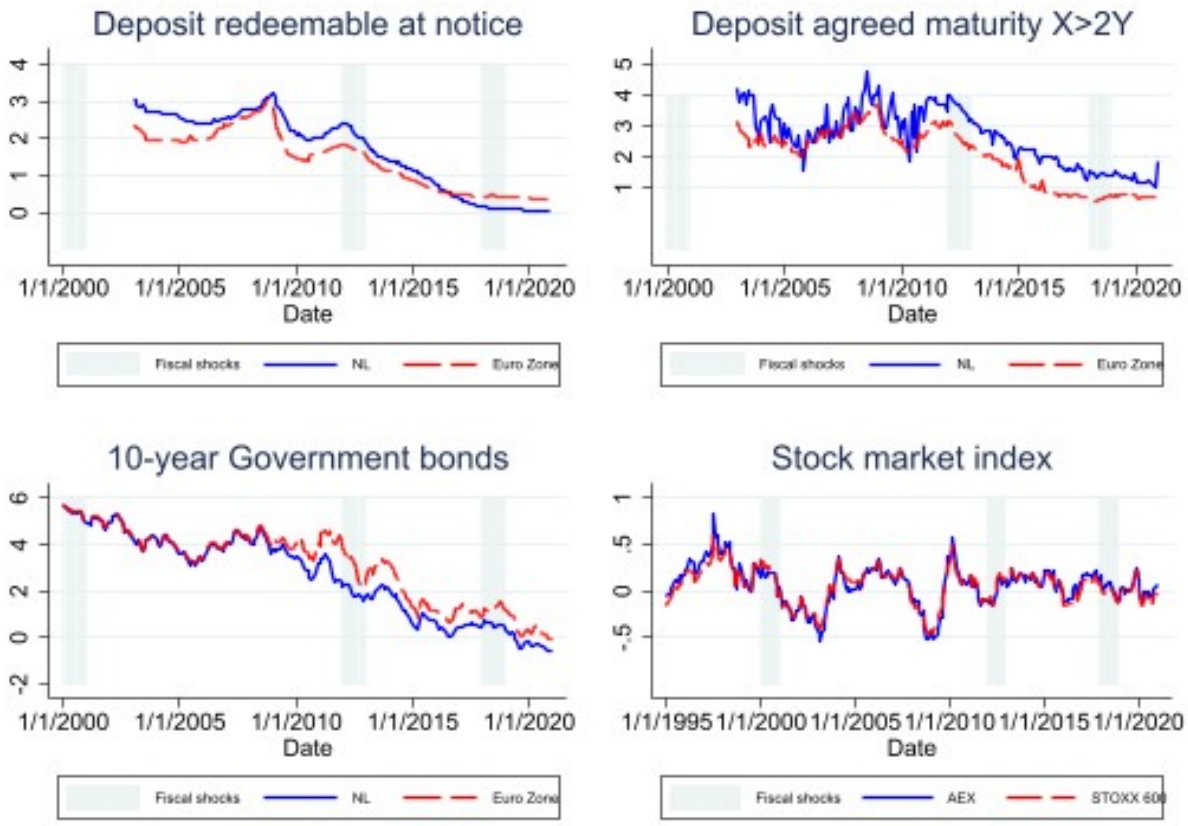
Notes: This Figure depicts demeaned inflation expectations by age groups in the Netherlands. Four-quarter moving averages of one-year inflation expectations of young individuals (below 40), mid-aged individuals (between 40 and 60), and old individuals (above 60) are shown as deviations from the cross-sectional mean expectation. The sample period is 1995-2020.

