Changes in diet at retirement and consequences on health in France

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Abstract

We estimate the impact of retirement on both food expenditure and food quantities purchased and assesses the associated health consequences in France, using home-scan panel data on household characteristics and food purchases and an epidemiological model. To identify a causal relationship, we exploit variations in the French legal minimum age for retirement as an exogenous shock to retirement behaviour. We find drops in food expenditure and quantities purchased at the aggregate level and for several food product categories. Health effects are ambiguous, with positive effects attributable to decreases in fat, cholesterol, salt and sugar consumption that have to be contrasted with potentially important negative health consequences due to lower protein, mineral and vitamin intakes. The effects are stronger for individuals from modest income households.

Keywords: Retirement, nutrient intake variations, diet-related diseases, mortality, regression discontinuity design

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1. Introduction

Population ageing is one of the most significant social transformations of the twenty-first century. In Europe, 25% of the population is already aged 60 years old or over and this proportion is projected to reach 35% in 2050 (United Nations, 2017). An issue of increasing concern for public policy is how this growing part of the population is affected by transition into retirement. This paper explores the effects of retirement on household food consumption and health in France. According to the World Health Organisation report on ageing and health (World Health Organization, 2015, pg. 70), maintaining adequate nutrition in older age is important in order to prevent or postpone the development of non-communicable diseases (NCD) as well as to reverse or delay declines in capacity and conditions such as frailty. Knowing how exactly retirement impacts food consumption and understanding the health consequences of these changes would allow policy makers to develop and correctly target preventive policies. Besides potential improvements in the well-being of the concerned individuals and families, such policies seem particularly necessary in a context of growing public health service costs associated with the treatment of chronic health conditions and elder care.

The vast literature on the impact of retirement on household consumption shows that households substantially reduce food expenditures upon retirement (Fisher et al., 2008; Hurst, 2008; Miniaci et al., 2010; Aguila et al., 2011; Barrett and Brzozowski, 2012; Luengo-Prado and Sevilla, 2013; Li et al., 2015). This fact has been named the "retirement (food) consumption puzzle" because it stands in contradiction to the implications of the standard life-cycle model of consumption which predicts that forward looking agents will smooth their consumption over their lifetime to avoid fluctuations induced by predictable income changes (Modigliani and Brumberg, 1980; Friedman, 1957). However, decreases in food expenditures do not necessarily indicate that quantities consumed vary to the same extent. After retirement, relatively cash-poor but time-rich households might devote more time to shop for bargains or produce time-intensive and relatively cheaper home-cooked meals. Evidence for this theory has been presented in Aguiar and Hurst (2005) and Dong and Yang (2017) which are some of the very few studies considering changes in actual food quantities consumed. However, these studies rely on food frequency questionnaires which might be subject to a high degree of measurement error. The few other studies we could find (Helldán et al., 2012; Plessz et al., 2015) use only a limited set of food products in addition to relying on data from food diaries. This relatively scarce amount of evidence leaves us still uncertain about the actual existence of the retirement food consumption puzzle. Finally, variations in different food products consumed do not have the same health effect and can compensate or exacerbate each other (e.g. a decrease in fruit and vegetable consumption can be compensated with a decrease in the consumption of fatty products). Knowing *which* and *how* each food product category varies in terms of quantity is therefore essential to assess how health evolves after retirement. To the best of our knowledge, none of the existing studies investigate the impact of retirement on diet in such great detail.

Our objective is to assess the impact of transition into retirement on food consumption not only in terms of household expenditure but also in terms of quantities purchased and to partially evaluate the health consequences of such changes. We use detailed home-scan data on all food items purchased by a representative panel of French households from *Kantar Worldpanel* covering the period 2005 to 2014. It allows us to differentiate several food categories and to control for various household and individual characteristics. Our method consists of two distinctive steps. First, we implement a Regression Discontinuity Design (RDD, see Lee and Lemieux 2010) to investigate variations in household food expenditure and quantities purchased at the onset of retirement. As the decision to retire is often a choice and likely to be determined by a range of unobservable characteristics which may be correlated with food consumption (e.g health status, household wealth), we expect the Ordinary Least Squares (OLS) estimates to be biased. Following Battistin et al. (2007), Li et al. (2015) and Godard (2016), we address this endogeneity issue using the legal minimum age for retirement as an instrument for retirement status. This identification strategy rests on the fact that reaching the minimum legal age for retirement (and thus becoming eligible to pension benefits) exerts a powerful influence on the individual's decision to retire (Diamond and Gruber, 1999), making retirement increasingly likely around this age. This discontinuous incentive in retirement schemes provides an exogenous shock on retirement behaviour which is exploited to estimate the causal impact of a transition to retirement. In a second step, the estimated variations in household food quantities purchased are translated into changes in individual nutrient intakes, using the INCA2 dietary intake database (Dubuisson et al., 2010). The nutrient intake variations are then fed into the epidemiological model DIETRON (Scarborough et al., 2012b), allowing us to evaluate the impacts on mortality due to non communicable diseases (NCD) such as chronic heart diseases, stroke and diet-related cancers.

We show that the retirement of the household head is associated with statistically significant drops in annual household food expenditures and quantities purchased. The changes are heterogeneous across the different food categories and differ across income groups. The decrease in the consumption of food groups containing high levels of fat, cholesterol, salt and sugar have positive health effects and might avoid as much as 6,462 deaths per year. Individuals from modest income households are particularly concerned, accounting for almost half of the deaths avoided (3,085). It is important to note that we also find decreases in protein, mineral and vitamin intakes which are not taken into account in the DIETRON model[1] but which may have potentially important negative impacts on health, especially because malnutrition in older age has been shown to interact with the underlying age-related changes (e.g. reduced muscle and bone mass). Our results should therefore be considered to be a lower bound of potentially much more negative health impacts.

2. Data

We use home-scan data for France from *Kantar Worldpanel*, covering the period 2005 to 2014. It provides detailed information on all purchases of food products for a representative consumer panel of more than 33,188 households.[2] We focus on the subset of 1,132 households for which we observe the

[1] To the best of our knowledge, there does not exist a model similar to DIETRON which would also take into account variations in protein, minerals and vitamins.

