



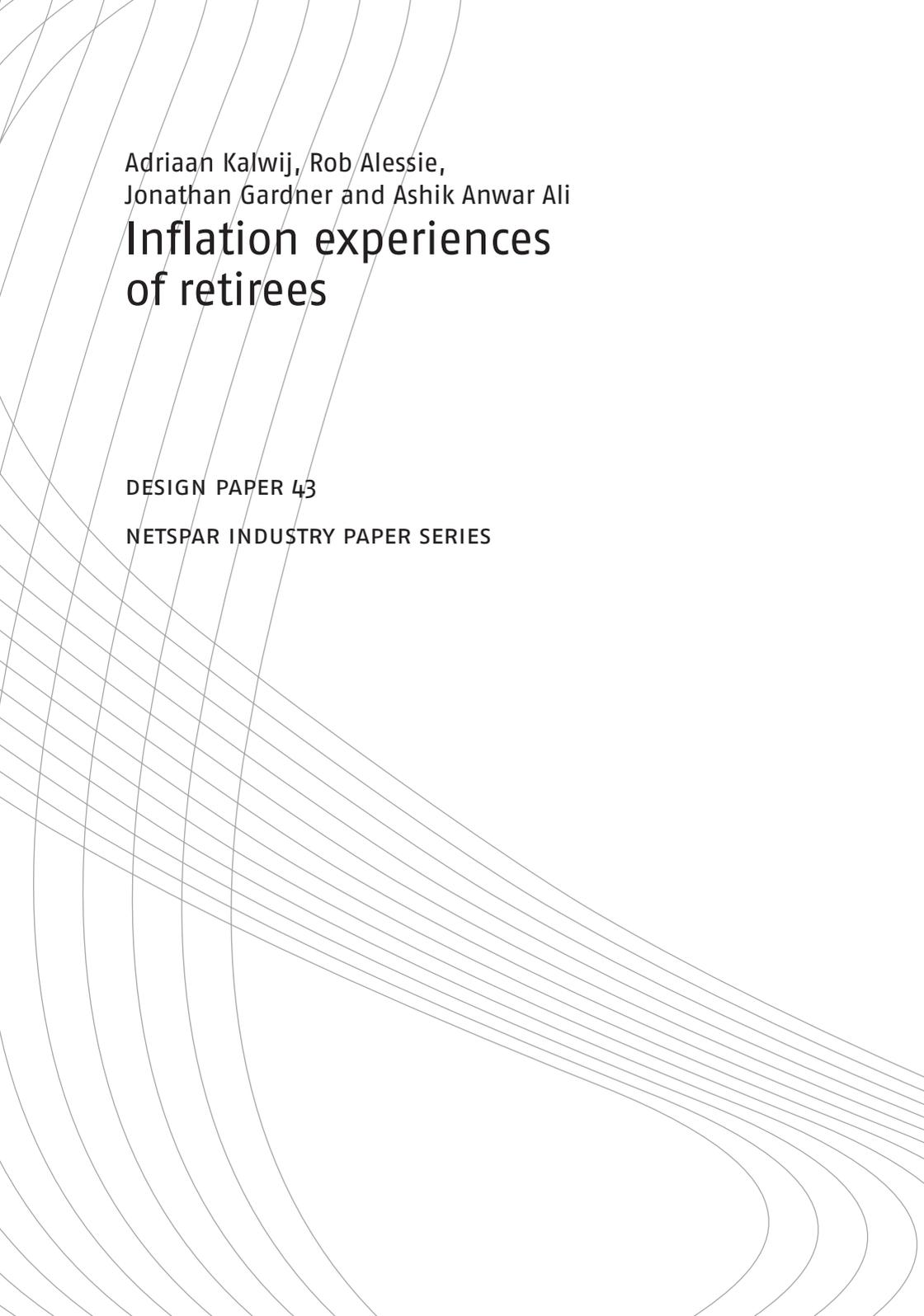
Network for Studies on Pensions, Aging and Retirement

Inflation experiences of retirees

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DESIGN PAPER 43

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INFLATION EXPERIENCES OF RETIREES

Samenvatting (Summary in Dutch)

Indexatie van pensioenen heeft de afgelopen jaren niet altijd plaatsgevonden vanwege de verslechterde financiële situaties bij pensioenfondsen. In dit project onderzoeken we voor de jaren 1978–2012 welke groepen gepensioneerden relatief hoge inflatie ondervonden en het meest kwetsbaar zijn als gevolg van het uitblijven van prijsindexatie.

De inflatie die gepensioneerden ondervonden hangt af van hun bestedingspatronen en de prijsveranderingen van de verschillende bestedingscategorieën. Een relatief hoge inflatie is het resultaat van een combinatie van relatief meer bestedingen aan goederen met een sterke prijsstijging (zoals woninghuur) en relatief minder bestedingen aan goederen met een geringe prijsstijging (zoals vakanties). Onze resultaten laten zien dat voor de jaren 1978–2012 de ondervonden inflatie van gehuwde gepensioneerden ongeveer gelijk was aan die van een gemiddeld huishouden. Alleenstaande gepensioneerden ondervonden ongeveer 0,14 procent punt hogere jaarlijkse inflatie dan gehuwde gepensioneerden en gepensioneerden met alleen een AOW-inkomen ondervonden ongeveer 0,18 procentpunt hogere jaarlijkse inflatie dan de rijkste gepensioneerden. De relatief hoge inflatie van gepensioneerden voor wie het inkomen voornamelijk uit AOW bestaat, leidt vanwege het uitblijven van prijsindexatie niet tot een kwetsbare situatie. Dat komt doordat deze groep geen of weinig aanvullend pensioen heeft opgebouwd en de AOW gekoppeld is aan de loonontwikkeling.

De gevonden verschillen in inflatie tussen groepen huishoudens zijn statistisch significant, maar klein ten opzichte van een gemiddelde jaarlijkse inflatie van 2,4 procent. Hoewel het uitblijven van prijsindexatie de koopkracht van gepensioneerden met een aanvullend pensioen zal hebben doen dalen, suggereren onze bevindingen dat het toepassen van dezelfde mate van indexatie (binnen een pensioenfonds) op zichzelf niet leidt tot substantiële en persistente verschillen in de koopkrachtontwikkeling tussen groepen huishoudens.

Summary

Pension entitlements have not been fully indexed in nominal terms in recent years in the Netherlands (in some case, they have even been reduced) due to low funding ratios at the pension funds. This has urged policymakers to make structural reforms, including a new pension law with a regulatory framework that includes conditions under which wage or price indexation of pension entitlements can occur. The inflation people experience depends on their expenditure patterns and price developments. This paper aims to identify groups of people that have experienced relatively high price inflation over the last few decades and could thus be considered most vulnerable when indexation does not take place. Our findings are based on a study of household budget survey data from 1978 to 2004, supplemented with price information from 1978 to 2012.

We found that retired couples age 65–69 have experienced about average inflation (population-averaged) over the past few decades and that inflation experience is significantly higher for single people, increases significantly with age and decreases significantly with the level of total expenditures. These differences in inflation experiences between households result from rela-

tive price increases in goods, such as rent and utilities, on which single, low-income and older people spend relatively more of their budget, and relative price decreases in goods, such as leisure activities (including vacations), on which these groups spend relatively less of their budget than the average household.

The difference in inflation experience is about 0.14 percentage points between single and married retirees, 0.06 percentage points between retired couples in the age groups 65–69 and 75–79 and 0.18 percentage points between retirees with only a public pension income and high-income retirees. Although these differences are statistically significant, they could be considered too small to be of economic significance compared to an average household experiencing 2.4 percent annual inflation. Moreover, for low-income retirees, indexation of pensions is less of an issue because most of their income is public pension income, which is indexed to wages. While all retirees whose pensions have not been fully indexed in recent years will have experienced a reduction in purchasing power, our findings suggest that using the same degree of indexation (within a pension fund) does not per se induce substantial or persistent differences in purchasing power between retirees of different ages, household compositions and levels of total expenditures.

1. Introduction

The overarching question we try to answer in this paper is whether all households experience the same price inflation, by and large. More particularly, we consider this in the context of the price indexation of pensions that is meant to compensate retirees for a loss in the purchasing power of their pensions due to inflation. If, for instance, some groups of retirees experience different levels of inflation than the average person, a price indexation scheme that uses the same degree of indexation across the board will end up making retirees who experience relatively high inflation worse off and retirees who experience relatively low inflation better off than others. In addition, our findings provide insights for policymakers into whether group-specific inflation rates are needed when assessing the impact of reforms on purchasing power.

We attempt to answer the above question by examining differences between groups of households in terms of their experienced inflation during the period from 1978 to 2012 in the Netherlands. Based on our findings, we identified the groups of retirees that are most vulnerable when pension benefits are not fully price indexed. An often necessary assumption made when calculating price inflation is the common price assumption, which is that all consumers face the same prices for sets of goods. One consequence of this assumption is that, given a set of prices (or price indices), differences in inflation experiences between households based on composite goods are solely determined by differences in their relative expenditures on those goods. We used data from the national Dutch Budget Surveys from 1978 to 2004 to analyze how relative expenditures on goods differed according to household characteristics and, by combining that informa-

tion with price information for the years 1978 to 2012 provided by Statistics Netherlands, were able to compute inflation experiences for different types of households based on household composition, age and level of total expenditures. Our main findings show that there are no substantial or persistent differences in inflation experiences between retirees of different ages, household compositions and levels of total expenditures. This suggests that there are no differences between these groups in terms of the changes in the purchasing power of their pensions when the same degree of indexation is used for all retirees.

Pension contracts in the Netherlands are in nominal terms, and wage or price indexation is only an ambition held by the pension funds. Before the turn of the millennium, wage indexation was taken for granted, because it was almost always in line with the pension funds' indexation ambitions. After the dotcom crash in 2000–2001, however, through 2007, indexation was lower, on average, than the pension funds' ambitions (Bonenkamp and Westerhout 2010), with a partial correction in 2008. Since the financial crisis of 2007–2008, indexation, excluding curtailments,¹ has been about 6.3 percentage points lower, on average, than consumer price inflation and most retirees have experienced a drop in their standard of living (DNB, 2013). In this respect, the Dutch pension system turned out to be much riskier for participants than they may have perceived it before the turn of the millennium.² The recent pension law reforms aim to make indexation ambitions explicit, including the associated risks, and

1 Based on the funding ratios of pension funds at year-end 2012, curtailments were predicted to be about 1 percent, on average, in 2013.

2 In addition, from the turn of the millennium through the 2007–2008 financial crisis, active participants saw their pension premiums almost double, early retirement schemes were abolished and defined benefits were switched from being based on final salary to lifetime average salary (Goudswaard *et al.* 2010).

the regulatory framework stipulates conditions for the degree of indexation (Rijksoverheid 2014).