Figure 6: Government Budget and VAT Rate



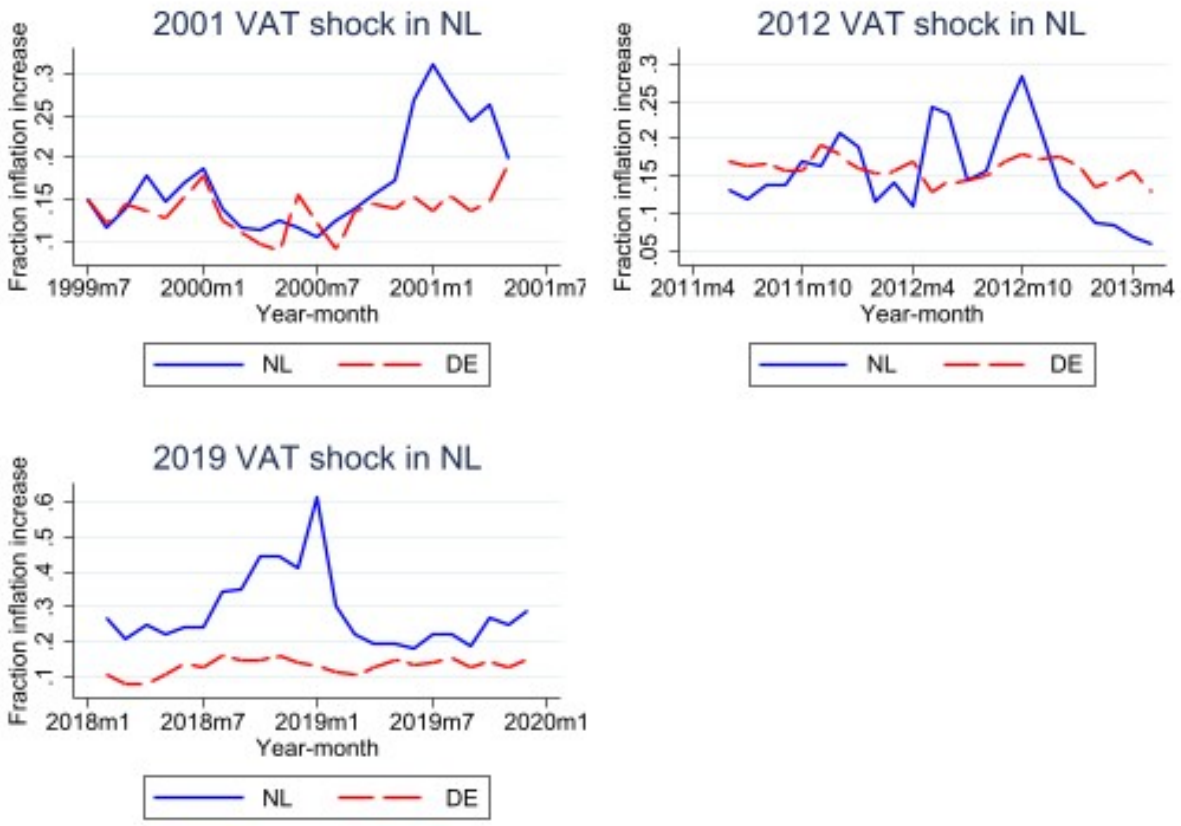
Notes: This Figure depicts the relationship between VAT and government budget over gross GDP. Negative budget means deficits. The data source is Statistics Netherlands (CBS). The sample period is 1995-2020.

Figure 7: Investment Opportunities Around the Shocks



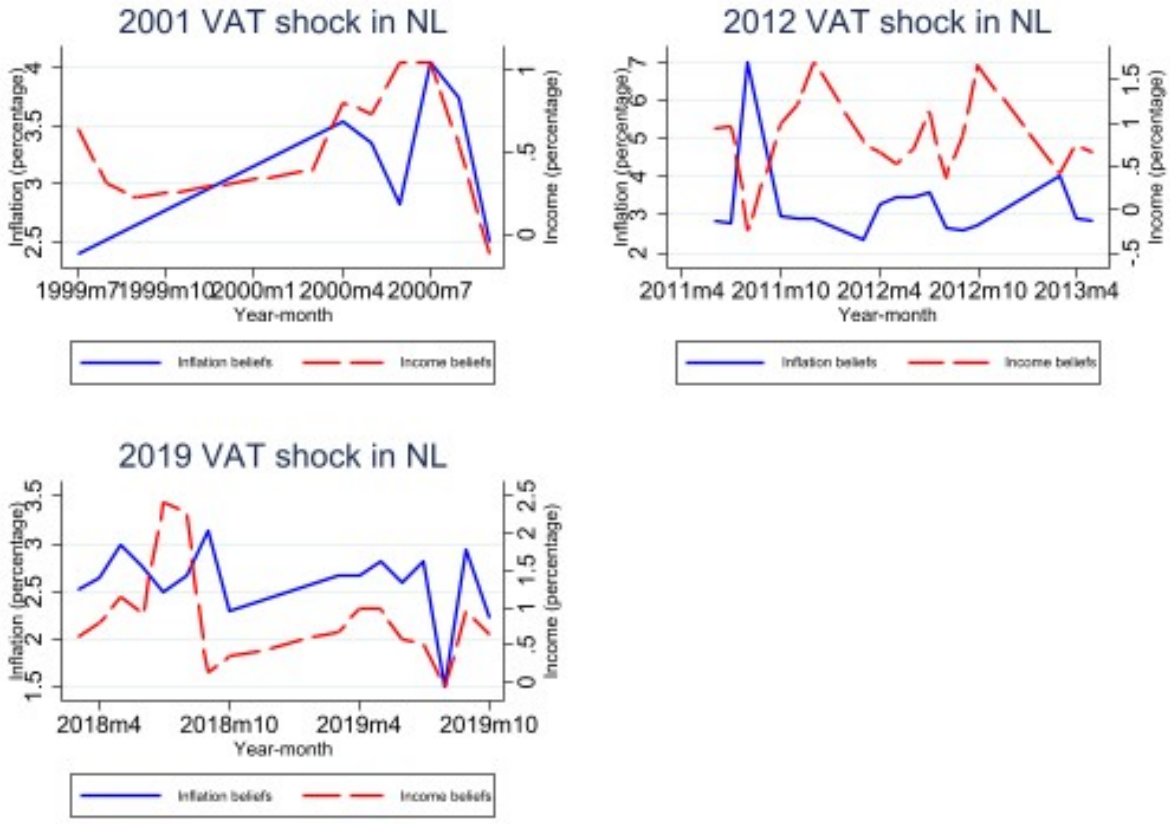
Notes: This Figure depicts the return of financial assets around VAT rate shocks. The financial assets include deposits, bonds and stocks. The data source is Statistics Netherlands (CBS). The sample period is 1995-2020.