[2] Kantar is a private company specialised in the construction of consumer panels and analysis for market research purposes. The firm provides households with hand-held scanners which are used to scan all food purchases of every good with a bar code. Food items without a bar code are entered manually by the panellist. For more information, refer to the Kantar Worldpanel website at https://www.kantarworldpanel.com/global/Consumer-Panels.

transition into retirement of the household head and for which we have data at least one year before and one year after retirement. Available information on household and individual characteristics include the number of household members, household income bins, individual socio-economic categories (SEC), age, gender, height, weight, education level, occupation status, the number of meals taken at home during a typical week, information on potential home production of food (presence of a garden or fruit trees) and the location of the family home (rural vs. urban). Information on food purchases include the product type, quantity, price and purchase date.

Household consumption is constructed as annual amount of product purchases, both in terms of total price denominated in Euro and total quantity measured in grams. To alleviate the estimation process, we divide the French diet into 15 categories. Following Allais et al. (2010), we carefully categorise the food products, taking into account similarities in the nutritional content and consumer preferences. The following categories are defined: red meat (beef and veal), other meat (poultry, pork, lamb, etc.), cooked meat (ham, pâté, sausages, bacon, etc.), dairy (milk, cheese, butter, cream, etc.), fish and seafood, potatoes, grain products (bread, pasta, rice, wheat flour and cereals), fruits (including juices), vegetables (including soups), ready meals (pizza, sauerkraut, cassoulet, etc.), oils and vegetable fat, salt-fat products (finger food, chips, crackers, appetisers), sugar-fat products (candy, chocolate, cookies, pastry, ice cream, jam, etc.), soft drinks (sodas, lemonade, syrups, etc.) and alcoholic beverages. Table A1 in the online appendix provides descriptive statistics of food consumption and household and individual characteristics.

3. Method

3.1. Empirical Strategy

We employ a Regression Discontinuity Design (RDD) to quantify the impact of retirement on household food consumption. The RDD can be implemented when assignment to treatment depends on an observable "running" or "forcing" variable and there exists a known point in the support of this variable where the probability of receiving treatment changes discontinuously. The treatment effect is estimated comparing outcomes for observations situated closely above and closely below the treatment threshold, yielding a local average treatment effect on the treated. In the present case, the treatment corresponds to the change in the retirement status and the running variable is the distance in years from the year in which the change in the retirement status takes place. Individuals close to the discontinuity are likely to be similar, which allows to identify the effect of the treatment. It is assumed that consumption would be the same around the threshold if individuals would not retire.[3]

The estimates are obtained from the following equation

$$C_{ht} = \alpha + \beta R_{ht} + \gamma f(t - \tilde{t_R}) + \rho X_{ht} + \epsilon_{ht},$$

where C_{ht} stands for the different measures of food consumption of household h at time t, R_{ht} is equal to 1 when the household head of household h is retired at time t and 0 otherwise and X_{ht} denotes household and individual covariates. The parameter of interest is β, the difference between consumption for households in which the household head is not yet retired and consumption just after retirement. The function f is a polynomial function of the distance in years from the year in which the retirement head retires (the running variable). Following the algorithm proposed in Imbens and Kalyanaraman (2011), we calculate that the optimal bandwidth is situated between 2 and 3.

We consider a wide range of covariates, including family size, the family's calorie needs (constructed as the sum of the Basal Metabolic Rate (BMR) of each family member using their height, weight, age and gender), dummy variables for the SEC of the household head before retiring, and a dummy variable indicating whether the household head and/or the spouse obtained a university degree. We do not dispose of information on food taken out of home but we include the number of meals taken at home reported in *Kantar Worldpanel* to control for the proportion of food eaten at home to food eaten outside. For some specifications we include a dummy indicating whether the household possesses a garden or fruit trees and a dummy for household living in a rural area to account for the possibility of home production.

[3]There is no direct possibility for testing this assumption, however, falsification tests are implemented in order to verify whether choosing any other arbitrary treatment threshold would yield statistically significant estimates of a treatment effect at a time when treatment actually does not occur.

3.2. Addressing potential endogeneity bias

The decision to retire is endogenous since it is very likely based on unobservable individual and household characteristics which may also have an impact on both food consumption and retirement status. In theory, the direction of the bias is far from clear. Health issues might for example force individuals to retire earlier than expected, leading to a sharp permanent decline in their lifetime resources which should cause a decrease in consumption. An observed decline in food consumption could then be wrongly interpreted as a consequence of retirement when the actual underlying reason is a deterioration of health. A positive shock to wealth (e.g the end of a mortgage payment, inheritance) could lead to increased household consumption as well as anticipated retirement which we could wrongly interpret as a positive effect of retirement on food consumption.[4] Even in the absence of shock, bias may still be present. We expect rational households to choose the moment of retirement which allows them to optimise their consumption. However, this decision depends on unobservable time preferences which also influence household consumption.[5]

To identify the causal effect of retirement on food consumption, we exploit variations in the French legal minimum age for retirement at which individuals are eligible to either reduced or full pension benefits, conditional on a sufficient number of years of social security contributions.[6] This age is situated between 60 to 62 years depending on the individual's year of birth.[7] The legal minimum retirement age is a good instrument. First, it has been shown to exert a powerful influence on the individual's retirement behaviour (Diamond and Gruber, 1999; see also Godard, 2016 who exploits variations in the minimum retirement age through time and across Europe). It is also confirmed in our data where we can see from Figure A1 in the online appendix that most individuals retire between the age 60 to 62. Second,

[4]See for example Barrett and Brzozowski (2012) for empirical evidence on the importance of whether retirement was anticipated or not for determining the consequences on food consumption.

[5]Unemployment as a de facto bridging pension until pension benefits are available could pose another problem. In the present case this is less of a concern as our data allows us to control for employment status. The results are not sensitive to the inclusion of households in which the household head transitions from unemployment to retirement.

[6]This method has also been used by Battistin et al. (2007), Li et al. (2015) and Godard (2016). A complementary approach would use information on the reasons for retirement as in Barrett and Brzozowski (2012), but we do not dispose of such information in the database.

[7]See the *"Décret n° 2012-847 du 2 juillet 2012 relatif à l'âge d'ouverture du droit à pension de vieillesse"*, https://www.legifrance.gouv.fr/eli/decret/2012/7/2/AFSS1227748D/jo/texte

reaching the legal minimum retirement age cut-off, after controlling for age, is unlikely to be correlated with food consumption behaviour, except through the increased probability of retiring. This exogenous shock to the retirement behaviour should therefore allow us to estimate the causal impact of a transition to retirement on food consumption.