Wage indexation of pensions or pension entitlements is often determined by wage increases in the employment sector. This means that differences in wage indexation result, in part, from differences in sector wage growth. Price indexation of pensions is commonly based on the official Consumer Price Index (CPI) published by Statistics Netherlands. Little is known, however, about the extent to which people have experienced different price inflation or, related to this, which groups of people are most affected by not having pension benefits price indexed. This question is particularly relevant given that, as mentioned above, the pension funds' indexation ambitions have not always been realized in recent years. One reason retirees and workers might have different inflation experiences is that they have different expenditure patterns (see Banks, Blundell and Tanner 1998 for the U.K.; Börsch-Supan and Stahl 1991 for Germany; Knoef, Hussem, Soede and de Bresser 2014 for the Netherlands; and Miniaci, Monfardini and Weber 2003 for Italy). For instance, retirees in the Netherlands spend relatively less on transportation and clothing and more on rent and utilities than workers. In addition, variations over time in the changing prices for goods produce different inflation experiences for groups of people with different expenditure patterns. If, for instance, there is a relatively large increase in the price of a good that retirees spend relatively more on than people of working age, the former group will experience higher inflation. There are other reasons, as well, for expecting different expenditure patterns across age groups, besides the spending restrictions associated with a potential drop in income upon retirement (De Ree and Alessie 2009). Budget shares are also affected by the role that health plays in spending decisions, which is referred to as

age-restricted consumption by Börsch-Supan and Stahl (1991). As people age, their health deteriorates and their overall expenditures decrease, resulting in an increase in the budget share spent on goods for which demand is inelastic.

Recent empirical studies on the inflation experiences of Dutch and UK households reached opposite conclusions. For the Netherlands, Ali (2014) concluded that for the period from 1978 to 2004, retirees had not experienced significantly different inflation compared to workers. Flower and Wales (2014) showed for the UK, however, that retired households had experienced higher inflation than non-retired households in almost all of the years between 2003 and 2013. They reported a 2.8 percent yearly inflation rate for retired households versus a 2.5 percent inflation rate for non-retired households, on average. The most striking result they presented, which is in line with an earlier UK study by Levell and Oldfield (2011) for the years 2000 through 2010, is the difference in inflation experience between low- and high-income households: for the 2003–2013 period, a household in the lowest total expenditures decile experienced an average yearly inflation of 3.7 percent, while a household in the highest total expenditures decile experienced an average yearly inflation of just 2.3 percent. This latter finding may, of course, be part of the explanation for the higher inflation experienced by retired households, since they may spend relatively less overall (i.e., have less income) than non-retired households, meaning that a relatively higher budget share goes to inelastic goods such as food and energy, which became relatively more expensive during the observation period.

In this paper, we document the inflation experiences of different types of households in the Netherlands, so that these can be compared to the figures presented for the UK in Flower

and Wales (2014). In addition, and this is one way our paper adds value to the existing literature, we use a consumer-demand model to analyze the inflation experiences of different households. This contribution to the literature is particularly important since, as mentioned above, it is the differences in spending patterns that cause heterogeneity in inflation experience. By explicitly taking this into account in a statistical analysis, it becomes possible to disentangle the effects of age, household total expenditures and composition on household inflation experience.

The outline of this paper is as follows. Section 2 discusses the role of indexation in the Dutch pension system. Section 3 presents the data and section 4 a descriptive analysis of households' inflation experiences. Section 5 presents predicted accumulated inflation experiences for the period from 1978 to 2012 for specific types of households, based on marital status, number of children, age and level of total expenditures. Section 6 presents our conclusions.

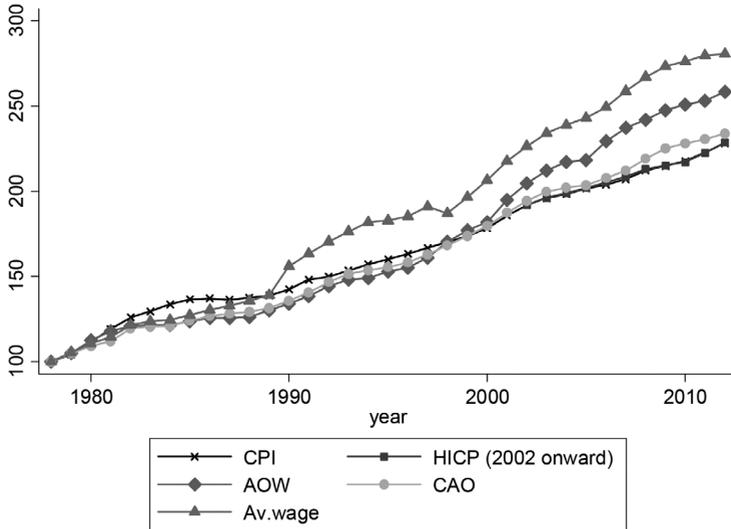
2. Indexation in the Dutch pension system

The Dutch pension system consists of three so-called pillars. The first pillar is the public pension benefit (AOW, like social security), which is independent of past earnings and guarantees every resident a level of income, from the statutory retirement age onward, such that at least basic needs are met.³ Figure 1 shows that from 1978 through the late 1990s, real net public pension benefits decreased (the AOW curve is below the CPI curve). This was a result of the fact that net AOW benefits were linked to the net minimum wage, which had been frozen for some years.⁴ Since the 1990s, public pension benefits have caught up and risen faster than prices, and viewed over the entire period, from 1978 to 2012, people who receive nothing other than public pension benefits have improved their standard of living. Dekker and van Vuuren (2011) concluded that AOW benefits have effectively been wage-indexed from 1957 to 2009. In line with their conclusion and the findings of the Dutch Ministry of Social Affairs and Employment (SZW, 2010), the numbers on which Figure 1 is based imply that from 1978 to 2012 the average yearly increase in contract wages (CAO) was about 2.5 percent, compared to an increase in public pension benefits (AOW) of about 2.7 percent.

The second pillar consists of occupational pension benefits, determined primarily by a person's earnings during their years of participation in an employment-based pension plan. Over

- 3 AOW benefits depend on the number of years of residence in the Netherlands prior to statutory retirement, with full benefits awarded to people who have resided in the Netherlands for 50 years (two percentage points for each year). The AOW benefit is supplemented to a subsistence level for people who have resided in the Netherlands less than 50 years and have no other income.
- 4 The gross minimum wage is, in principle, linked to sector wages (from collective bargaining agreements), but lawmakers have overruled this in years when economic conditions were bad.

Figure 1 Consumer Price Index (CPI), OECD's Harmonized Index of Consumer Prices (HICP), net public pension benefits (AOW), gross contract wage rates in collective agreements (CAO) and average gross wage earnings (Av.wage)



Sources: Statistics Netherlands and Sociale Verzekeringsbank

Note: The jump in average gross wage earnings (*Av. wage*) in 1990 was due to tax reforms.

90 percent of employees have an occupational pension plan.⁵

While the main source of income for most retirees 65 and over is a public pension benefit, occupational pensions form a substantial part of the income of current retirees in the Netherlands and

5 Occupational pension plans are capital funded and mostly based on a defined benefits (as opposed to a defined contributions) system. The employees' pension contributions are taken out of their gross wages, with employers contributing as well. Up to a certain threshold (the so-called *Witteveenkader*), this income (i.e., the contributions) and accumulated pension wealth are not taxed. Taxes are deferred to the retirement years when the pension benefits are taxed.

their importance has grown over time. Knoef, Alessie and Kalwij (2012) reported that in 1989 occupational pensions were the main source of income for about 20 percent of households with a head of household age 65–90 and that by 2007 this percentage had risen to about 30. That percentage is likely to continue to increase due to higher labor force participation among women who are currently of working age compared to women who are retired.

The third pillar consists of personal retirement savings or annuity plans. Knoef *et al.* (2015) showed that for 1989 to 2012, third pillar products accounted for about 3 percent of people's pension entitlements. They also showed that while income from private wealth accounted for about 10 percent of retirees' income, on average, it was mostly concentrated in the top deciles of the income distribution, and the median income from private wealth was, for instance, less than 2 percent of the median income for retirees age 65–69 in 2008.

Indexation in the Netherlands applies primarily to occupational pension benefits for retirees and occupational pension entitlements for workers (the second pillar). Indexation based on the consumer price index (CPI) is used to adjust the occupational pension income of current and future retirees for price inflation, and when tied to changes in average wages, it adjusts for labor productivity growth, as well. Pension funds differ in terms of their ambitions for indexation, with almost every combination of wage and price indexation occurring. A pension fund may, for instance, index the pension benefits of retirees to the CPI and the future entitlements of workers to average sector wages. About 80 percent of workers covered by an occupational pension plan have their entitlements indexed to wages and price indexation is more common for retirees than for workers (Goudswaard *et al.* 2010). In recent years, pension funds have enhanced their funding ratios by

curtailing pension entitlements or not correcting for price inflation as they discovered that their past expectations concerning mortality risk and returns on investments were overly optimistic. At the largest pension fund in the Netherlands, for instance, pensions have not been price-indexed for the past five years; in real terms, that implies a reduction of about 10 percent.

The Dutch Central Bank (DNB) started collecting data on the indexation policies of pension funds in 2008. In 2013, it reported a 1.3 percent indexation for the 2009–2012 period. With an increase in the same period in CPI of about 6 percent (Figure 1, CPI) and in contract wages of about 3.8 percent (Figure 1, CAO), this amounts to an under-indexation of 4.7 percentage points compared to price indexation and 2.5 percentage points compared to wage indexation.⁶ In addition, curtailments were predicted to be about 1 percent, on average, for 2013 (DNB 2013). In other words, pension entitlements have decreased in real terms, and most retirees have experienced a drop in their standard of living in recent years as indexation has fallen below price inflation. Indeed, Vermeulen *et al.* (2015) reported a reduction of 6 percent in the standard of living of people age 65 and over between 2009 and 2013 (compared to 1 percent for workers) and mentioned that this reduction was due in part to pensions not being fully indexed and even curtailed in some cases.

Indexation plays an important role in the recent pension law reforms (Rijksoverheid 2014). Under the new law, pension contracts will continue to be in nominal terms with indexation ambitions. One important difference between the old and new pension law that is pertinent for the purposes of this paper is that the regulatory framework (i.e., the new “Financial Assessment

6 Public pension benefits have increased during this period by about 4.4 percent (Figure 1, AOW).

Framework") stipulates the conditions under which wage or price indexation can take place.⁷ There are specific rules for what the maximum degree of indexation can be in light of prevailing interest rates and the pension fund's funding ratio. Any indexation of the tax benefits associated with pension contributions cannot exceed price or wage inflation. In practice, indexation will be about 1 percent (at most) for each 10–percentage–point increase in the funding ratio above a certain threshold. Below this threshold, no indexation can be granted. In addition, indexation can be further limited if a pension fund's funding ratio has been too low in the past and it is still in a recovery phase.