Figure 8: Expected Increase in Inflation: Netherlands and Euro Zone Countries



Notes: This Figure depicts the monthly expected increase in inflation around three VAT shocks in the Netherlands. The treatment group is Dutch households and the control group is German households.

Figure 9: Channels: Income Effect



Notes: This Figure depicts the monthly inflation expectations and income expectations around three VAT shocks in the Netherlands.

Table 1: Household Balance Sheet

	Level 3	Level 2	Level 1	Level 0
Asset.1	Checking account with positive balance	Checking and saving accounts	Safe financial assets	Total Financial assets
Asset.2	Saving/Deposit account	Checking and saving accounts	Safe financial assets	Total Financial assets
Asset.3	Bank certificates and Deposit books	Checking and saving accounts	Safe financial assets	Total Financial assets
Asset.4	Saving certificates	Checking and saving accounts	Safe financial assets	Total Financial assets
Asset.5	Single premium annuity insurance	Cash value of Insurance	Safe financial assets	Total Financial assets
Asset.6	Saving/endowment insurance	Cash value of Insurance	Safe financial assets	Total Financial assets
Asset.7	Life cycle saving plan	Cash value of Insurance	Safe financial assets	Total Financial assets
Asset.8	Mortgage related life insurance	Cash value of Insurance	Safe financial assets	Total Financial assets
Asset.9	Cash at home	Cash at home	Safe financial assets	Total Financial assets
Asset.10	Growth funds	Funds	Risky financial assets	Total Financial assets
Asset.11	Mutual Funds	Funds	Risky financial assets	Total Financial assets
Asset.12	Bonds	Bonds	Risky financial assets	Total Financial assets
Asset.13	Shares	Stocks	Risky financial assets	Total Financial assets
Asset.14	Crypto currency	Cryptos	Risky financial assets	Total Financial assets
Asset.15	Options	Options	Risky financial assets	Total Financial assets
Asset.16	Stocks from substantial holdings	Business equity	Non-financial assets	Total Non-financial assets
Asset.17	Business partnership	Business equity	Non-financial assets	Total Non-financial assets
Asset.18	Business self-employed	Business equity	Non-financial assets	Total Non-financial assets
Asset.19	Cars	Durables	Non-financial assets	Total Non-financial assets
Asset.20	Motorbikes	Durables	Non-financial assets	Total Non-financial assets
Asset.21	Boats	Durables	Non-financial assets	Total Non-financial assets
Asset.22	Caravans	Durables	Non-financial assets	Total Non-financial assets
Asset.23	Lending out	Other nonfinancial assets	Non-financial assets	Total Non-financial assets
Asset.24	Saving/Investment not mentioned	Other nonfinancial assets	Non-financial assets	Total Non-financial assets
Asset.25	Real estate: primary residence	Residence	Real estate assets	Total Non-financial assets
Asset.26	Real estate: second residence	Houses	Real estate assets	Total Non-financial assets
Asset.27	Real estate: not residence (other houses)	Houses	Real estate assets	Total Non-financial assets
Asset.28	Employer-sponsored savings plans	Mixed	Mixed	Mixed
Liability.1	Private loans	Consumer credits	Non-mortgage liabilities	Total liability
Liability.2	Extended credit lines	Consumer credits	Non-mortgage liabilities	Total liability
Liability.3	Credit card debts	Consumer credits	Non-mortgage liabilities	Total liability
Liability.4	Finance debts (Hire Purchase)	Consumer credits	Non-mortgage liabilities	Total liability
Liability.5	Other outstanding debts	Other Liabilities	Non-mortgage liabilities	Total liability
Liability.6	Loans from families/friends	Other Liabilities	Non-mortgage liabilities	Total liability
Liability.7	Study Loans	Study loan	Non-mortgage liabilities	Total liability
Liability.8	Other Loans	Other Liabilities	Non-mortgage liabilities	Total liability
Liability.9	Checking account with negative account	Consumer credits	Non-mortgage liabilities	Total liability
Liability.10	Mortgage: primary residence	Mortgages	Mortgages	Total liability
Liability.11	Mortgage: the 2nd residence	Mortgages	Mortgages	Total liability
Liability.12	Mortgage: houses	Mortgages	Mortgages	Total liability