Formally, the retirement decision of the household head in household h at time t, R_{ht} is instrumented by an indicator variable, A_{ht}, equal to 1 if the household head's age is above the minimum retirement age $\tilde{a}_t$ and equal to 0 otherwise. The estimates are obtained from a two-stages least squares estimation with the first-stage equation

$$R_{ht} = \alpha_0 + \beta_0 A_{ht} + \gamma_0 f(age_{ht} - \tilde{a}_t) + \rho_0 X_{ht} + \epsilon_{0,ht}$$

and second-stage equation

$$C_{ht} = \alpha + \beta R_{ht} + \gamma f(age_{ht} - \tilde{a}_t) + \rho X_{ht} + \epsilon_{ht},$$

where f is again a polynomial function of the running variable which is now the distance in years between the household head's age, age_{ht}, and his or her legal minimum retirement age $\tilde{a}_t$. For the construction of the running variable and the indicator variable A_{ht}, we carefully take into account that the French legal minimum retirement age varies as a function of the individuals birth year and changes over time due to the 2010 pension reform which increased the legal minimum retirement age for certain cohorts from age 60 to 62.[8] The rest of the variables correspond to what has been presented previously in the simple RDD model.

4. Results

Table 1 shows that households around the onset of retirement are indeed relatively similar which is key for the validity of our RDD. The number of household members, household total calorie needs and the number of meals taken home do not change at the onset of retirement in a statistically significant

[8]Details on the 2010 retirement reform can be found at http://www.vie-publique.fr/actualite/panorama/texte-vote/loi-du-9-novembre-2010-portant-reforme-retraites.html

manner. We find statistically significant variations in income which is unsurprising as drops in revenue are one of the changes that are typically associated with transition into retirement. The gross replacement rate (the pension benefits relative to earnings when working) for the average earners at retirement age in France is equal to 64% (OECD, 2017) and we would have expected an even sharper drop in income. However, the data only include income brackets. The retirement status of the spouse seems to change at the retirement of the household head. Spouses might have similar age and therefore retire simultaneously, or they might coordinate their transition into retirement. In our study, we therefore cannot distinguish the effect of household head retirement from the effect of spouse retirement.

[Table 1 about here]

4.1. The impact of retirement on household food consumption at the aggregate level

Tables 2 and 3 present results for the impact of retirement on food consumption at the aggregate level. The first three columns report regression estimates for different specifications of the OLS model and the last 3 columns present results for the IV model. The estimates are robust to the inclusion of different covariates.[9] The results from the OLS regressions suggest that retirement is associated with a drop of 13% to 14% in total quantities purchased and a drop of 15% to 16% in total food expenditures. This is consistent with previous literature where results for a decline in food expenditure have been situated in between 4% (Aguila et al., 2011) and 14% (Hurst, 2006; Hurd and Rohwedder, 2003; Hurst, 2008; Li et al., 2015). The IV regressions yield estimates that are at least 5 percentage points larger compared to results from the OLS regressions. Food quantities purchased drop by 22% to 24% and food expenditure declines in between 26% and 29%. The first-stage F-statistic of the test on the excluded instruments reported at the bottom of the Tables 2 and 3 suggest that we can reject the hypothesis of weak instrument.

[9]Models in which we include only the number of household members and year fixed effects yield comparable results.

[Tables 2 and 3 about here]

The results are robust to the inclusion of different bandwidths. For the OLS regressions, this can be seen in Table A2 in the online appendix. The lowest effects we find are drops of at least 10% in quantities purchased and 11% in food expenditure. Using larger bandwidths than 5 years before and after retirement does not lead to a further decrease in the magnitude of the estimates. For a further robustness check concerning the OLS model, we run placebo regressions where we set up the cut-off threshold up to 2 years before and after actual retirement. We find an absence of any strong, negative and statistically significant effects at any other threshold than at the moment of actual retirement. Table A3 in the online appendix shows that the only statistically significant estimates are situated at one year before and 2 years after actual retirement are positive, of low magnitude and only statistically significant at the 10%. The results from the IV model are also robust to the usage of different bandwidths (see Table A4 in the online appendix). Note however that the IV estimates are only statistically significant at the 10% level. This loss of precision is not surprising given that the IV regressions yield estimates of a Local Average Treatment Effect (LATE) which is identified for compliers, that is to say the subset of individuals whose behaviour is shifted by the instrument.[10] Variation in food consumption from non-compliers, meaning from individuals who retire at an age far away from the minimum legal age threshold is so not used in these regressions.[11]

The loss of precision when estimating the IV model becomes problematic when we want to investigate effects by income and at the food category level because this means using an even smaller number of observations, resulting in an even less precisely estimated results. We therefore chose to continue our investigation using the OLS model. Working with OLS is the more conservative approach because, in

[10]More precisely, compliers are individuals who reached the legal minimum age to be eligible for pension benefits and retired but would not have done so had they not reached this minimum age, and individuals whose eligibility to pension did not change and did not retire but would have retired had they reached the legal minimum retirement age.

[11]We do not observe the household head reaching the legal minimum retirement age for about 30% of the households when using a bandwidth of 9.

addition of leading to more precisely estimated results, the OLS estimates are downward biased and can be seen as a lower bound for any impact of retirement on food consumption. All results reported from now on are based on the Model 3 specification, which includes all covariates.

4.2. Heterogeneous effects and effects at the food category level

Table 4 reports the changes in food consumption for the 30% most modest income households, the households in the middle of the income distribution and the 30% richest households. As expected, we estimate that the modest income households experience the strongest drop in food expenditures (26.4%) and quantities consumed (19.7%). The strong drop in expenditures compared to the drop in quantities consumed may indicate that poor households change their spending behaviour more than they change the total amount of food intake. Households in the middle of the income distribution are subject to a decrease of around 10.9% in expenditure and 13.5% in quantities consumed. For the group of the 30% richest households, quantities consumed drop by 13.4% and expenditure by 11.1%. Note that expenditure for this group is less responsive than quantities purchased.