In the new law, pension funds are allowed to spread financial setbacks and windfalls related to changes in longevity and returns on investments over a longer period of time than is currently the case. It allows the funding ratio to be calculated based on a 10–year (maximum) moving average of the risk–free interest rate, instead of the current interest rate, as is now the case.⁸ These new rules concerning the financial situation of pension funds aim to make individuals' pension entitlements less volatile. They also suggest that there will be years when pension funds will not be able to fully adjust entitlements for wage or price inflation. Shu, Melenberg and Schumacher (2014) modeled the strictness of the new regulatory framework in a simulation–based study, and their findings suggest that under the new Financial Assessment Framework, fully wage–indexed pensions for both workers and retirees can be achieved in only about 60% of the economic scenarios over a 50–year period.

7 The main condition concerns the funding ratio of a pension fund. We refer to Shu, Melenberg and Schumacher (2014 working paper) for an overview of the new Financial Assessment Framework.

8 A similar moving average strategy will be used for returns on investments.

3. The data

Data are drawn from the 1978–2000, 2003 and 2004 Dutch Consumer Budget Surveys (Budgetonderzoek, CBS 2012).⁹ The Budget Survey provides detailed information on household expenditures on certain groups of commodities. It also contains information related to household characteristics, such as family size and composition, age of all household members, income and socioeconomic status. For one entire year, households keep a daily record of all expenses above a certain threshold amount per item.¹⁰ Expenditures below the threshold amount per item are recorded for a short period of time and that information is used to construct yearly expenses.¹¹ Vacation expenditures are recorded in a separate diary. In addition, mandatory health insurance premiums are not considered expenditures and are deducted from net income.¹²

We constructed household-specific inflation experiences in accordance with the official inflation rate for the Netherlands published by Statistics Netherlands (the Consumer Price Index, CPI). The CPI includes the items rent for renters and rental value of a home for homeowners. In the Budget Surveys the rental value

9 The Budget Survey was not conducted in 2001 and 2002; surveys after 2004 used a different methodology and were not available for this research.

10 The threshold amount for the daily records varied over the years between about €11 and €16.

11 This period was initially one month but was reduced to about half a month in the late 1980s and further reduced to 7 or 8 days towards the end of the survey period.

12 This is referred to as disposable income. Gross household income includes the labor income of all household members, income from other activities, asset income, rent subsidies, child allowances, social security benefits, pension income and other monetary transfers such as inheritance, scholarships and alimony. To arrive at net household income, social security contributions and labor and income tax are deducted from gross household income (Kalwij and Salverda 2007).

is based on, for instance, appraisals by real estate experts of what the rent would be if the premises were rented out. In line with the calculation of the CPI by Statistics Netherlands, we consider the rental value of a house to be an expenditure and add it to net income. As an alternative, since 2002 Statistics Netherlands has also reported the OECD Harmonized Index of Consumer Prices (HICP), which, among other things, excludes rental value but includes mortgage interest payments (CBS 2014). Figure 1 shows that the HICP and CPI virtually coincide in the years for which both are available (2002–2012), which provides some confidence that definitional differences between these two indices are not a major issue in terms of investigating the inflation experiences of households.¹³

The Budget Survey population is not a representative sample of the Dutch population, so the available sampling weights are used to approximate a representative sample. The descriptive statistics throughout this study are weighted sample statistics. In addition, people living in nursing homes are not covered by the survey. Although households may participate in the survey for at most three years, panel identifiers are not made available, and the survey is used as a series of cross-sections. The average annual sample size over the years was 2,260 households (56,571 observations over 25 years). There was only about a 1 percent reduction due to missing values on the variables used in the analysis, so that our final sample consisted of 55,962 household-year observations over the 1978–2004 period. Table 1 reports the sample sizes and weighted sample averages of household characteristics.

Our selection of the 13 composite commodity groups – hereafter referred to as goods – was influenced primarily by the avail-

13 We cannot construct an HICP using the Budget Survey data, since they do not have information on mortgage interest payments over the entire survey period.

ability of price information (see below). We defined the following 13 goods categories: food and non-alcoholic beverages, food out (cafes and restaurants), alcoholic beverages, tobacco, clothing and footwear, leisure activities (education and recreation, including vacations), housewares and appliances (furniture, cooking utensils, dishwasher, gardening tools, etc.), rent for renters and rental value for homeowners, utilities (heating and electricity), transportation (including fuel), personal care, medical care (not covered by health insurance) and miscellaneous (mainly financial goods and services).

Figures 2 to 5 show average budget shares for each of these goods by age and year of birth. The budget share is defined as the expenditure on a good divided by total expenditures. Figure 2, for instance, shows that the food budget share decreases with age and also that the more recent cohorts spend a smaller share of their budget on food. The observation that the more recent cohorts spend relatively less on food could be explained by the fact that they tend to have smaller household sizes (see Figure 6). Figure 2 also shows that the budget share of food out decreases with age and that there are only minor cohort effects for this item. One good typically associated with retirees is vacations (a component of leisure activities). Figure 3, however, shows that its budget share decreases rather sharply with age. It is, furthermore, noteworthy that homeownership rates decline somewhat with age (Figure 4), presumably due to widowhood, and that there is some evidence of cohort effects in ownership rates, since the more recent cohorts are more likely to be homeowners. An interesting finding is the strong cohort effects on the rent budget share for renters, with more recent birth cohorts spending relatively more on rent. This is likely to be related to rent control and the fact that rent increases are regulated based on tenancy. Another

thing frequently associated with aging is personal and medical care, and indeed Figure 5 shows increases in these budget shares with an increase in age. These budget shares are nevertheless relatively small, since virtually all medical expenditures during the survey period would have been covered by universal health insurance.

The patterns in budget shares in Figures 2–5 can partially be explained by differences in household characteristics. Figure 6 shows the familiar hump–shape for expenditures over the life cycle. Older people spend relatively more on necessity goods, such as food and utilities, and less on luxury goods, such as food out and leisure activities (Figures 2 and 3). The period in which children are in the household is typically a period in which a relatively large share of the budget is allocated to food and clothing and footwear (Figures 2 and 3). In addition, Figure 6 shows that women in the more recent cohorts are more likely to work, which may explain the somewhat higher budget share of transportation for these cohorts (Figure 3).

In addition to the Budget Surveys spanning 27 years (1978–2004), we obtained price information on these goods categories from the price statistics published by Statistics Netherlands from 1978 through 2012 (www.cbs.nl). Figure 7 shows the price changes over this period relative to the CPI for all thirteen goods. This figure shows relatively strong price increases for, in order of magnitude, food out, utilities and rent. Relatively strong price decreases are observed for clothing and footwear and leisure activities.

Table 1 Sample size and weighted sample averages of the main background variables by survey year

Year	Number of households	Single person households %	Couple households %	Other types of households %	Household size mean	Home ownership %
1978	1876	23	71	6	2.8	41
1979	1943	25	69	5	2.8	43
1980	2685	27	66	7	2.8	42
1981	2776	29	66	5	2.7	42
1982	2786	27	68	5	2.8	42
1983	3145	28	66	6	2.7	43
1984	3185	29	69	2	2.7	43
1985	2845	29	65	6	2.7	43
1986	2999	31	68	1	2.6	43
1987	2562	33	66	2	2.5	44
1988	1949	32	67	1	2.5	44
1989	1944	33	66	1	2.5	45
1990	2766	35	63	2	2.5	46
1991	1056	33	65	2	2.4	46
1992	1964	35	64	1	2.4	46
1993	1957	35	64	1	2.4	47
1994	2046	36	63	1	2.3	48
1995	2066	37	62	1	2.3	48
1996	2026	37	61	1	2.3	49
1997	2038	39	59	2	2.3	49
1998	1996	40	59	1	2.3	49
1999	1847	39	59	1	2.3	51
2000	2392	39	60	1	2.3	52
2003	1557	39	59	1	2.3	53
2004	1556	39	59	2	2.3	52

Male employment %	Female employment %	Expenditures (mean) mean	Income (mean) mean	Age <35 %	Age 35-49 %	Age 50-64 %	Age >64 %
62	30	29578	31654	31	25	25	19
60	29	28632	31642	27	27	27	19
58	32	29177	32900	28	27	25	20
57	32	27380	31511	28	26	27	20
57	32	27225	30451	33	27	21	19
53	32	26911	29607	31	26	21	21
53	32	26792	28668	28	28	23	21
52	30	26447	28347	31	27	22	20
51	32	26740	28479	29	29	22	19
51	31	27034	28954	27	30	22	21
53	32	26888	29666	28	32	21	19
51	35	27397	30339	28	32	20	19
54	35	27123	30845	30	31	19	19
53	36	27413	31089	30	29	21	20
53	32	28370	30131	30	29	22	19
54	33	28850	30694	29	33	19	20
54	34	28495	30038	29	32	18	21
53	33	28496	30007	28	34	18	20
53	36	28669	30595	27	34	18	20
53	36	29032	31102	26	33	20	20
55	37	29701	31659	26	34	20	20
55	40	30383	31659	23	34	23	20
55	41	31188	30819	27	31	23	20
54	42	32433	33787	21	35	24	19
54	43	32029	32371	22	32	27	19

Figure 2 Average budget shares by age and year of birth (cohort) for food, food out, alcoholic beverages and tobacco

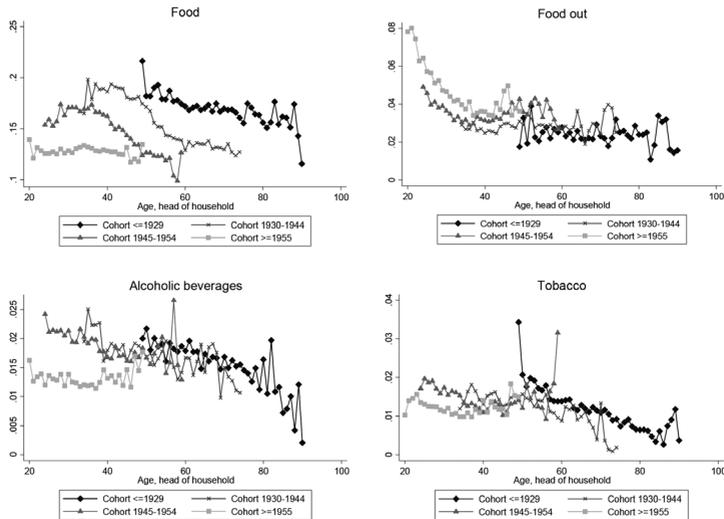


Figure 3 Average budget shares by age and year of birth (cohort) for clothing & footwear, leisure activities, utilities and transportation