Notes: This Table reports the categories of the household balance sheet. The sample period is 1995-2020.

Table 2: Descriptive Statistics

Variable	N	Mean	Min	p5	p25	p50	p75	p95	Max	SD
Panel A: Social economic variables										
Inflation expectations	42513	2.82	-1	0	2	2	3.05	6	30.35	2.06
Income expectations	36251	0.04	-0.96	-0.96	-0.51	-0.10	0.25	2.70	2.85	0.91
Financial literacy	42276	0.25	0	0	0	0	1	1	1	0.43
Risk aversion	37530	4.97	1	1	4	5	6	7	7	1.85
Panel B: Household demographics										
age	46344	50.092	16	22	37	50	63	77	95	16.60
sex	46343	0.532	0	0	0	1	1	1	1	0.50
The number of member	46343	2.560	1	1	2	2	4	5	9	1.32
The number of kids	46340	0.771	0	0	0	0	2	3	7	1.11
Marriage	46343	0.756	0	0	1	1	1	1	1	0.43
Own property	46345	0.434	0	0	0	0	1	1	1	0.50
Rental	46345	0.275	0	0	0	0	1	1	1	0.45
Urbanlization	45014	2.945	1	1	2	3	4	5	5	1.33
No education	46345	0.063	0	0	0	0	0	1	1	0.24
Special education	46345	0.016	0	0	0	0	0	0	1	0.13
Primary education	46345	0.098	0	0	0	0	0	1	1	0.30
Pre-vocational education	46345	0.255	0	0	0	0	1	1	1	0.44
Pre-college education	46345	0.300	0	0	0	0	1	1	1	0.46
Senior vocational education	46345	0.147	0	0	0	0	0	1	1	0.35
Vocational college education	46345	0.171	0	0	0	0	0	1	1	0.38
University education	46345	0.121	0	0	0	0	0	1	1	0.33
Employed on a contractual basis	46345	0.722	0	0	0	1	1	1	1	0.45
Self employment	46345	0.037	0	0	0	0	0	0	1	0.19
Unemployment	46345	0.023	0	0	0	0	0	0	1	0.15
Retirement	46345	0.288	0	0	0	0	1	1	1	0.45
Disabled	46345	0.042	0	0	0	0	0	0	1	0.20
Net income	37419	20524.980	-6435	0	8176	18874	28502	48485	1158915	20055.59
Networth	46345	202897.3	-1480882	-1897.19	3076	22715	135821.9	466800	101000000	3069052

Notes: This Table reports the descriptive statistics of household members. Panel A reports household's psychological situations and Panel B reports demographic variables. The sample period is 1995-2020.

Table 3: Summary Statistics of Household Portfolio

Variable	N	Mean	Min	p5	p25	p50	p75	p95	Max	SD
Panel A: Market participation										
Stock market participation	46336	0.09	0	0	0	0	0	1	1	0.29
Mutual fund market participation	46336	0.13	0	0	0	0	0	1	1	0.34
Equity market participation	46336	0.18	0	0	0	0	0	1	1	0.39
Risky asset participation	46336	0.20	0	0	0	0	0	1	1	0.40
Safe asset participation	46336	0.95	0	1	1	1	1	1	1	0.21
Panel B: Asset holding										
Stock holding	46334	2520.40	0	0	0	0	0.00	5000.00	1298265	23617.45
Mutual fund holding	46334	4055.25	0	0	0	0	0.00	15882.31	1300000	27318.73
Equity holding	46336	6575.48	0	0	0	0	0.00	26378.00	2300000	39823.47
Risky asset holding	46336	8054.39	0	0	0	0	0.00	33478.00	3050000	46933.29
Safe asset holding	46336	114783.00	-9	0	907.56	4795.00	20499	92000.00	101000000	3054840
Panel C: The number of equities a household member holds		1	2	3	4	5	6	8	10	>10
Percentage of inidviduals hold stocks		43.68	14.84	10.93	9.15	6.10	3.79	1.84	2.11	3.64
Percentage of inidviduals hold mutual funds		57.60	20.07	8.21	4.44	4.21	1.56	0.63	0.39	1.78