[Table 4 about here]

We finally explore the impact of retirement on food consumption at the level of the 15 food categories. The results for changes in food quantities purchased for the whole population are reported in Table 5. Changes differ across the food categories. We find statistically significant drops for the categories other meat (11.9%), cooked meat (11.2%), dairy products (13.6%), fish (11.5%), potatoes (21.2%), grains (9.1%), ready meals (9.9%) oils and condiments (9.7%), salty-fat products (12.3%), sugary-fat products (14.6%), soft drinks (21%) and alcohol (13.7%). The estimates on red meat and vegetables are only statistically significant at the 10% level. Effects in terms of expenditure are similar (see Table A5 in the online appendix) with coefficients of a slightly larger magnitude except for the categories potatoes, oils and condiments and soft drinks.

[Table 5 about here]

We find that the consumption of the different food categories changes differently across the income groups. The results are generally stronger for the 30% most modest income households. The coefficients on expenditure are generally larger than the coefficients on quantities consumed. For detailed results, refer to Tables A6 and A7 in the online appendix.

4.3. Nutrient intake variations and health consequences

The assessment of the health consequences requires the translation of the household level variations in food consumption into changes in food and nutrient intakes at the level of the individual. We follow Irz et al. (2015) to determine these intakes. Assuming that (i) the percentage changes in food consumption are the same for all the members of a given household, (ii) the percentage changes are the same for at-home and out-of-home consumption and (iii) the changes are permanent over time[12], we apply *significant* percentage variations obtained in previous section to the average adult intakes of the food components of each of the 15 food categories. These average intakes are calculated using INCA2 database on the population aged between 55 and 74 years,[13] which documents the individual food consumption of French adult consumers (Dubuisson et al., 2010). These variations in INCA2 food items are then translated into variations in nutrient intakes, using the INCA2 matrix of the nutritional contents of INCA2 food items.

The health effects are then assessed using the epidemiological model DIETRON, which allows the estimation of mortality rates attributable to coronary heart diseases, strokes and cancers. The input data of the DIETRON model are daily intakes of energy, fruit, vegetables, fibres, total fat, mono-unsaturated

[12]In order to know whether the effects of retirement on food consumption are temporary or relatively persistent over time, we run additional OLS regressions replacing the dummy for treatment status by a vector of dummy variables indicating that retirement takes place in a previous, current or future year. The results are reported in Table A8 in the annexe. The results are statistically significant for at least up to 3 years after retirement. Note that the number of households observed decreases over time and that this smaller number of observations might explain why results are not statistically significant thereafter. It seems that food consumption is impacted several years after retirement.

[13]Étude Individuelle des Consommations Alimentaires 2 de 2006-2007, (Agence Française de Sécurité Sanitaire des Aliments, 2009)

fatty acids, polyunsaturated fatty acids, saturated fatty acids, dietary cholesterol and salt. The exact pathways to specific diseases and intermediate risk factors are described in Scarborough et al. (2012b). The studies covered by the meta-analysis of risk factors are clearly listed in Table 1 of the same reference, while the relative risk ratios used in DIETRON are published in Table A2 of the Appendix of Scarborough et al. (2012a). We adapt the DIETRON model to France by calibrating the initial mortality levels by relevant causes, using the INSERM data on mortality attributable to major diet-related diseases[14]. We limit the study to individuals between the age of 55 and 74, since our food variations concern individuals around retirement age and focus on the effects of dietary changes on premature deaths. The chronic diseases considered in DIETRON account for slightly more than one third of total French mortality.

Table 6 reports the changes in daily intakes at level of the individual resulting from household level variations in consumption. Results are presented separately for the entire population, individuals from the 30% most modest income households and individuals from the 30% most well-off households. Transition to retirement brings about nutritionally beneficial changes but also adverse one. Positive changes can be attributed to the drop in food categories which are rich in fat, cholesterol, salt and sugars such as sugar fat products in general and certain dairy products (cheese, cream, etc.). These changes might save as much as 6,462 deaths per year, which is about 12.8% of the total number of deaths taken into account in the DIETRON model. These positive effects concern particularly individuals from the 30% most modest income households for whom we find 3,085 deaths avoided compared to just 1,290 for individuals from the 30% most well-off households. This is not surprising as we found that retirement leads to stronger drops in food consumption for these modest households, which also translate into more important drops in fat, cholesterol, salt and sugars.

[14]More information on this data can be found at the following link http://www.cepidc.inserm.fr/

5. Discussion

This paper investigates the causal impact of retirement on household food consumption and partially evaluates the health effects of the diet changes, using home-scan data from a detailed and representative panel of French households followed from 2005 to 2014. We find drops in aggregate household food consumption in terms of food expenditure as well as food quantities purchased of around 10% to 14%. Addressing the potentially endogenous nature of the decision to retire via IV regressions yields even stronger effects. The decreases in food expenditures and quantities purchased are heterogeneous across different food categories. They have positive health effects attributable to decreases in fat, cholesterol, salt and sugar consumption.

However, it is important to keep in mind that the epidemiological model DIETRON, used to measure the health effects associated with the diet changes at retirement, does not assess the impact of changes in protein, mineral and vitamin intakes.[15] We find that the diet changes at the onset of retirement translate into important drops in intakes of these macro- and micro-nutrients and this especially for individuals from modest income households. Although energy needs decrease with age, the need for most nutrients remains relatively unchanged. Malnutrition in older age interacts with the underlying age-related changes, often taking the form of reduced muscle and bone mass, and increases the risk of frailty. Malnutrition has also been associated with diminished cognitive function, a diminished ability to care for oneself, and a higher risk of becoming care-dependent (World Health Organization (2015)). The results from the DIETRON simulations should therefore be considered a lower bound of potentially more negative health impacts. We therefore recommend that food policies targeting individuals at the onset of retirement and older focus more on the improvement of the nutrient density of food and particularly that of vitamins and minerals in order to avoid adverse health effects.

[15]We remind the reader that we are not aware of any other model similar to DIETRON which would take into account variations in protein, minerals and vitamins.

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Table 1: Effects of Retirement on covariates, bandwidth 3

	Nb household members	Household BMR	Higher edu.	Nb. of meals	Spouse retired	Income
Retired	-0.00233	8.123	0.00739	-0.0270	0.394***	-92.63**
	(0.022)	(31.841)	(0.007)	(0.033)	(0.017)	(37.071)
Constant	2.414***	3439.2***	0.0840**	2.302***	0.00986	2080.6***
	(0.109)	(180.978)	(0.033)	(0.095)	(0.009)	(108.022)
Observations	5603	5335	5556	5555	5603	5603
R^2	0.014	0.012	0.007	0.008	0.292	0.014

Note: Robust standard errors clustered at the household level in parenthesis.