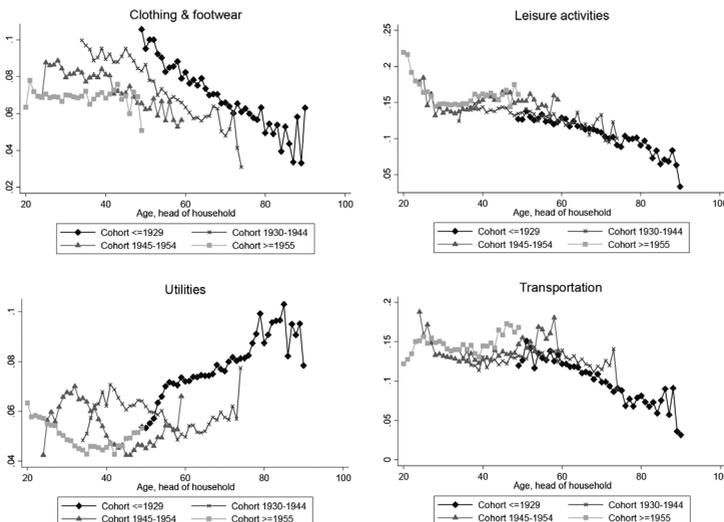


Figure 4 Homeownership and average budget shares by age and year of birth (cohort) for rent, rental values and housewares & appliances

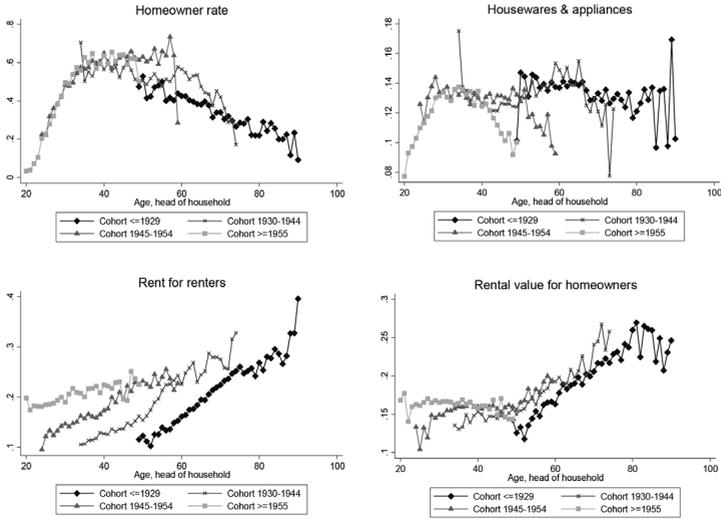


Figure 5 Average budget shares by age and year of birth (cohort) for personal care, medical care and miscellaneous goods

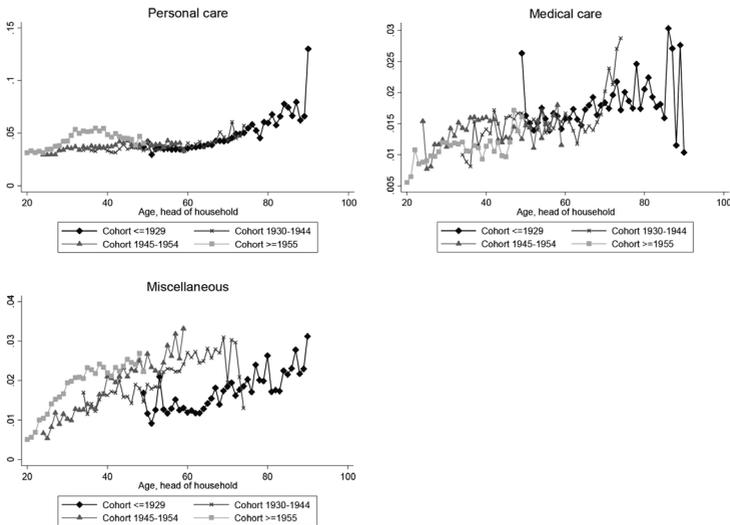


Figure 6 Average budget shares by level of expenditures, household size and employment

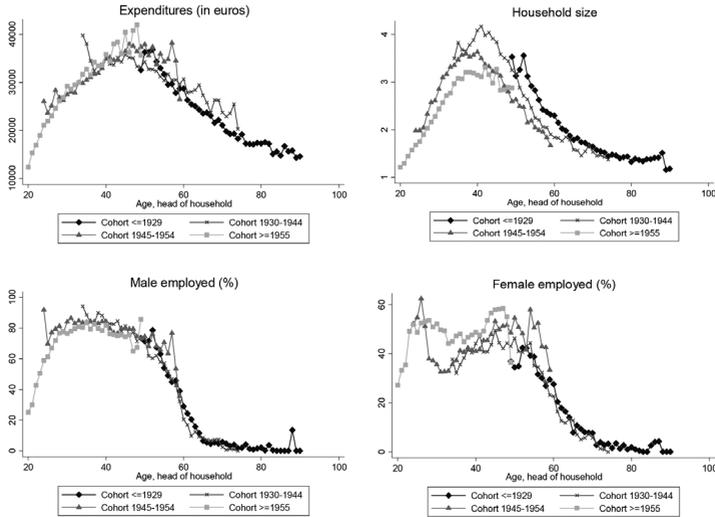
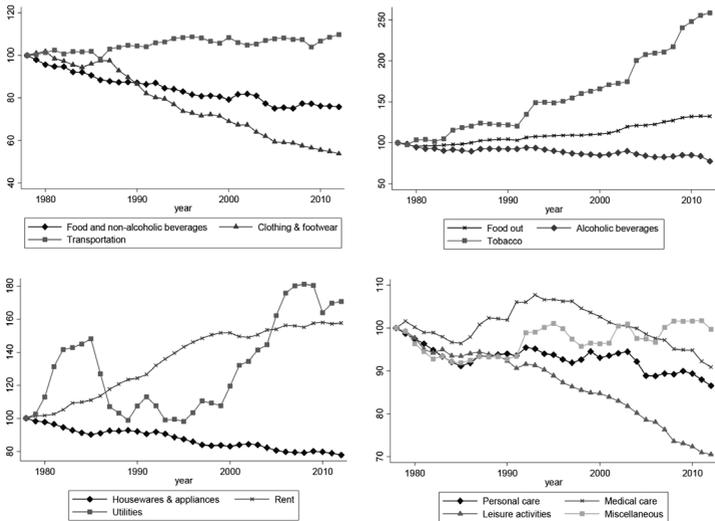


Figure 7 Price indices relative to CPI (1978=100)



4. Household inflation experiences

The logarithm of a Stone price index for household i in year t is given by

$$\log(P_{it}) = \sum_{j=1}^J w_{it}^j \log(p_t^j), \quad (1)$$

where w_{it}^j is the share of total expenditures that household i spends on good j , J is the number of goods and p_t^j is the price index of good j in year t . Likewise, we approximate the inflation rate that a household i in year t experiences using the following weighted inflation index:

$$\sum_{j=1}^J w_{it}^j \Delta \log(p_t^j). \quad (2)$$

The inflation rate of the price of good j is approximated by

$$\Delta \log(p_t^j) = \log(p_t^j) - \log(p_{t-1}^j). \quad (3)$$

The log operator is the natural logarithm.

Table 2 reports inflation experiences for different groups of households by year based on Equation (2). The top row of the table reports the official population inflation rate reported by Statistics Netherlands (CPI based).¹⁴ The first period in this table is from

¹⁴ The official population inflation rate is rather close to the sample average household inflation experience based on Equation (2). Not shown here are two notable exceptions. First, based on Equation (2), the only year of deflation was a year earlier than that based on CPI data (1986 instead of 1987) and, based on Equation (2), the inflation rate was 0.03 percent in 1987, whereas the official inflation rate was -0.5 that year. Note that stock markets crashed worldwide on October 19, 1987 ("Black Monday"). Second, the sharp decrease in the official inflation rate in 1992, by 2.7 percentage points, does not show up in the price indices of the goods categories we have, and based on Equation (2), the average inflation experience decreased by only about 0.7 percentage points.

1978 to 1987, a period of decreasing inflation that eventually culminated in a period of deflation in 1987. The following period, 1988–1992, is one of increasing inflation through 1991, averaging 2 percent as a whole, with a slight decrease at the end. From 1993

Table 2 The official inflation rate by year and household inflation experiences by household characteristic and year

Cells: Percentages / averaged over the years	1978–1987	1988–1992	1993–2000	2003–2004	1978–2004
Official inflation rate ^{a)}	3.52	1.91	2.17	1.64	2.62
All households ^{b)}	3.42	2.15	2.04	1.41	2.56
<i>Age</i>					
18–29	3.39	2.16	2.07	1.52	2.57
30–39	3.41	2.09	1.99	1.36	2.53
40–49	3.38	2.07	1.98	1.29	2.50
50–64	3.40	2.14	2.03	1.46	2.55
65–74	3.49	2.27	2.14	1.48	2.65
75 and over	3.55	2.35	2.23	1.50	2.72
<i>Household size</i>					
1	3.53	2.32	2.22	1.65	2.72
2	3.43	2.13	2.00	1.38	2.55
3	3.39	2.07	1.96	1.30	2.50
4	3.37	2.03	1.91	1.14	2.45
5 or more	3.32	1.99	1.86	1.08	2.41
<i>Number of children</i>					
0	3.47	2.22	2.11	1.52	2.63
1	3.40	2.08	1.97	1.35	2.51
2	3.37	2.04	1.92	1.16	2.46
3 or more	3.32	1.99	1.88	1.09	2.41
<i>Accommodation</i>					
Renter	3.41	2.18	2.14	1.55	2.61
Homeowner	3.43	2.10	1.95	1.28	2.52

Table 2 The official inflation rate by year and household inflation experiences by household characteristic and year

Cells: Percentages / averaged over the years	1978–1987	1988–1992	1993–2000	2003–2004	1978–2004
Official inflation rate ^{a)}	3.52	1.91	2.17	1.64	2.62
All households ^{b)}	3.42	2.15	2.04	1.41	2.56
<i>Labor force status</i>					
Not employed or retired	3.45	2.25	2.19	1.62	2.66
Employed	3.40	2.08	1.98	1.35	2.52
Retired	3.50	2.27	2.11	1.47	2.65
<i>Household income</i>					
1st decile	3.50	2.31	2.23	1.64	2.71
2nd decile	3.48	2.34	2.26	1.66	2.72
3rd decile	3.46	2.25	2.16	1.57	2.65
4th decile	3.42	2.19	2.12	1.53	2.61
5th decile	3.40	2.13	2.03	1.44	2.55
6th decile	3.40	2.10	1.99	1.35	2.53
7th decile	3.39	2.07	1.94	1.31	2.49
8th decile	3.38	2.04	1.93	1.22	2.48
9th decile	3.39	2.02	1.91	1.23	2.47
10th decile	3.37	2.00	1.86	1.16	2.44
<i>Household expenditures</i>					
1st decile	3.45	2.36	2.30	1.76	2.73
2nd decile	3.48	2.27	2.21	1.55	2.68
3rd decile	3.44	2.19	2.14	1.52	2.62
4th decile	3.40	2.17	2.06	1.51	2.58
5th decile	3.42	2.14	2.02	1.40	2.56
6th decile	3.40	2.10	2.00	1.30	2.52
7th decile	3.41	2.09	1.96	1.29	2.51
8th decile	3.41	2.08	1.95	1.25	2.50
9th decile	3.38	2.05	1.91	1.29	2.48
10th decile	3.39	2.03	1.88	1.25	2.47

a) Statistics Netherlands (www.statline.cbs.nl); based on the Consumer Price index (CPI)

b) The average over the years is taken after having computed average inflation rates within a group per year.

to 2000 there was relatively stable inflation of around 2 percent. The 2003–2004 period is just after the dotcom crash; these were years with low inflation.