Notes: This table reports the summary statistics of household portfolio. Panel A includes variables for market participation and Panel B for the value of investment. The sample period is 1995-2020.

Table 4: Baseline Models

VARIABLES	Participation	Participation	Participation	Participation	Amount	Amount	Amount	Amount
Inflation Expectations	0.331***	0.246*	0.278**	0.343**	2.548***	2.202*	2.381**	3.513**
	(0.113)	(0.138)	(0.117)	(0.156)	(0.983)	(1.232)	(1.037)	(1.462)
Demographics	NO	YES	YES	YES	NO	YES	YES	YES
Education	NO	NO	NO	YES	NO	NO	NO	YES
Age group	NO	YES	YES	YES	NO	YES	YES	YES
Employment	NO	YES	YES	YES	NO	YES	YES	YES
Urbanization	NO	YES	NO	YES	NO	YES	NO	YES
Housing	NO	NO	YES	YES	NO	NO	YES	YES
Income	NO	YES	NO	YES	NO	YES	NO	YES
Networth	NO	NO	YES	YES	NO	NO	YES	YES
Credit Constraints	NO	NO	NO	YES	NO	NO	NO	YES
Financial Literacy	NO	NO	YES	YES	NO	NO	YES	YES
Risk Aversion	NO	NO	NO	YES	NO	NO	NO	YES
Observations	26,201	20,110	24,966	17,630	26,201	20,110	24,966	17,630
R-squared	0.760	0.760	0.767	0.767	0.780	0.780	0.784	0.786
Household member FE	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	Member	Member	Member	Member	Member	Member	Member	Member
Controls	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES

Notes: This Table reports the baseline models. The dependent variable is equity market participation (columns 2-5) and the value of equity market investment (columns 6-9). The independent variable is inflation expectations. The selection of control variables follows Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011) since both papers also use DNB Household Survey. I refer them as VW(2019) and RLA(2011). The last column implement all controls. The sample period is 1995-2020. Standard errors are clustered at the household member level. *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.

Table 5: The First Stage of 2SLS

VARIABLES	Inflation Expectations	Inflation Expectations	Inflation Expectations	Inflation Expectations
Experience effect	0.965***	0.929***	0.949***	0.894***
	(0.0315)	(0.0343)	(0.0347)	(0.0353)
Demographics	NO	YES	YES	YES
Education	NO	NO	NO	YES
Age group	NO	YES	YES	YES
Employment	NO	YES	YES	YES
Urbanization	NO	YES	NO	YES
Housing	NO	NO	YES	YES
Income	NO	YES	NO	YES
Net-worth	NO	NO	YES	YES
Credit Constraints	NO	NO	NO	YES
Financial Literacy	NO	NO	YES	YES
Risk Aversion	NO	NO	NO	YES
Observations	38,478	29,407	36,400	25,397
R-squared	0.498	0.510	0.504	0.512
Household member FE	YES	YES	YES	YES
F test	940.53	48.23	48.68	45.12
Cluster	Household member	Household member	Household member	Household member
Controls	NO	VW (2019)	RLA (2011)	YES

Notes: This Table reports the first stage of 2SLS. The dependent variable is inflation expectations and independent variable is inflation experience derived based on Malmedier and Nagel (2016). The selection of control variables follows Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011) since both papers also use DNB Household Survey. I refer them as VW(2019) and RLA(2011). The last column implement all controls. The sample period is 1995-2020. Standard errors are clustered at the household member level. *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.