* p<0.10, ** p<0.05, *** p<0.01

Table 2: Effects of Retirement on on food quantities purchased

	OLS (bandwidth 3)			IV (bandwidth 9)		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Retired	-0.133***	-0.138***	-0.139***	-0.241*	-0.241*	-0.243*
	(0.032)	(0.032)	(0.032)	(0.137)	(0.132)	(0.132)
Nb. household members	0.134***	0.0184	0.0145	0.137***	0.0338	0.0294
	(0.042)	(0.042)	(0.042)	(0.042)	(0.041)	(0.041)
Household total BMR	0.000107***	0.0000992***	0.000101***	0.000120***	0.000111***	0.000111***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Income	0.0000203*	0.0000224**	0.0000209*	0.0000207*	0.0000227**	0.0000213**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Higher education = 1	-0.0888**	-0.0894**	-0.0878**	-0.126***	-0.117***	-0.118***
	(0.043)	(0.042)	(0.042)	(0.042)	(0.041)	(0.040)
Nb. meals home		0.182***	0.180***		0.174***	0.170***
		(0.022)	(0.021)		(0.019)	(0.019)
Garden or fruit trees			0.0505**			0.0779***
			(0.025)			(0.025)
Rural household			-0.0509			-0.0335
			(0.034)			(0.034)
Constant	12.60***	12.43***	12.43***	12.52***	12.41***	12.39***
	(0.096)	(0.095)	(0.098)	(0.087)	(0.087)	(0.089)
Observations	5300	5263	5263	6495	6433	6433
R^2	0.221	0.255	0.257	0.227	0.263	0.267
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
SEC dummies	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-stat				82.81	82.28	82.38

Note: Robust standard errors clustered at the household level in parenthesis.

* p<0.10, ** p<0.05, *** p<0.01

Table 3: Effects of Retirement on on food expenditure

	OLS (bandwidth 3)			IV (bandwidth 9)		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Retired	-0.149***	-0.153***	-0.153***	-0.270*	-0.290**	-0.291**
	(0.032)	(0.032)	(0.032)	(0.145)	(0.140)	(0.140)
Nb. household members	0.0879*	-0.0186	-0.0220	0.0813	-0.0161	-0.0199
	(0.048)	(0.048)	(0.048)	(0.050)	(0.049)	(0.049)
Household total BMR	0.0000958***	0.0000897***	0.0000925***	0.000114***	0.000107***	0.000109***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Income	0.0000678***	0.0000700***	0.0000686***	0.0000715***	0.0000733***	0.0000719***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Higher education = 1	-0.0954**	-0.0968**	-0.0947**	-0.143***	-0.137***	-0.137***
	(0.044)	(0.044)	(0.044)	(0.042)	(0.041)	(0.041)
Nb. meals home		0.165***	0.163***		0.158***	0.156***
		(0.023)	(0.023)		(0.019)	(0.020)
Garden or fruit trees			0.0141			0.0401
			(0.027)			(0.027)
Rural household			-0.0690*			-0.0517
			(0.036)			(0.037)
Constant	6.958***	6.808***	6.836***	6.873***	6.778***	6.780***
	(0.094)	(0.096)	(0.097)	(0.075)	(0.078)	(0.079)
Observations	5300	5263	5263	6495	6433	6433
R^2	0.188	0.215	0.216	0.192	0.218	0.219
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
SEC dummies	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-stat				82.81	82.28	82.38

Note: Robust standard errors clustered at the household level in parenthesis.

* p<0.10, ** p<0.05, *** p<0.01

Table 4: Effects of Retirement on food consumption by income, bandwidth 3

	Quantity	Expenditure
Retired - 30% poorest	-0.197***	-0.264***
	(0.044)	(0.046)
Retired - middle income	-0.109***	-0.135***
	(0.036)	(0.037)
Retired - 30% richest	-0.134***	-0.111***
	(0.040)	(0.040)
Constant	12.42***	6.829***
	(0.098)	(0.099)
Observations	5263	5263
R^2	0.257	0.205

Note: Robust standard errors clustered at the household level in parenthesis
* p<0.10, ** p<0.05, *** p<0.01

Table 5: Effects of retirement on food quantities consumed, bandwidth 3

	Red meat	Other meat	Cooked meat	Dairy prod.	Fish	Potatoes	Grains	Fruits
Retired	-0.0946*	-0.119**	-0.112***	-0.136***	-0.115***	-0.212***	-0.0913**	-0.0532
	(0.055)	(0.059)	(0.041)	(0.034)	(0.042)	(0.062)	(0.037)	(0.044)
Constant	8.323***	8.570***	8.538***	10.87***	8.376***	8.130***	9.184***	9.952***
	(0.237)	(0.306)	(0.206)	(0.121)	(0.195)	(0.335)	(0.142)	(0.221)
Observations	4933	4943	5240	5262	5228	4712	5252	5244
R^2	0.159	0.111	0.201	0.237	0.122	0.073	0.266	0.123

	Vegetables	Ready meal	Oils	Salt fat	Sugar fat	Soft drinks	Alcohol
Retired	-0.0627*	-0.0990**	-0.0968***	-0.123**	-0.146***	-0.210***	-0.137**
	(0.037)	(0.050)	(0.036)	(0.048)	(0.038)	(0.062)	(0.057)
Constant	9.889***	8.479***	8.945***	7.605***	9.390***	8.536***	9.399***
	(0.197)	(0.264)	(0.152)	(0.214)	(0.158)	(0.283)	(0.319)
Observations	5251	5199	5236	5154	5256	4923	5121
R^2	0.111	0.130	0.238	0.122	0.197	0.131	0.081

Note: Robust standard errors clustered over household in parenthesis.