The overall picture that emerges from Table 2 is as follows. With respect to age, households in which the head of the household is between 40 and 49 years old have experienced the lowest inflation. For all periods, a household's inflation experience decreases with an increase in household size and with an increase in the number of children. The difference in inflation experience between renters and homeowners has increased over time; their inflation experiences were about equal in the years from 1978 to 1987, but after that, homeowners started to experience lower inflation than renters, with the discrepancy steadily increasing to 0.27 percentage points per year as of 2003–2004 (1.55 vs. 1.28 percent). Retirees have 0.13 percentage points higher inflation than employed households in all periods (on average 2.65 vs. 2.52 percent from 1978 to 2004). In line with evidence from other countries, such as the UK (Flower and Wales 2014), Table 2 shows that the most notable differences in inflation experiences between households are related to levels of income and total expenditures. The patterns are about the same for household income and total expenditures. Compared to households in the highest total expenditures decile, households in the lowest total expenditures decile have experienced, on average, a 0.26 percentage point higher yearly inflation rate (2.73 vs. 2.47 percent from 1978 to 2004). Over the years, this difference has sharply increased from 0.06 percentage points for the 1978–1987 period to 0.51 percentage points for the 2003–2004 period.¹⁵

15 Appendix A presents the estimation results of a multivariate analysis and provides insights into how inflation experience varies according to specific household characteristics, holding all other characteristics constant.

5. Empirical results

Our statistical model consisted of two components. The first component is a consumer demand model. This model relates households' budget shares for the thirteen goods (see Section 3) to household characteristics, prices and standardized total household expenditures. As mentioned above, it is assumed that all households face the same prices for goods (the common price assumption). The second component is the household inflation experience as presented in Equation (2); it is a weighted inflation index, where the price inflation rates of the thirteen goods are weighted against each household's budget shares. Hence, as discussed above, differences in inflation experience across households are the result of household characteristics affecting the budget shares. In addition, having the estimation results of the consumer demand model provides insights into which goods cause the differences in inflation experiences. We will return to that issue at the end of this section.

The consumer demand model we estimated was developed by Lewbel and Pendakur (2009) and is outlined in Appendix B. The budget share equations for each of the thirteen goods were estimated as a system of demand equations. The explanatory variables included in the analysis were:

- Age of head of household, in the age categories 17-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80+
- Number of other household members in the age categories 0-3, 4-16, 17-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80+

- A dummy variable for a couple household and a dummy variable for other types of households (the reference group is singles)
- A dummy variable for whether or not the head of household was employed
- The number of other employed household members
- Homeownership dummy
- Log-household size
- Log-standardized total expenditures¹⁶
- Relative prices

Possible cohort effects in expenditure patterns, as shown in Figures 2–5, are assumed to be sufficiently captured by this set of explanatory variables. The full set of estimation results are presented in Appendix C. These estimation results were used to predict budget shares for various types of households. Next, we substituted these predictions in Equation (2), together with price information and forecast yearly inflation experiences for various types of households for the years 1978–2012. These forecasts are reported in Table 3. In the discussion of the results, we also present accumulated inflation experiences for the years 1978–2012 based on Equation (1). This makes it possible to extrapolate from short-term differences in inflation experiences between households that may average out over time and to have a long-term view of differences in inflation experiences between households that have been persistent over a 35-year period (1978–2012). For this purpose, we also present confidence intervals to provide insight into the statistical significance of our findings. Finally, in the figures, all results are presented relative to the official

16 Log-standardized total expenditures is household expenditures divided by the equivalence scale provided by Statistics Netherlands (Siermann *et al.*, 2004).

Consumer Price Index (CPI) and show whether a specific type of household has experienced an accumulated inflation over the long term that has been above or below what an average household experienced.

The top row of Figure 8 shows that, compared to the average household, single persons age 20–24 and couples with no children in which both are age 25–29 have experienced slightly higher inflation. Given the upper and lower bounds of the 95% confidence interval, these differences are close to being insignificant, however. Couples age 30–34 with one child have accumulated about 2 percentage points lower inflation in 35 years. This latter finding, too, is a rather small difference compared to an accumulated inflation from 1978 to 2012 of about 228 percent for an average household. To break it down, Table 3 shows that the average yearly inflation experience for an average household is about 2.4 percent and that the yearly inflation experience of couples age 30–34 with one child is 0.03 percentage points lower. The bottom row of Figure 8 shows that couples (of any age) with children (of any age) have experienced lower inflation. As shown in Table 3, the inflation experiences are about 0.05–0.11 percentage points lower per year than for an average household. While these differences are small, the overall trend, which started in the late 1980s, is a persistent lower inflation experience for households with children.

Figure 9 shows that retired couples age 65–69 experience about average inflation. The most dominant picture is that single persons experience a higher inflation than couples and that inflation experiences increase with age. Retired single persons age 75–79 have experienced a yearly inflation rate that is 0.14 percentage points higher than for an average household (Table 3). Taking into account the confidence intervals, the inflation

Table 3 Predicted yearly household inflation experience by household composition, age, expenditures and homeownership status

Cells: (%)	Average household	Household composition and age			
		Single 20-24	Couple 25-29	Couple 30-34	Couple 35-39
		No children	No children	One child 0-3	Two children 0-3 & 4-16
Period					
1978-1987	3.42	3.47	3.41	3.37	3.33
1988-1992	2.09	2.09	2.10	2.07	2.02
1993-2000	2.01	2.07	2.03	1.99	1.94
2001-2004	2.53	2.50	2.52	2.48	2.41
2005-2012	1.58	1.54	1.59	1.55	1.50
1978-2012	2.38	2.40	2.39	2.35	2.30
Difference from the average household	0.00	0.02	0.01	-0.03	-0.08
Standardized household expenditures Retirees age 65-69, couple					
Period	Low*	Median**	1.35 x median	1.8 x median	
1978-1987	3.44	3.39	3.36	3.34	
1988-1992	2.19	2.10	2.05	2.01	
1993-2000	2.10	2.01	1.96	1.93	
2001-2004	2.71	2.52	2.45	2.42	
2005-2012	1.71	1.58	1.51	1.47	
1978-2012	2.48	2.37	2.33	2.29	
Difference from the average household	0.09	-0.01	-0.06	-0.09	

* Public pension benefit (AOW, about €12,500); ** About €20,000

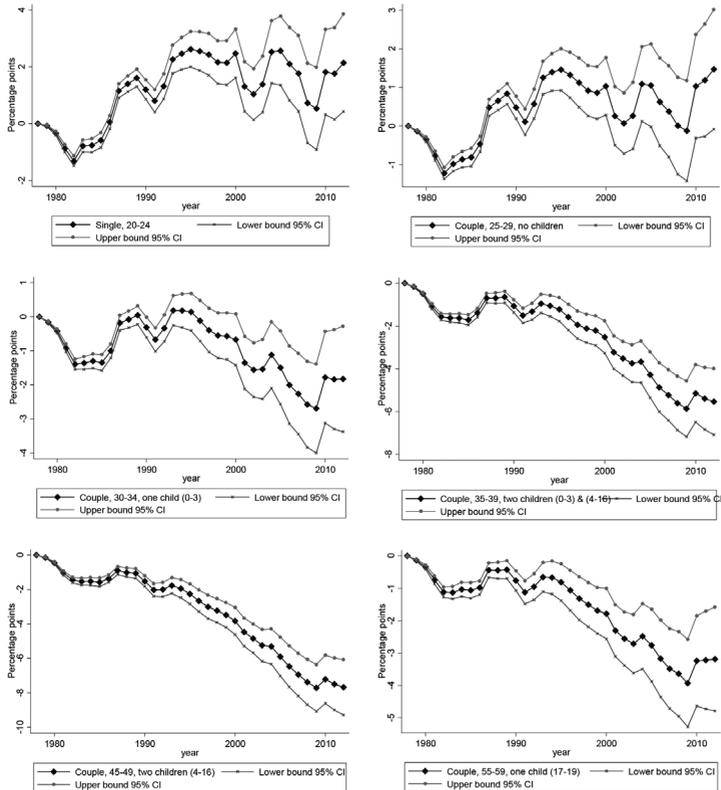
Couple 45-49		Couple 55-59		Couple 65-69		Single 65-69		Couple 75-79		Single 75-79	
Two children both 4-16		One child 17-19		No children at home		No children at home		No children at home		No children at home	
3.31		3.35		3.39		3.57		3.44		3.58	
1.96		2.03		2.10		2.24		2.19		2.28	
1.90		1.96		2.01		2.17		2.07		2.19	
2.39		2.46		2.52		2.64		2.57		2.66	
1.49		1.56		1.58		1.64		1.60		1.64	
2.27		2.33		2.37		2.51		2.43		2.53	
-0.11		-0.05		-0.01		0.13		0.05		0.14	
Homeownership status Retirees age 65-69, couple				Extreme case							
Renter		Owner		Single, 80+, Low expenditures*							
3.39		3.40		3.67							
2.10		2.15		2.44							
2.01		2.01		2.33							
2.52		2.57		2.90							
1.58		1.60		1.80							
2.37		2.40		2.67							
-0.01		0.02		0.29							

experiences of retirees who rent and those who own are not significantly different from the inflation experience of an average household (see Figure 10).

Figure 11 shows that inflation experience decreases with the level of total household expenditures. Compared to an average household, retirees with expenditures equal to the public pension benefit (about €12,500 in 2012) have an accumulated inflation experience that is about 8 percentage points higher than that of an average household. This amounts to about 0.09 percentage points higher yearly inflation (Table 3). Likewise, the bottom graphs in Figure 11 are for retirees with levels of total expenditures equal to 1.35 and 1.8 times, respectively, the median level of standardized total expenditures and show that these retirees have experienced lower inflation compared to average households. For retirees with 1.8 times the median level of standardized expenditures (about the 95th percentile of the distribution), this amounts to an average of 0.09 percentage points lower yearly inflation (Table 3).