Table 6: Inflation Expectations and Equity Market Participation

VARIABLE	Participation	Participation	Participation	Participation	Amount	Amount	Amount	Amount	Entry	Entry	Entry	Entry
Panel A: Equity												
Inflation Expectations	2.829***	2.284***	2.385***	3.116***	24.71***	23.30***	23.62***	31.07***	0.016	0.364	0.464	0.659
	(0.709)	(0.866)	(0.759)	(0.964)	(6.237)	(7.630)	(6.867)	(8.728)	(0.446)	(0.573)	(0.546)	(0.698)
Controls	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES
Observations	26,165	20,076	24,952	17,622	26,165	20,076	24,952	17,622	20,296	15,004	19,363	12,978
Household member FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member
Panel B: fund												
Inflation Expectations	2.359***	1.520*	1.924**	2.252**	18.75***	14.02*	16.08**	19.90**	0.412	0.0480	0.888*	0.950
	(0.673)	(0.798)	(0.751)	(0.982)	(6.135)	(7.337)	(6.965)	(9.166)	(0.447)	(0.556)	(0.530)	(0.614)
Controls	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES
Observations	26,165	20,076	24,952	17,622	26,165	20,076	24,952	17,622	21,753	16,280	20,756	14,131
Household member FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member
Panel C: stock												
Inflation Expectations	2.785***	2.642***	2.906***	3.678***	24.21***	24.71***	26.20***	32.83***	-0.0213	0.102	0.239	0.581*
	(0.562)	(0.643)	(0.597)	(0.785)	(4.600)	(5.329)	(5.041)	(6.666)	(0.172)	(0.238)	(0.237)	(0.338)
Controls	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES
Observations	26,165	20,076	24,952	17,622	26,165	20,076	24,952	17,622	23,257	17,580	22,170	15,330
Household member FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member

Notes: This Table reports the second stage of 2SLS. The dependent variable is equity/stock/mutual fund market participation, and whether a household enters equity market or not. The independent variable is inflation expectations. The selection of control variables follows Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011) since both papers also use DNB Household Survey. I refer them as VW(2019) and RLA(2011). The last column implement all controls. The sample period is 1995-2020. Standard errors are clustered at the household member level. *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.

Table 7: Inflation Expectations and Risky Assets Allocation

VARIABLE	Net Purchase	Net Purchase	Net Purchase	Net Purchase	Asset/Income	Asset/Income	Asset/Income	Asset/Income	Asset/Liquidty	Asset/Liquidty	Asset/Liquidty	Asset/Liquidty
Panel A: Equity												
Inflation Expectations	14.59***	9.830	14.30**	18.39***	9.956	9.004	16.65*	12.92**	9.892**	6.597*	8.869**	6.097*
	(5.054)	(6.133)	(5.704)	(6.949)	(7.939)	(7.492)	(9.259)	(6.286)	(4.831)	(3.937)	(4.365)	(3.407)
Controls	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES
Observations	23,631	17,892	22,555	15,655	20,013	19,572	19,061	17,301	26,165	20,076	24,952	17,622
Household member FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member
Panel B: fund												
Inflation Expectations	9.768**	7.187	10.10*	16.05**	2.562	2.194	3.760	1.489	5.017	5.174	4.821	3.851
	(4.848)	(5.852)	(5.495)	(6.845)	(5.264)	(3.042)	(6.458)	(3.302)	(3.456)	(3.144)	(3.170)	(2.548)
Controls	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES
Observations	24,204	18,380	23,099	16,087	20,013	19,572	19,061	17,301	26,165	20,076	24,952	17,622
Household member FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member
Panel C: stock												
Inflation Expectations	5.943**	4.298	4.884	6.440	7.394	6.810	12.89**	11.43*	4.832	1.423	4.035*	2.246
	(2.842)	(3.592)	(3.304)	(4.007)	(5.450)	(7.039)	(6.365)	(6.589)	(2.935)	(1.862)	(2.353)	(1.571)
Controls	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES	NO	VW (2019)	RLA (2011)	YES
Observations	24,929	19,023	23,776	16,663	20,013	19,572	19,061	17,301	26,165	20,076	24,952	17,622
Household member FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member	Member

Notes: This Table reports the second stage of 2SLS. The dependent variable is net equity purchase, equity to income ratio, and equity to net financial assets ratio. The independent variable is the inflation expectations. The selection of control variables follows Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011) since both papers also use DNB Household Survey. I refer them as VW(2019) and RLA(2011). The last column implement all controls. The sample period is 1995-2020. Standard errors are clustered at the household member level. *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.

