The marginal propensity to consume out of a tax rebate: the case of Italy

Andrea Neri *

Concetta Rondinelli†

Filippo Scoccianti ‡§

Abstract

We estimate the consumption responses of Italian households to the income tax credit introduced in 2014, using the panel component of the Survey of Household Income and Wealth. We find that households that received the bonus increased their food and durable consumption by about 20 and 30 euros, respectively; these results are consistent with an aggregate marginal propensity to consume (MPC) out of the bonus in the range of 0.5-0.6. Responses are larger for households with low liquid wealth or low income. Our estimates are quite robust to different model's specifications and broadly in line with the evidence available from similar tax rebates in other countries but, due to the small sample size, are not statistically significant. To further support our results we have then simulated an overlapping generation model that can quantify

*Bank of Italy, Statistical Analysis Directorate, via Nazionale, 91, 00184 Roma Italy. E-mail: andrea.neri@bancaditalia.it.

†Bank of Italy, Economic Outlook and Monetary Policy Directorate, via Nazionale, 91, 00184 Roma Italy. E-mail: concetta.rondinelli@bancaditalia.it. Corresponding author.

‡Bank of Italy, Structural and Economic Directorate, via Nazionale, 91, 00184 Roma Italy. E-mail: filippo.scoccianti@bancaditalia.it

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households' consumption responses to the Italian tax credit: the MPC out of the model are in line with our empirical estimates. We show that low-income households, especially when young, compress their non-housing consumption and use most of their liquid saving to achieve their desired level of housing. We find that, given the lumpiness in house sizes, the tax credit is too small to allow for an increase in housing consumption. At the same time, households have few incentives to increase their liquid saving since the housing good already guarantees an important storage of wealth. As a result, households use the rebate to rebalance their consumption basket towards the composite non-housing good.

Keywords: fiscal stimulus, marginal propensity to consume, household expenditure, consumer behavior.

JEL Codes: D12, E21.

1 Introduction

During the Great Recession governments on both sides of the Atlantic have enacted large fiscal packages aimed at stimulating internal demand. In 2014, the Italian Government introduced a tax credit aimed at increasing households' consumption: according to government's estimates the fiscal package entailed a transfer of almost 7 billion euros in 2014, equivalent to 0.6 per cent of households' disposable income and 0.4 of Italian GDP. The Italian tax credit was introduced in May 2014 and was targeted to employees with gross annual income between €8,145 and €26,000. The bonus resulted in an average salary's increase of about 80€ per month. For earnings between 24,000 and 26,000€, the amount of the bonus was smaller.[1]

The effectiveness of tax credits in stimulating consumption has being the subject of much research. Increasing households' disposable income can be an effective way of stimulating expenditure and hence the entire economy (Guiso, 2015), but many factors may affect the fraction of the tax credit that is actually spent on consumption by households. The way the tax credit is financed should influence households' consumption responses: under the Barro/Ricardo hypothesis, rational households will simply save the money and not spend their rebate unless the tax cut is accompanied by a cut in government spending (Shapiro and Slemrod, 2003b). Moreover, the proportion of the bonus actually spent on consumption can be influenced by many factors, like the fraction of households that are liquidity constrained or the perceived horizon of the tax credit (permanent versus transitory).

We use the evidence from the Survey of the Italian Household Income and Wealth (SHIW) that asked households whether they spent or saved the money received from the stimulus package. This strategy follows the approach that Shapiro and Slemrod (2003a, 2009) and Sahm et al. (2010) have taken to analyzing United States' fiscal stimulus packages. Compared to the previous literature, we take a further step and, instead of just relying on what households declare, we use the panel component of the SHIW to analyze households actual behavior. Indeed, it may be difficult to disentangle the effective use of a relatively small amount of money; some authors (Sahm et al. 2012) have also argued that the role of mental

[1] In this specific income bracket the bonus was calculated as follows: 80€ X (26,000 - income)/2000.

accounts may be important when households reply to the questions, as when we ask people about their consumption they should have in mind a counterfactual state of the world in which they received no tax credit (Shapiro and Slemrod, 2003b).

We estimate the Marginal Propensity to Consume (MPC) out of the tax rebate[2] by comparing expenditures for households that received the payment with the expenditures of those that did not receive it but were otherwise similar in some key characteristics. Our comparison group (non-recipient households) is chosen using propensity score matching (as in Brzozowski 2007). We proceed this way to make sure that households in the comparison group that do not receive the payment had similar characteristics to payment recipients. We estimate an average MPC between 0.5 and 0.6, a magnitude in line with the relevant literature (Shapiro and Slemrod 2003a and 2009; Leigh 2012; Jappelli and Pistaferri 2014). Moreover, we find that responses to the tax rebate were larger for households with low liquid wealth or low income, as in Johnson et al. (2006) or Jappelli and Pistaferri (2014).