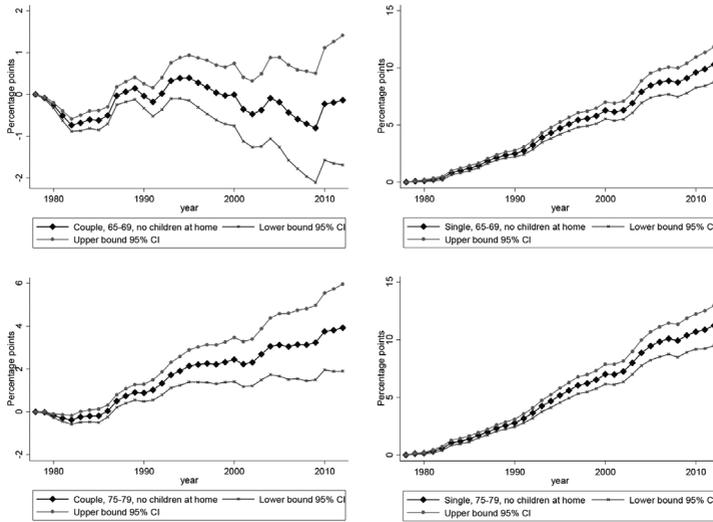
Figure 12 provides insight into what causes the significant differences in household inflation experience by age, marital status and level of expenditures. As mentioned in the introduction, the assumption that all consumers face the same prices implies that our predicted differences in inflation experience between households are solely determined by differences in predicted expenditure patterns. The top two graphs of Figure 12 show that couples spend a relatively small share of their budget on rent, for instance, and a relatively large share on food. This, together with the fact that rents have increased relative to CPI and the price of food has decreased relative to CPI (Figure 7), results in couple households experiencing lower inflation than single person households. The middle two graphs of Figure 12 show that

Figure 8 Price indices by age and household composition for people of working age, relative to CPI



when households become older, they spend less of their budget on food and leisure activities and more on rent. These changes in spending patterns, together with increasing rents and decreasing prices for leisure activities and food (Figure 7), result in a higher inflation experience for older retirees. The bottom two graphs of Figure 12 provide insight into the budget shares of retirees with different levels of standardized total expenditures. Together with

Figure 9 Price indices by age and household composition for retirees, relative to CPI



the relative price changes in Figure 7, they show that the significant differences in inflation experience are caused by relatively strong rent increases and increases in the prices for goods, such as utilities, on which retirees with only a public pension income spend more, along with decreases in the prices for goods, such as leisure activities (including vacations), on which they spend less than higher-income retirees.

Figure 10 Price indices for a 65–69 year-old couple that either rents or owns, relative to the CPI

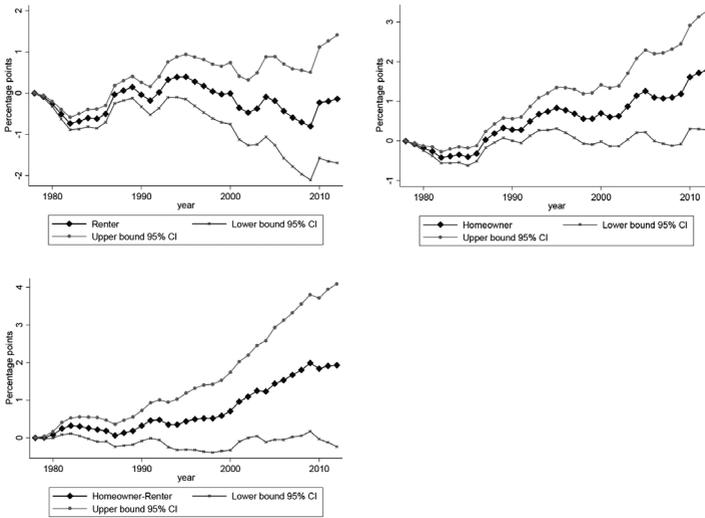


Figure 11 Price indices for a 65–69 year-old couple by level of total household expenditures, relative to CPI

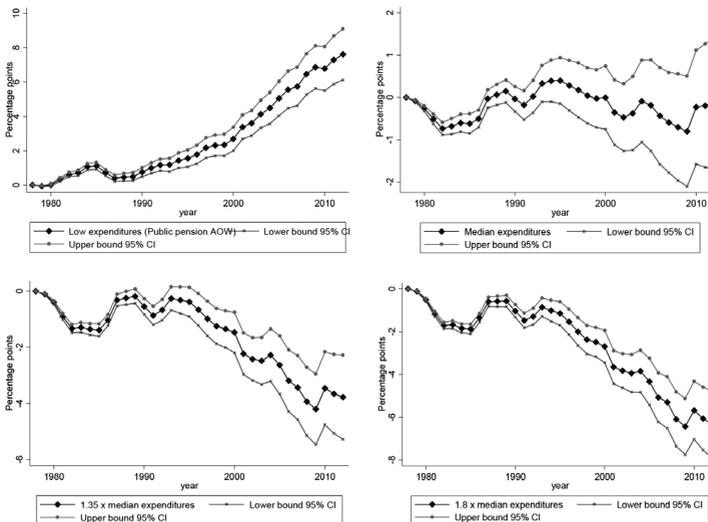
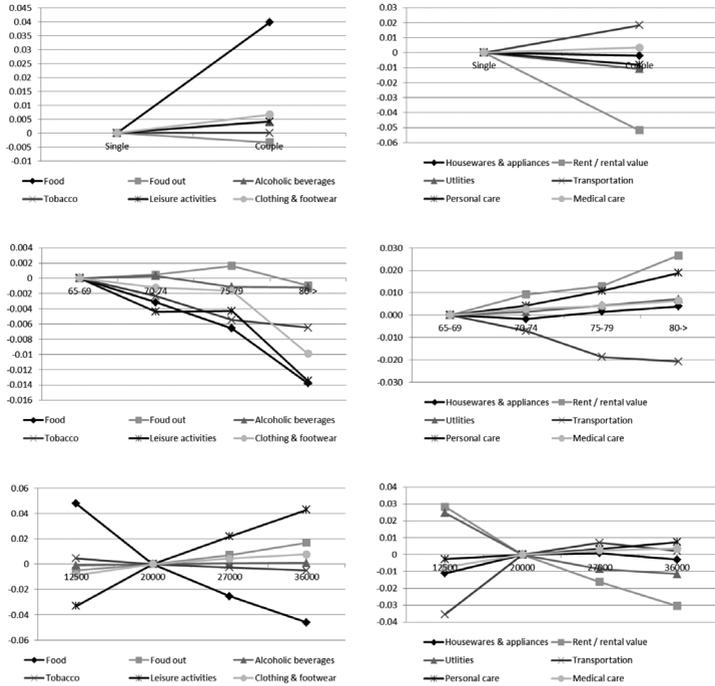


Figure 12 Predicted budget shares by household type (top), age of head of household (middle) and household expenditures (bottom) relative to a single person household, age 65-69, with median standardized total household expenditures during retirement (€20,000)



6. Conclusions

This paper set out to analyze differences in inflation experiences across households. In particular, the aim was to identify groups of retirees that have experienced above-average price inflation and could be considered vulnerable when pensions are not indexed, as has been the case in recent years in the Netherlands in the aftermath of the recent financial crisis. We analyzed expenditure patterns using data from the 1978–2004 Dutch Budget Surveys and, by combining this with price information for the years 1978–2012 provided by Statistics Netherlands, computed household inflation experiences for different types of households based on household composition, age and level of total expenditures.

We found that over a 35-year period (1978–2012), single person households have experienced higher inflation than couple households and that inflation experiences are higher for older households than for younger ones and for low-income households than for high-income ones. These differences are statistically significant and are the result of relative price increases in goods, such as rent and utilities, on which single, low-income and older people spend relatively more of their budget, coupled with relative price decreases in goods, such as leisure activities (including vacations), on which these groups spend relatively less of their budget than the average household.

Nevertheless, the differences we found in inflation experiences across the various types of households were rather small and might be considered too small to be of economic significance. Differences in expenditure patterns across people of different ages and income levels have therefore not led to substantial or persistent differences in their inflation experiences in the past few decades. This suggests that the same degree of indexation

used for occupational pensions (within a pension fund) does not in itself induce major differences in purchasing power between retirees of different ages, household compositions and levels of total expenditures.

All retirees with an occupational pension will experience a reduction in purchasing power when pensions are not fully price indexed. While our findings do show that low-income retirees experience a higher inflation than high-income retirees, the former rely primarily on public pension benefits and are not considered vulnerable because these benefits are effectively wage indexed. This will have had a mitigating effect on the differences in changes over time in the standard of living between low- and high-income households (e.g., Vermeulen *et al.* 2015).

Our study has several limitations, some of which can be addressed in future work. An important limitation that is likely to also be present in future studies is the common price assumption, that is that all households face the same prices. It is a reasonable expectation that people in low-income households shop in stores with lower prices than those to which people with a higher income go. This may produce an overestimation of the differences in inflation experiences between low- and high-income households. If one could find a way to take this issue into account, it could further mitigate the differences in inflation experiences. Another limitation concerns the fact that, in accordance with the official inflation rate calculations, we assume that the price corresponding to rental value is the same as that for rent. Since the rent price index mostly covers accommodations in a highly regulated rental market, one might question the validity of this assumption, and more research is needed.

Two further limitations of our study are the absence of more disaggregated price information and the absence of a recent

Budget Survey for the Netherlands, with the latest available data being from 2004. With regard to the former limitation, Statistics Netherlands does use more disaggregated price information when constructing the population inflation rate. If such information were to become available, it could be used to produce more accurate household inflation experiences. Our main findings also imply that it is quite reasonable to use the consumer price index when calculating the impact of a policy reform on the standards of living for different groups of people, without taking into account possible changes in their expenditure patterns. However, future research should assess this conclusion in more detail and use more disaggregated price information and more recent budget data to capture the consequences of the reforms that have taken place since the last available Budget Survey of 2004, since they are likely to have a strong impact on household spending over the years to come.

For instance, the reforms in the health insurance and long-term care systems over the years have resulted in fewer health services being covered by health insurance, a minimum compulsory own-risk cover (which can be optionally increased) and copayments for long-term care that depend on both income and assets. Inherent to health care services is that demand is rather inelastic and increases with age. If the price developments in health care services exceed that of the population consumer price index, it will yield higher inflation experiences for people who are relatively more unhealthy, a group that is likely to include more retirees than, for instance, workers. Another reform that may have an impact on inflation experiences is the recent reform of the housing market, which stipulates, for instance, that rent increases be tied to the quality of the accommodation. As with health services, housing services are rather inelastic, and if rents

rise relatively fast it may especially affect the inflation experience of renters.

Under the assumptions that increases in rents and the prices of health services are exceeding the consumer price index and that demand for such services is inelastic, one could infer that renters and people with a high demand for health services will experience relatively higher inflation. Many of the reforms, however, have a strong income component, which makes it rather speculative to draw strong conclusions about how such reforms might relate to the inflation experiences of low- and high-income households. What *is* apparent is that given the pension, housing and health care reforms, it seems highly advisable to monitor household spending patterns closely and determine if there are any substantial or persistent changes in the differences in inflation experiences across households. The statistical framework presented in this paper could be used for this. Taken together with more detailed price information and up-to-date information on the spending patterns of households, such a framework would provide the necessary insights into the consequences of reforms on the differences in inflation experiences across households.