Table 8: Inflation Expectations and Portfolio Performance

Panel A: Holding Period Return				
Inflation Expectations	0.615***	0.656***	0.0767	0.479***
	(0.158)	(0.141)	(0.191)	(0.154)
Controls	NO	VW (2019)	RLA (2011)	YES
Observations	3,761	3,334	3,569	3,066
Household member FE	YES	YES	YES	YES
Cluster	Member	Member	Member	Member
Panel B: Market β				
Inflation Expectations	3.660***	3.383**	2.807	2.390**
	(1.378)	(1.586)	(1.972)	(1.080)
Controls	NO	VW (2019)	RLA (2011)	YES
Observations	3,761	3,334	3,569	3,066
Household member FE	YES	YES	YES	YES
Cluster	Member	Member	Member	Member
Panel C: Sharpe Ratio				
Inflation Expectations	-2.977	2.404	0.695	3.425
	(4.353)	(2.629)	(2.788)	(5.321)
Controls	NO	VW (2019)	RLA (2011)	YES
Observations	3,761	3,334	3,569	3,066
Household member FE	YES	YES	YES	YES
Cluster	Member	Member	Member	Member

Notes: This Table reports the second stage of 2SLS. The dependent variable is holding period return (HPR), market β derived by CAPM, and Sharpe ratio. The independent variable is inflation expectations. The selection of control variables follows Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011) since both papers also use DNB Household Survey. I refer them as VW(2019) and RLA(2011). The last column implement all controls. The sample period is 1995-2020. Standard errors are clustered at the household member level. *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.

Table 9: Inflation Expectations and Portfolio Optimization

Panel A: Diversification Loss				
Inflation Expectations	-39.17	-44.16*	-49.37	-36.83*
	(26.57)	(27.23)	(32.11)	(20.26)
Controls	NO	VW (2019)	RLA (2011)	YES
Observations	3,761	3,334	3,569	3,066
Household member FE	YES	YES	YES	YES
Cluster	Member	Member	Member	Member
Panel A: Return Loss				
Inflation Expectations	-5.592	-5.969	-6.959	-3.949*
	(5.428)	(5.467)	(6.386)	(2.147)
Controls	NO	VW (2019)	RLA (2011)	YES
Observations	3,761	3,334	3,569	3,066
Household member FE	YES	YES	YES	YES
Cluster	Member	Member	Member	Member

Notes: This Table reports the second stage of 2SLS. The dependent variable is diversification loss and return loss, and the independent variable is inflation expectations. The selection of control variables follows Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011) since both papers also use DNB Household Survey. I refer them as VW(2019) and RLA(2011). The last column implement all controls. The sample period is 1995-2020. Standard errors are clustered at the household member level. *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.

Table 10: Heterogeneity: the Role of Horizon

VARIABLE	Participation	Amount	Net Asset Purchase	Asset/income
Inflation Expectations (life expectancy <15)	3.432	26.66	-20.56	2.936
	(2.958)	(29.10)	(23.83)	(2.280)
Inflation Expectations (life expectancy >15)	3.050***	24.69***	12.96**	1.630***
	(0.923)	(8.016)	(6.508)	(0.590)
Controls	YES	YES	YES	YES
Household member FE	YES	YES	YES	YES
Cluster	Member	Member	Member	Member

Notes: This Table reports the second stage of 2SLS. The dependent variable is equity market participation, the value of equity, net equity purchase, and equity to income ratio. The independent variable is inflation expectations. The sample is divided into two sub-sample according to whether the life expectancy of a household is more than 15 years or not. Thus, there are two separated regressions in each column. The control variables include all controls from Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011). The coefficients represent the sub-sample used in the estimation. The sample period is 1995-2020. Standard errors are clustered at the household member level. *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.

Table 11: Heterogeneity: the Role of Financial Literacy

VARIABLE	Participation	Amount	Net Asset Purchase	Asset/income
Inflation Expectations* financial literacy	6.360***	56.76***	16.47	2.966***
	(1.610)	(13.73)	(11.42)	(0.975)
Inflation Expectations	0.0153	0.113	-0.0131	0.00717
	(0.0131)	(0.116)	(0.0957)	(0.00797)
Controls	YES	YES	YES	YES
Household member FE	YES	YES	YES	YES
Cluster	Member	Member	Member	Member

Notes: This Table reports the second stage of 2SLS. The dependent variable is equity market participation, the value of equity, net equity purchase, and equity to income ratio. The independent variable is inflation expectations, financial literacy, and the interactions. The control variables include all controls from Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011). The sample period is 2005-2006. Standard errors are clustered at the household member level. *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.