* p<0.05, ** p<0.01, *** p<0.001

Table 6: Daily changes in the nutritional profile of the diet and resulting simulated health effects, entire sample

Daily changes in nutrients for the entire population
Percentage variations (%) in nutritional factor/indicator

Dietron nutritional factors (units)				*Other nutritional indicators (unit)*			
	%variation				%variation		
Nut. indicator	All	Poor	Rich	Nut. indicator	All	Poor	Rich
Fruits (g)	0.0	-16.8	0.0	Energetic density (kcal/100g)	-10.3	-13.3	-10.0
Vegetables (g)	-6.3	0.0	0.0	Proteins (g)	-10.7	-11.2	-8.8
Fibres (g)	-6.5	-9.0	-6.0	Available carbohydrates (g)	-9.5	-13.7	-10.6
Lipids (g)	-11.0	-14.7	-10.2	Sugars (g)	-7.8	-14.8	-8.0
MUFA (g)	-10.4	-13.6	-9.8	Calcium (mg)	-11.1	-16.7	-9.3
PUFA (g)	-9.5	-12.5	-9.6	Iron (mg)	-9.0	-9.6	-8.2
SFA (g)	-12.1	-16.9	-10.7	Potassium (mg)	-8.7	-10.6	-7.2
Cholesterol (g)	-11.5	-12.8	-9.5	Magnesium (mg)	-8.6	-10.1	-8.0
Salt (mg)	-9.1	-11.6	-7.7	Phosphorus (mg)	-10.8	-12.7	-9.2
Energy (kcal)	-10.5	-14.1	-10.5	Manganese (mg)	-7.9	-11.0	-8.5
				Copper (mg)	-8.7	-9.2	-7.2
				Zinc (mg)	-10.4	-10.7	-8.3
				Selenium (mg)	-10.6	-10.3	-8.1
				Iodine (mg)	-11.1	-15.3	-7.6
				Retinol (mg)	-8.6	-8.3	-6.6
				Beta-carotene (mg)	-6.3	-3.6	-1.7
				Vitamin D (mg)	-0.3	-0.5	-0.2
				Vitamin E (mg)	-8.3	-11.9	-8.5
				Vitamin C (mg)	-4.8	-11.7	-3.0
				Vitamin B1 (mg)	-9.4	-11.4	-8.2
				Vitamin B2 (mg)	-10.5	-13.1	-8.6
				Vitamin B3 (mg)	-9.6	-7.8	-8.4
				Vitamin B4 (mg)	-11.0	-9.0	-6.8
				Vitamin B5 (mg)	-10.1	-11.9	-8.7
				Vitamin B6 (mg)	-9.5	-10.8	-7.8
				Vitamin B9 (mg)	-8.0	-10.7	-6.1

Health effects of the simulated dietary adjustments
DA: Deaths averted per annum

	All	Poor	Rich
Mortality of DIETRON Diseases	50,567	19,572	11,381
DA on Dietron Diseases	6,462	3,085	1,290
% DA on Dietron diseases	12.8	15.8	11.3
% CHD	30.1	39.4	26.4
% Strokes	30.7	38.3	17.4
% Cancers	7.4	8,2	7.9

Note: mono unsaturated fatty acids (MUFA), polyunsaturated fatty acids(PUFA), saturated fatty acids (SFA), chronic heart diseases (CHD).

Table A1: Household and individal characteristics

Household and individual characteristics

Variable	Mean	Std. Dev.	Min.	Max.	N
Number of household members	2.07	0.96	1	8	9207
Age of the household head	61.67	5.74	18	91	9207
Age of the spouse	59.73	6.9	21	95	9207
Age at retirement	62.03	4.71	43	88	1132
Total household BMR	2979.84	1473.85	995.30	11402.2	8747
Higher education = 1	0.2	0.4	0	1	9130
Income	2606.54	1413.96	150	10000	9207

Annual household consumption

Variable	Mean	Std. Dev.	Min.	Max.	N
Red meat (grams)	16886.83	16892.64	60	188960	8615
Other meat (grams)	28536.2	29224.68	60	261784	8589
Cooked meat (grams)	23923	19087.13	0	178845	9177
Dairy products (grams)	180495.3	121987.27	210	1118827.5	9206
Fish (grams)	20284.2	20822.87	2.94	382197	9160
Potatoes (grams)	24384.63	74277.01	125	6330184	8206
Grains (grams)	37524.52	28162.75	125	318261	9191
Fruits (grams)	128834.84	109021.24	120	1656764	9175
Vegetables (grams)	88261.33	65123.89	60	736477	9191
Ready meal (grams)	25876.14	26609.19	0	310080	9106
Oil, condiments (grams)	22824.05	15800.26	75	129957	9172
Salt-fat products (grams)	7551.34	6963.71	50	66682	9011
Sugar-fat products (grams)	40746.24	31083.57	42	347047	9194
Soft drinks (grams)	53544.79	92200.95	130	1164000	8617
Alcoholic beverages (grams)	83269.21	108628.1	25	1182750	8951
Red meat (expenditure)	213.81	232.56	0.88	2084.78	8615
Other meat (expenditure)	236.08	228.53	1	1754.13	8589
Cooked meat (expenditure)	269.81	207.88	0.69	1636.55	9177
Dairy products (expenditure)	509.87	291.92	1.61	3038.57	9206
Fish (expenditure)	224.71	204.6	0.68	2252.93	9160
Potatoes (expenditure)	24.42	25.4	0.29	309.83	8206
Grains (expenditure)	111	78.72	0.35	761.69	9191
Fruits (expenditure)	239.88	203.2	0.8	2189.12	9175
Vegetables (expenditure)	202.67	145.33	0.3	1442.85	9191
Ready meal (expenditure)	175.01	179.08	0.67	2437.23	9106
Oil, condiments (expenditure)	83.67	57.03	0.43	1160.64	9172
Salt-fat products (expenditure)	63.41	58.3	0.39	606.91	9011
Sugar-fat products (expenditure)	290.59	211.4	1.06	2710.22	9194
Soft drinks (expenditure)	57.55	75.99	0.18	914.06	8617
Alcoholic beverages (expenditure)	364.01	435.44	0.42	4443.16	8951