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Appendix A

Table Regression results: A reduced form analysis of the determinants of household inflation experiences

Cells: Percentage points	coeffi- cient	t-values		coeffi- cient	t-values
Explanatory variables					
<i>Labor force status</i>			<i>Number of other household members by age</i>		
Not employed or retired	-0.01	-0.74	0-3	-0.02	-5.13
Employed	0.00		4-16	-0.03	-13.90
Retired	-0.01	-0.83	17-19	-0.03	-4.67
<i>Accommodation</i>			20-24	-0.01	-2.40
Renter	0.00		25-29	-0.02	-2.32
Homeowner	0.04	9.40	30-34	-0.04	-4.44
<i>Household composition</i>			35-39	-0.06	-5.15
Single	0.00		40-44	-0.06	-5.46
Couple	-0.004	-0.42	45-49	-0.08	-5.98
Other household type	-0.03	-1.81	50-54	-0.08	-6.21
<i>Age of head of household</i>			55-59	-0.10	-6.96
17-19	-0.34	-4.82	60-64	-0.08	-5.22
20-24	-0.15	-10.86	65-69	-0.08	-5.46
25-29	-0.03	-3.72	70-74	-0.11	-5.77
30-34	-0.003	-0.40	75-79	-0.05	-2.22
35-39	0.00		80 and over	-0.04	-0.99
40-44	0.01	1.82	<i>Expenditures</i>		
45-49	0.01	1.09	1st decile	0.00	
50-54	0.004	0.35	2nd decile	-0.07	-4.92
55-59	0.01	0.58	3rd decile	-0.12	-8.76
60-64	0.02	1.65	4th decile	-0.18	-13.28
65-69	0.02	1.64	5th decile	-0.21	-15.66
70-74	0.04	2.61	6th decile	-0.25	-18.05
75-79	0.07	3.56	7th decile	-0.26	-18.60
80 and over	0.08	2.88	8th decile	-0.28	-19.82
			9th decile	-0.30	-20.81
			10th decile	-0.33	-21.98
R-squared	0.95				
Number of observations	55,962				
<i>Note: Year dummies are included.</i>					

Appendix B

The budget share of commodity j depends on household characteristics (X_{it}), prices and standardized total household expenditures (r_{it}). Standardized total household expenditures are equal to total household expenditures divided by the equivalence scale provided by Statistics Netherlands (Siermann *et al.*, 2004). We estimate the following demand system that allows for the budget shares to be quadratic in log expenditures:

$$w_{it}^j = \alpha^j + \mathbf{X}_{it} \delta^j + \beta^j \log\left(\frac{r_{it}}{P_{it}}\right) + \lambda^j \left(\log\left(\frac{r_{it}}{P_{it}}\right)\right)^2 + \sum_{k=1}^J \gamma^{jk} \log(p_t^k) + \varepsilon_{it}^j, \quad j=1, \dots, J, \quad (\text{B1})$$

with

$$\log(P_{it}) = \alpha_0 + \sum_{k=1}^J \left((\alpha^k + X_{it} \delta^k) \log(p_t^k) \right) + \frac{1}{2} \sum_{k=1}^J \sum_{l=1}^J \gamma^{kl} \log(p_t^k) \log(p_t^l), \quad (\text{B2})$$

and

$$\sum_{j=1}^J \alpha^j = 0, \quad \sum_{j=1}^J \delta^j = \bar{\mathbf{0}}, \quad \sum_{j=1}^J \beta^j = 0, \quad \sum_{j=1}^J \lambda^j = 0, \quad \sum_{j=1}^J \gamma^{jk} = \sum_{k=1}^J \gamma^{jk} = 0, \quad \text{and} \quad \gamma^{jk} = \gamma^{kj} \quad \forall j, k. \quad (\text{B3})$$

Equation (B1) is similar to the one proposed by Pashardes, Blundell and Weber (1993) as an extended version of the Almost Ideal Demand System of Deaton and Muellbauer (1980) and is nested in the (approximate) Exact Affine Stone Index demand system recently proposed by Lewbel and Pendakur (2009).

The price index P_t (Equation [B2]) is replaced by the following approximation (P_t) that uses average budget shares:

$$\log(P_t) = \sum_{j=1}^J \bar{w}_t^j \log(p_t^j). \quad (\text{B4})$$

Equation (B4) is a Stone price index. Lewbel and Pendakur (2009) show that the estimates of the parameters of the demand system of Equation (B1) are rather insensitive to using the approximation of Equation (B4). The main advantage of using this approximation is that Equation (B1) becomes linear in the parameters. Equation (B1) is estimated with an Instrumental Variables estimator to take into account the possible endogeneity of log-standardized total expenditures, since total expenditures are also used to construct the budget shares. The instrument variable for this is log-standardized disposable income.

Appendix C Estimation results

	Food		Food out	
	coef.	z-values	coef.	z-values
Couple household (0-1)	0.011	8.23	-0.008	-7.86
No single/coupled (0-1)	0.006	2.76	-0.006	-4.13
Employment HH (0-1)	0.002	2.27	0.003	4.13
Employment others (#)	-0.001	-1.14	0.003	7.12
Homeowner (0-1)	-0.006	-9.81	-0.005	-11.73
ln(household size)	0.033	13.64	-0.030	-17.44
HH age 17-19	-0.054	-9.11	0.020	4.72
HH age 20-24	-0.024	-14.88	0.020	17.59
HH age 25-29	-0.011	-10.02	0.010	12.41
HH age 30-34	-0.005	-5.04	0.005	7.79
HH age 40-44	0.006	5.68	-0.006	-8.84
HH age 45-49	0.010	8.90	-0.009	-11.06
HH age 50-54	0.014	10.90	-0.015	-16.19
HH age 55-59	0.015	10.69	-0.020	-20.00
HH age 60-64	0.016	11.02	-0.021	-20.51
HH age 65-69	0.017	11.64	-0.023	-21.08
HH age 70-74	0.014	8.86	-0.022	-19.18
HH age 75-79	0.011	5.85	-0.021	-15.84
HH age 80 ->	0.004	1.45	-0.024	-13.39
# other persons age 0-3	-0.004	-4.11	0.001	1.17
# other persons age 4-16	0.000	-0.26	0.005	8.90
# other persons age 17-19	-0.001	-0.80	0.012	14.87
# other persons age 20-24	-0.003	-2.27	0.015	17.44
# other persons age 25-29	0.001	0.36	0.015	14.60
# other persons age 30-34	0.000	-0.08	0.017	15.08
# other persons age 35-39	0.002	1.37	0.019	16.01
# other persons age 40-44	0.004	2.56	0.019	15.25
# other persons age 45-49	0.004	2.37	0.020	16.04
# other persons age 50-54	0.005	2.94	0.020	15.56

Alcoholic beverages		Tobacco		Leisure activities		Clothing & footwear	
coef.	z-values	coef.	z-values	coef.	z-values	coef.	z-values
0.005	9.47	0.003	6.66	-0.026	-13.24	-0.004	-3.07
0.006	6.93	0.005	6.30	-0.021	-7.24	-0.005	-2.86
-0.001	-4.00	-0.001	-4.72	-0.002	-1.87	0.005	6.52
0.000	0.63	0.001	3.28	0.000	0.06	0.003	7.20
-0.003	-10.25	-0.003	-14.38	-0.021	-22.52	-0.008	-15.55
-0.003	-3.67	-0.002	-2.38	0.013	3.63	0.018	9.03
-0.009	-3.93	-0.011	-5.16	0.119	13.90	0.042	8.42
-0.005	-8.27	-0.006	-10.04	0.051	21.79	0.009	6.49
-0.004	-8.52	-0.003	-8.35	0.017	10.14	0.004	3.79
-0.001	-3.29	-0.001	-3.45	0.007	4.85	0.001	1.49
0.000	0.05	0.001	3.99	-0.008	-5.69	0.001	0.63
0.000	0.64	0.000	1.10	-0.016	-9.65	0.003	2.75
-0.001	-1.89	0.001	1.15	-0.027	-14.42	0.004	3.97
-0.003	-4.95	-0.002	-4.36	-0.031	-15.72	0.007	5.89
-0.004	-6.56	-0.005	-9.94	-0.034	-16.16	0.009	7.01
-0.004	-7.44	-0.007	-12.46	-0.036	-16.49	0.007	5.93
-0.004	-6.43	-0.009	-15.54	-0.040	-17.22	0.006	4.63
-0.005	-7.57	-0.012	-18.23	-0.040	-14.98	0.006	3.77
-0.006	-5.77	-0.013	-14.83	-0.049	-13.85	-0.002	-1.17
0.000	-0.43	-0.003	-7.58	-0.016	-11.14	-0.001	-1.23
-0.001	-2.15	-0.002	-6.48	0.003	2.23	0.002	3.55
-0.001	-2.75	0.000	-1.09	0.003	1.96	0.000	0.08
-0.002	-3.49	0.000	-0.75	-0.003	-1.98	-0.003	-3.34
-0.001	-1.74	0.000	0.26	-0.002	-1.07	-0.002	-1.86
0.000	0.06	0.000	0.43	0.005	2.42	-0.003	-2.35
0.001	1.16	-0.001	-1.46	0.013	5.79	-0.002	-1.82
0.002	2.32	-0.001	-1.08	0.018	7.59	-0.002	-1.37
0.002	2.29	-0.002	-2.40	0.023	9.03	-0.001	-0.57
0.002	2.54	-0.001	-0.89	0.024	9.13	-0.004	-2.58

	Food		Food out	
	coef.	z-values	coef.	z-values
# other persons age 55-59	0.006	3.30	0.022	16.35
# other persons age 60-64	0.004	2.28	0.026	18.93
# other persons age 65-69	0.006	2.83	0.026	18.07
# other persons age 70-74	0.006	2.77	0.027	16.86
# other persons age 75-79	0.000	-0.14	0.027	13.78
# other persons age 80->	0.008	2.05	0.031	10.52
Log(price food)	0.063	2.50	0.038	2.90
Log(price food out)	0.038	2.90	0.062	4.65
Log(price alcoholic beverages)	0.025	1.92	0.028	3.26
Log(price tobacco)	0.003	0.57	-0.001	-0.32
Log(price clothing & footwear)	-0.025	-2.81	0.009	1.33
Log(price leisure activities)	-0.052	-2.04	-0.028	-1.56
Log(price housewares & appliances)	0.082	3.41	-0.130	-7.22
Log(rent)	-0.089	-7.41	-0.032	-3.27
Log(price utilities)	-0.003	-1.13	-0.013	-6.98
Log(price transportation)	0.066	3.92	0.073	5.59
Log(price personal care)	0.027	1.51	0.054	5.11
Log(price medical care)	-0.084	-6.75	0.013	1.32
Log(price miscellaneous)	-0.050	-4.41	-0.073	-8.91
log(standardized expenditures)	-0.521	-5.29	-0.319	-4.47
sq. log(standardized expenditures)	0.022	4.36	0.017	4.73
Constant	3.157	6.50	1.537	4.36
R-squared	0.439		0.125	