Table 12: Heterogeneity: the Role of Income

VARIABLE	Participation	Amount	Net Asset Purchase	Asset/income
Inflation Expectations (high income)	4.692***	42.91***	12.67	49.12
	(1.719)	(13.97)	(8.435)	(41.63)
Inflation Expectations (middle income)	2.508	25.64*	7.909	10.54**
	(1.779)	(14.35)	(9.855)	(5.053)
Inflation Expectations (low income)	2.275	16.77	4.231	-5.669
	(1.614)	(15.49)	(14.70)	(4.807)
Controls	YES	YES	YES	YES
Household member FE	YES	YES	YES	YES
Cluster	Member	Member	Member	Member

Notes: This Table reports the second stage of 2SLS. The dependent variable is equity market participation, the value of equity, net equity purchase, and equity to income ratio. The independent variable is inflation expectations. The sample is divided into three groups based on net income. Thus, there are two separated regressions in each column. The control variables include all controls from Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011). The sample period is 1995-2020. Standard errors are clustered at the household member level. *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.

Table 13: Heterogeneity: the Role of Gender

VARIABLE	Participation	Amount	Net Asset Purchase	Asset/income
Inflation Expectations (Male)	2.256*	20.10*	1.449	9.967
	(1.180)	(10.85)	(8.647)	(7.087)
Inflation Expectations (Female)	4.292***	39.12***	27.98**	20.78
	(1.631)	(13.37)	(11.01)	(12.96)
Controls	YES	YES	YES	YES
Household member FE	YES	YES	YES	YES
Cluster	Member	Member	Member	Member

Notes: This Table reports the second stage of 2SLS. The dependent variable is equity market participation, the value of equity, net equity purchase, and equity to income ratio. The independent variable is inflation expectations. The sample is divided into two group based on whether a household member is female or male. Thus, there are two separated regressions in each column. The control variables include all controls from Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011). The sample period is 1995-2020. Standard errors are clustered at the household member level. *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.

Table 14: Channels: Income Expectations Effect

Panel A: Equity market participation	Participation	Amount	Net Asset Purchase	Asset/income
Inflation Expectations (Income Expectations>=0)	5.098**	51.18***	6.957	10.96
	(1.995)	(18.04)	(7.794)	(14.71)
Inflation Expectations (Income Expectations<0)	2.352**	18.75**	0.295	7.775
	(0.999)	(8.885)	(14.74)	(5.947)
Controls	YES	YES	YES	YES
Household member FE	YES	YES	YES	YES
Cluster	Member	Member	Member	Member

Notes: This Table reports the second stage of 2SLS. The dependent variable is equity market participation, the value of equity, net equity purchase, and equity to income ratio. The independent variable is inflation expectations. The sample is divided into two group based on income expectations. Thus, there are two separated regressions in each column. The control variables include all controls from Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011). The sample period is 1995-2020. Standard errors are clustered at the household member level. *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.

Table 15: Channels: Nominal Saving Effect

Panel A	Liquid Asset	Liquid Asset	Liquid Asset	Liquid Asset
Inflation Expectations* Equity Market Investment	-0.00222	0.212	0.141	0.319
	(0.204)	(0.217)	(0.211)	(0.235)
Inflation Expectations	0.0377	0.569	0.603	0.689
	(1.030)	(1.112)	(1.064)	(1.214)
Equity Market Investment	0.0813***	0.0786***	0.0830***	0.0742***
	(0.0114)	(0.0117)	(0.0113)	(0.0125)
Controls	NO	VW (2019)	RLA (2011)	YES
Household member FE	YES	YES	YES	YES
Cluster	Member	Member	Member	Member
Panel B	**Liquid Networth**	**Liquid Networth**	**Liquid Networth**	**Liquid Networth**
Inflation Expectations* Equity Market Investment	0.182	0.357*	0.329	0.465**
	(0.200)	(0.211)	(0.208)	(0.231)
Inflation Expectations	-1.799*	-1.191	-1.193	-2.743**
	(0.990)	(1.048)	(1.024)	(1.172)
Equity Market Investment	0.0648***	0.0638***	0.0640***	0.0580***
	(0.0113)	(0.0119)	(0.0114)	(0.0127)
Controls	NO	VW (2019)	RLA (2011)	YES
Household member FE	YES	YES	YES	YES
Cluster	Member	Member	Member	Member

Notes: This Table reports the second stage of 2SLS. The dependent variable is liquid asset (in Panel A) and liquid wealth (in Panel B). The independent variable is inflation expectations, equity market investment, and their interaction. The selection of control variables follows Vellekoop and Wiederholt (2019), and van Rooij, Lusardi, and Alessie (2011) since both papers also use DNB Household Survey. I refer them as VW(2019) and RLA(2011). The last column implement all controls. The sample period is 1995-2020. Standard errors are clustered at the household member level. *, **, *** represent statistical significance at 10%, 5%, and 1%, respectively.