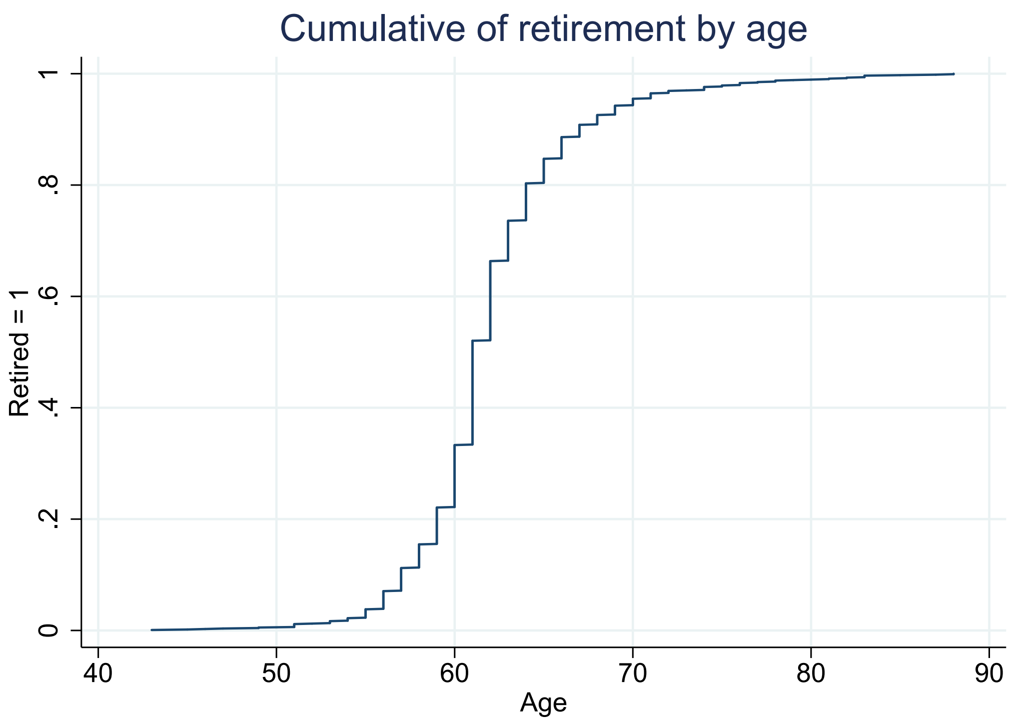

Figure A1: Cumulative of retirement by age

Table A2: Effects of Retirement on consumption, different bandwidths

	Bandwidth 3		Bandwidth 4		Bandwidth 5	
	Quantity	Expenditure	Quantity	Expenditure	Quantity	Expenditure
Retired	-0.139***	-0.153***	-0.123***	-0.138***	-0.108***	-0.119***
	(0.032)	(0.032)	(0.026)	(0.026)	(0.025)	(0.025)
Constant	12.43***	6.836***	12.47***	6.862***	12.49***	6.884***
	(0.098)	(0.097)	(0.096)	(0.094)	(0.092)	(0.090)
Observations	5263	5263	6297	6297	6931	6931
R^2	0.257	0.216	0.265	0.223	0.266	0.224

Note: Robust standard errors clustered at the household level in parenthesis.
* p<0.10, ** p<0.05, *** p<0.01

Table A3: Placebo regressions

	2 years before		1 year before		1 year after		2 years after	
	Quant.	Exp.	Quant.	Exp.	Quant.	Exp.	Quant.	Exp.
Retired	0.00115	0.00469	0.0484*	0.0509*	0.0291	0.0249	0.0537	0.0784*
	(0.020)	(0.021)	(0.028)	(0.029)	(0.024)	(0.025)	(0.037)	(0.040)
Constant	12.46***	6.851***	12.43***	6.828***	12.39***	6.789***	12.27***	6.668***
	(0.092)	(0.082)	(0.096)	(0.091)	(0.099)	(0.100)	(0.104)	(0.112)
Observations	4827	4827	4735	4735	4192	4192	2903	2903
R^2	0.294	0.255	0.271	0.232	0.297	0.254	0.338	0.291

Note: Robust standard errors clustered at the household level in parenthesis.
* p<0.10, ** p<0.05, *** p<0.01

Table A4: Effects of Retirement on consumption, different bandwidths

	Bandwidth 7		Bandwidth 8		Bandwidth 9		Bandwidth 10	
	Quantity	Expenditure	Quantity	Expenditure	Quantity	Expenditure	Quantity	Expenditure
Retired	-0.194	-0.242	-0.224	-0.272*	-0.243*	-0.291**	-0.221*	-0.265*
	(0.149)	(0.158)	(0.138)	(0.148)	(0.132)	(0.140)	(0.128)	(0.136)
Constant	12.39***	6.781***	12.38***	6.768***	12.39***	6.780***	12.39***	6.783***
	(0.088)	(0.075)	(0.090)	(0.079)	(0.089)	(0.079)	(0.088)	(0.079)
Observations	6072	6072	6283	6283	6433	6433	6551	6551
R^2	0.269	0.223	0.268	0.221	0.267	0.219	0.269	0.222
First-stage F-stat	70.15	70.15	76.76	76.76	82.38	82.38	87.68	87.68

Note: Robust standard errors clustered at the household level in parenthesis.

* p<0.10, ** p<0.05, *** p<0.01

Table A5: Effects of retirement on food expenditure, bandwidth 3

	Red meat	Other meat	Cooked meat	Dairy prod.	Fish	Potatoes	Grains	Fruits
Retired	-0.107*	-0.125**	-0.124***	-0.157***	-0.152***	-0.176***	-0.0930**	-0.0761*
	(0.055)	(0.055)	(0.041)	(0.032)	(0.040)	(0.053)	(0.036)	(0.042)
Constant	3.829***	3.703***	4.009***	5.202***	3.860***	1.654***	3.323***	3.709***
	(0.262)	(0.282)	(0.199)	(0.100)	(0.183)	(0.250)	(0.144)	(0.195)
Observations	4933	4943	5245	5262	5228	4712	5252	5244
R^2	0.117	0.100	0.172	0.215	0.129	0.082	0.225	0.128

	Vegetables	Ready meal	Oils	Salt fat	Sugar fat	Soft drinks	Alcohol
Retired	-0.0991***	-0.103**	-0.0791**	-0.131***	-0.158***	-0.148**	-0.167***
	(0.035)	(0.046)	(0.036)	(0.047)	(0.037)	(0.058)	(0.059)
Constant	3.889***	3.601***	3.300***	2.610***	4.333***	2.085***	3.924***
	(0.174)	(0.263)	(0.150)	(0.217)	(0.148)	(0.245)	(0.265)
Observations	5251	5211	5236	5154	5256	4923	5121
R^2	0.125	0.105	0.188	0.114	0.173	0.131	0.077

Note: Robust standard errors clustered over household in parenthesis.