Alcoholic beverages		Tobacco		Leisure activities		Clothing & footwear	
coef.	z-values	coef.	z-values	coef.	z-values	coef.	z-values
0.002	2.64	-0.001	-1.53	0.021	7.94	-0.003	-1.84
0.001	1.85	0.000	0.18	0.019	6.81	-0.003	-1.86
0.001	1.53	-0.002	-2.73	0.022	7.68	-0.003	-1.56
0.001	0.81	-0.002	-2.98	0.016	5.01	-0.004	-2.04
0.000	-0.46	-0.001	-1.23	0.007	1.87	-0.008	-3.27
0.001	0.50	0.000	-0.12	-0.002	-0.33	-0.014	-4.23
0.025	1.92	0.003	0.57	-0.052	-2.04	-0.025	-2.81
0.028	3.26	-0.001	-0.32	-0.028	-1.56	0.009	1.33
-0.034	-2.97	-0.003	-1.16	-0.009	-0.66	0.008	1.65
-0.003	-1.16	0.003	1.28	-0.006	-0.75	-0.006	-2.25
0.008	1.65	-0.006	-2.25	-0.007	-0.43	0.021	3.08
-0.009	-0.66	-0.006	-0.75	0.067	1.39	-0.007	-0.43
0.008	0.55	-0.011	-1.61	0.046	1.41	0.048	4.21
-0.017	-2.42	-0.029	-7.85	0.045	2.63	-0.013	-2.01
0.002	1.24	-0.003	-3.19	0.021	5.92	0.010	7.35
-0.018	-2.17	0.021	3.60	-0.080	-3.19	-0.038	-3.87
-0.037	-3.17	0.000	0.05	-0.044	-2.14	-0.002	-0.33
0.020	2.29	-0.003	-0.90	0.057	3.55	0.012	2.04
0.027	4.05	0.035	10.31	-0.011	-0.68	-0.017	-2.74
0.007	0.18	-0.024	-0.68	0.028	0.19	0.122	1.48
0.000	-0.13	0.001	0.42	0.002	0.31	-0.005	-1.28
-0.020	-0.10	0.188	1.06	-0.330	-0.47	-0.613	-1.51
0.029		0.062		0.124		0.078	

Estimation results (table continued)

	Housewares & appliances		Rent/Rental value	
	coef.	z-values	coef.	z-values
Couple household (0-1)	0.024	12.60	-0.002	-1.42
Not a single or couple (0-1)	0.021	7.37	-0.003	-1.38
Employment HH (0-1)	-0.002	-1.47	-0.005	-5.46
Employment others (#)	0.000	-0.34	-0.008	-13.92
Homeowner (0-1)	0.043	48.95	0.013	17.72
ln(household size)	0.000	0.07	-0.023	-8.45
HH age 17-19	-0.023	-2.79	-0.071	-10.53
HH age 20-24	-0.007	-3.36	-0.037	-20.31
HH age 25-29	-0.002	-1.12	-0.011	-8.61
HH age 30-34	0.000	0.21	-0.004	-3.31
HH age 40-44	0.001	1.06	0.005	4.04
HH age 45-49	0.005	3.00	0.008	5.71
HH age 50-54	0.010	5.38	0.012	8.18
HH age 55-59	0.013	6.83	0.018	11.53
HH age 60-64	0.019	9.66	0.021	12.86
HH age 65-69	0.016	7.90	0.024	14.25
HH age 70-74	0.014	6.52	0.033	18.25
HH age 75-79	0.018	6.98	0.037	17.70
HH age 80 ->	0.020	5.95	0.051	18.20
# other persons age 0-3	-0.002	-1.43	0.004	3.72
# other persons age 4-16	-0.005	-4.92	0.001	0.59
# other persons age 17-19	-0.011	-7.69	-0.006	-4.86
# other persons age 20-24	-0.007	-4.36	-0.005	-3.68
# other persons age 25-29	-0.007	-3.63	-0.010	-6.04
# other persons age 30-34	-0.011	-5.06	-0.017	-9.64
# other persons age 35-39	-0.019	-8.32	-0.019	-10.55
# other persons age 40-44	-0.024	-10.20	-0.024	-12.64
# other persons age 45-49	-0.024	-10.10	-0.027	-13.39

Utilities		Transportation		Personal care		Medical care	
coef.	z-values	coef.	z-values	coef.	z-values	coef.	z-values
0.001	1.12	0.000	-0.19	-0.005	-7.00	-0.001	-1.00
0.002	1.84	0.000	0.11	-0.004	-3.42	-0.002	-2.22
0.002	4.97	-0.001	-0.55	0.000	0.21	-0.001	-1.67
0.000	-1.29	0.003	3.28	0.004	12.76	-0.002	-10.26
0.006	23.46	-0.011	-9.88	-0.006	-16.64	-0.002	-6.80
-0.002	-2.38	-0.011	-2.45	0.014	10.21	-0.001	-1.35
-0.033	-13.23	0.030	2.79	-0.010	-3.10	0.011	4.06
-0.012	-17.84	0.020	6.95	-0.006	-6.19	0.001	1.29
-0.005	-10.82	0.012	5.96	-0.005	-8.13	0.000	0.22
-0.002	-5.22	0.002	1.25	-0.003	-5.16	0.000	0.60
0.003	6.34	-0.004	-2.30	0.000	0.83	0.001	1.61
0.005	9.89	-0.010	-4.50	0.001	0.90	0.002	4.11
0.007	11.79	-0.011	-4.68	0.001	1.94	0.003	4.28
0.009	15.41	-0.016	-6.21	0.003	3.81	0.002	3.75
0.011	17.50	-0.024	-9.00	0.005	6.02	0.003	4.54
0.013	20.74	-0.027	-10.05	0.009	10.36	0.005	6.90
0.014	21.28	-0.035	-11.80	0.013	14.22	0.007	10.17
0.017	22.27	-0.046	-13.74	0.020	18.76	0.009	10.56
0.020	19.54	-0.048	-10.77	0.028	19.87	0.011	10.05
-0.001	-2.35	-0.001	-0.47	0.014	26.27	0.004	9.76
-0.002	-4.72	-0.001	-0.69	-0.005	-10.38	0.002	4.97
-0.003	-5.50	0.009	4.65	-0.006	-10.05	0.001	1.55
-0.002	-4.27	0.016	7.42	-0.008	-11.78	-0.001	-1.27
-0.003	-5.71	0.017	6.57	-0.010	-11.74	-0.001	-1.03
-0.004	-6.52	0.017	5.96	-0.006	-6.72	0.001	0.95
-0.004	-6.50	0.013	4.58	-0.005	-5.61	0.001	1.92
-0.004	-6.19	0.015	4.98	-0.006	-6.13	0.003	3.63
-0.005	-6.64	0.016	4.93	-0.009	-8.65	0.003	4.36

	Housewares & appliances		Rent/Rental value	
	coef.	z-values	coef.	z-values
# other persons age 50-54	-0.023	-9.34	-0.029	-14.33
# other persons age 55-59	-0.023	-9.23	-0.031	-14.70
# other persons age 60-64	-0.025	-9.63	-0.032	-14.93
# other persons age 65-69	-0.026	-9.67	-0.033	-14.96
# other persons age 70-74	-0.022	-6.99	-0.033	-13.03
# other persons age 75-79	-0.022	-5.97	-0.024	-7.85
# other persons age 80->	-0.033	-5.97	-0.029	-6.22
Log(price food)	0.082	3.41	-0.089	-7.41
Log(price food out)	-0.130	-7.22	-0.032	-3.27
Log(price alcohol)	0.008	0.55	-0.017	-2.42
Log(price tobacco)	-0.011	-1.61	-0.029	-7.85
Log(price clothing & footwear)	0.048	4.21	-0.013	-2.01
Log(price leisure activities)	0.046	1.41	0.045	2.63
Log(price housewares & appliances)	-0.201	-4.93	0.040	2.31
Log(rent)	0.040	2.31	0.176	15.15
Log(price utilities)	-0.036	-10.86	-0.021	-11.63
Log(price transportation)	0.020	0.83	-0.061	-3.94
Log(price personal care)	0.011	0.50	-0.001	-0.11
Log(price medical care)	0.028	1.73	-0.006	-0.68
Log(price miscellaneous)	0.095	6.61	0.008	1.08
log(standardized expenditures)	0.545	4.01	-0.217	-1.95
sq. log(standardized expenditures)	-0.027	-3.93	0.008	1.44
Constant	-2.631	-3.92	1.521	2.77
R-squared	0.128		0.366	

Utilities		Transportation		Personal care		Medical care	
coef.	z-values	coef.	z-values	coef.	z-values	coef.	z-values
-0.007	-8.63	0.020	6.19	-0.011	-10.39	0.004	4.61
-0.008	-9.96	0.025	7.39	-0.012	-11.65	0.003	3.92
-0.008	-10.23	0.026	7.69	-0.013	-11.86	0.004	4.37
-0.010	-11.83	0.026	7.35	-0.012	-11.11	0.005	5.74
-0.010	-10.33	0.025	6.23	-0.011	-8.96	0.006	5.58
-0.010	-9.05	0.031	6.19	-0.009	-6.03	0.008	6.86
-0.008	-4.57	0.036	4.92	-0.003	-1.24	0.009	4.74
-0.003	-1.13	0.066	3.92	0.027	1.51	-0.084	-6.75
-0.013	-6.98	0.073	5.59	0.054	5.11	0.013	1.32
0.002	1.24	-0.018	-2.17	-0.037	-3.17	0.020	2.29
-0.003	-3.19	0.021	3.60	0.000	0.05	-0.003	-0.90
0.010	7.35	-0.038	-3.87	-0.002	-0.33	0.012	2.04
0.021	5.92	-0.080	-3.19	-0.044	-2.14	0.057	3.55
-0.036	-10.86	0.020	0.83	0.011	0.50	0.028	1.73
-0.021	-11.63	-0.061	-3.94	-0.001	-0.11	-0.006	-0.68
0.050	69.12	-0.010	-3.24	-0.012	-6.41	0.012	7.87
-0.010	-3.24	0.057	1.71	0.026	2.19	-0.018	-1.92
-0.012	-6.41	0.026	2.19	0.055	2.95	-0.038	-3.50
0.012	7.87	-0.018	-1.92	-0.038	-3.50	0.001	0.05
0.003	1.76	-0.036	-3.50	-0.038	-4.08	0.007	0.90
-0.661	-16.02	1.382	7.70	-0.117	-2.09	0.197	4.43
0.031	15.09	-0.068	-7.45	0.006	2.25	-0.009	-4.17
3.506	17.22	-6.904	-7.79	0.574	2.08	-1.019	-4.64
0.490		0.143		0.116		0.042	

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Inflation experiences of retirees

The inflation people experience depends on their expenditure patterns and price developments. This paper by Adriaan Kalwij (UU), Rob Alessie (RUG), Jonathan Gardner (Towers Watson) and Ashik Anwar Ali (RUG) aims to identify groups of people that have experienced relatively high price inflation over the last decades and could thus be considered most vulnerable when indexation does not take place. For this purpose they use household budget survey data from 1978 to 2004, supplemented with price information from 1978 to 2012.

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