* p<0.05, ** p<0.01, *** p<0.001

Table A6: Effects of retirement on food quantities consumed, bandwidth 3

	Red meat	Other meat	Cooked meat	Dairy prod.	Fish	Potatoes	Grains	Fruits
Retired - 30% poorest	-0.0978	-0.0428	-0.160***	-0.235***	-0.156**	-0.233**	-0.112**	-0.168***
	(0.076)	(0.083)	(0.057)	(0.049)	(0.061)	(0.090)	(0.053)	(0.061)
Retired - middle income	-0.0913	-0.117	-0.0613	-0.104**	-0.128**	-0.220***	-0.0531	-0.0430
	(0.069)	(0.079)	(0.052)	(0.042)	(0.053)	(0.078)	(0.046)	(0.056)
Retired - 30% richest	-0.106	-0.180**	-0.135***	-0.104**	-0.0897	-0.188**	-0.114**	0.00306
	(0.071)	(0.077)	(0.051)	(0.045)	(0.058)	(0.077)	(0.049)	(0.059)
Constant	8.325***	8.575***	8.533***	10.86***	8.375***	8.127***	9.181***	9.944***
	(0.238)	(0.306)	(0.206)	(0.120)	(0.198)	(0.336)	(0.142)	(0.223)
Observations	4933	4943	5240	5262	5228	4712	5252	5244
R^2	0.158	0.112	0.201	0.239	0.116	0.073	0.266	0.120

	Vegetables	Ready meal	Oils	Salt fat	Sugar fat	Soft drinks	Alcohol
Retired - 30% poorest	-0.0841	-0.165**	-0.134***	-0.150**	-0.187***	-0.203**	-0.266***
	(0.056)	(0.073)	(0.052)	(0.069)	(0.058)	(0.094)	(0.097)
Retired - middle income	-0.0453	-0.0104	-0.0477	-0.0682	-0.0989**	-0.173**	-0.0171
	(0.047)	(0.067)	(0.043)	(0.060)	(0.049)	(0.081)	(0.076)
Retired - 30% richest	-0.0707	-0.146**	-0.125***	-0.162***	-0.164***	-0.253***	-0.180**
	(0.050)	(0.067)	(0.048)	(0.060)	(0.051)	(0.080)	(0.079)
Constant	9.887***	8.472***	8.941***	7.602***	9.385***	8.536***	9.386***
	(0.197)	(0.262)	(0.152)	(0.213)	(0.158)	(0.282)	(0.321)
Observations	5251	5199	5236	5154	5256	4923	5121
R^2	0.111	0.131	0.238	0.123	0.197	0.131	0.082

Note: Robust standard errors clustered over household in parenthesis.

* p<0.05, ** p<0.01, *** p<0.001

Table A7: Effects of retirement on food quantities consumed, bandwidth 3

	Red meat	Other meat	Cooked meat	Dairy prod.	Fish	Potatoes	Grains	Fruits
Retired - 30% poorest	-0.176**	-0.124	-0.224***	-0.285***	-0.260***	-0.200***	-0.188***	-0.224***
	(0.080)	(0.078)	(0.058)	(0.045)	(0.060)	(0.076)	(0.051)	(0.059)
Retired - middle income	-0.120*	-0.134*	-0.0910*	-0.136***	-0.183***	-0.196***	-0.0495	-0.0842
	(0.070)	(0.074)	(0.051)	(0.038)	(0.052)	(0.064)	(0.044)	(0.054)
Retired - 30% richest	-0.0698	-0.133*	-0.107**	-0.101**	-0.0726	-0.143**	-0.0765	0.0145
	(0.075)	(0.072)	(0.052)	(0.041)	(0.057)	(0.066)	(0.048)	(0.057)
Constant	3.828***	3.706***	4.003***	5.193***	3.856***	1.648***	3.315***	3.701***
	(0.264)	(0.284)	(0.200)	(0.100)	(0.188)	(0.251)	(0.145)	(0.196)
Observations	4933	4943	5245	5262	5228	4712	5252	5244
R^2	0.112	0.097	0.166	0.211	0.111	0.082	0.226	0.118

	Vegetables	Ready meal	Oils	Salt fat	Sugar fat	Soft drinks	Alcohol
Retired - 30% poorest	-0.166***	-0.256***	-0.172***	-0.232***	-0.245***	-0.209**	-0.351***
	(0.053)	(0.070)	(0.052)	(0.067)	(0.055)	(0.083)	(0.094)
Retired - middle income	-0.103**	-0.0626	-0.0451	-0.0923	-0.116**	-0.0882	-0.0699
	(0.045)	(0.061)	(0.044)	(0.058)	(0.048)	(0.073)	(0.076)
Retired - 30% richest	-0.0626	-0.0586	-0.0632	-0.115*	-0.147***	-0.175**	-0.160**
	(0.048)	(0.061)	(0.047)	(0.059)	(0.049)	(0.071)	(0.079)
Constant	3.886***	3.591***	3.293***	2.604***	4.326***	2.080***	3.910***
	(0.174)	(0.264)	(0.150)	(0.218)	(0.149)	(0.244)	(0.269)
Observations	5251	5211	5236	5154	5256	4923	5121
R^2	0.119	0.100	0.182	0.110	0.173	0.132	0.075

Note: Robust standard errors clustered over household in parenthesis.
* p<0.05, ** p<0.01, *** p<0.001

Table A8: Dynamic effects of Retirement on consumption

	Quantity	Expenditure
t minus 2	-0.0245	-0.0327
	(0.019)	(0.020)
t minus 1	-0.0172	-0.00742
	(0.017)	(0.019)
t plus 1	-0.132***	-0.137***
	(0.025)	(0.026)
t plus 2	-0.0811***	-0.0764***
	(0.025)	(0.027)
t plus 3	-0.0633**	-0.0721**
	(0.032)	(0.033)
t plus 4	-0.0444	-0.0304
	(0.036)	(0.038)
t plus 5	-0.0835	-0.0706
	(0.054)	(0.055)
t plus 6	-0.0609	-0.0911
	(0.088)	(0.090)
Constant	12.47***	6.854***
	(0.050)	(0.050)
Observations	8616	8616
R^2	0.278	0.237
Year dummies	Yes	Yes
Dummies	Yes	Yes

Note: Robust standard errors in parenthesis
* p<0.05, ** p<0.01, *** p<0.001