While our results are quite robust to different model's specifications, the final sample size of the credit recipients was too small to obtain statistically significant estimates. Therefore, to further support our empirical analysis we study what would have been the consumption response of Italian households to the tax credit in a structural model of households' consumption. The results from the model are broadly in line with the empirical estimates. Our model contribute to the strand of the literature that evaluates households' consumption responses to earnings shocks in heterogeneous agents models (Kaplan and Violante, 2010; Kaplan and Violante 2014; Violante et al. 2014; Huntley and Michelangeli, 2014; Cerletti and Pijoan-Mas, 2012). We show that when the housing good is expensive with respect to the nondurable good and is available in discrete and big sizes, a small positive shock, either transitory or persistent, cannot allow a further increase in housing consumption. At the same time, since housing represents a considerable store of wealth, it reduces the incentive to allocate part of the income increase to liquid saving. As a result, a relatively high fraction of the shock translates into a nondurable consumption increase. The MPCs out of the shock are higher for low liquid households, mainly young, since the marginal utility from an immediate increase in consumption is higher when cash-on-hand is low and those same

[2]In this paper we will call the tax credit also bonus or rebate.

households have a consumption basket skewed towards the expensive housing good and seize the opportunity of the tax credit to rebalance it towards non-housing consumption.

The reminder of the paper is organized as follows. Section 2 describes the tax credit together with the use of the SHIW to assess the effect of the rebate on household expenditure. Section 3 discusses our empirical methodology and presents the main results about the response to the rebate across different type of households. In Section 4 we use a dynamic structural model of household behavior to further support our empirical estimates of the MPCs out of the tax credit; the results and sensitivity analysis are presented in Sections 5 and 6, respectively. Section 7 wraps up the main findings of the paper.

2 The 2014 tax credit

The tax credit introduced by Decree Law 66/2014 benefited, starting from May 2014, employees with gross annual income between €8,145 and €26,000. According to government estimates, it entailed a transfer to households of almost €7 billions, equal to 0.6 per cent of households' disposable income.

The Decree Law 66/2014 stated that the employer, acting as a "withholding tax", should reduce the withholding tax to the employee in order to increase its salary by 80€ per month. If income tax deductions are not enough to reach the amount of 80€ then the employer may reduce the withholding of contributions for pension purposes. The bonus hence represented a reduction in labor taxes, i.e. the so-called 'tax wedge', that is the difference between the total cost of an employee to his employer and the pure compensation of the employees.

The tax credit of €80 per month (€640 for 8 months, from May 2014) was given to 10 million employees (including collaboration, occasional and project contracts) who have a gross annual salary ranging between €8,145 and €24,000. For earnings in between 24,000 and 26,000€, the bonus is calculated as follows: 80€ X (26,000 - income)/2000.[3] Those who earn less than 8,145€ (the so-called non-taxpayers) or more than 26,000€ and those who are not employed (retired, self-employed, unemployed etc.) are not entitled to the tax credit.

[3] A worker with annual income of 25,000€ will have a monthly bonus of 40€.

The eligibility condition is defined on individual income; thus a family can benefit from zero, one, or more tax credits depending on how many family members are employed.

With this tax credit workers in very similar conditions are being treated differently: those who are just below the minimum threshold (8,145€) are not entitled to the bonus while those who are marginally above that threshold are entitled to the extra 80€ per month.

The structure of the bonus increases the marginal tax rate to over 60% for the income bracket of between 24,000 to 26,000€, i.e. any additional euro gained in the range 24-26,000€ was taxed at a rate of over 60%, possibly creating distortions and inequities (Morelli, 2014). Additionally, households who lose their jobs during 2014 may have to repay part of the bonus received in the months they were employed. The monthly bonus is calculated on an annual basis, according to the number of months spent in employment. An employee with a gross annual salary of 15,000€ losing the job in September 2014, received 80€ from May to September but, on balance, was entitled only to a part of this bonus of 60€ (relating to the nine months of work in a year). Similarly, for those employees who got the job after January 2014, who were entitled to less than 80€: an employee who started its job at the beginning of May was entitled to only 60€ (the bonus is again proportional to just 9 months).

2.1 The income tax credit in the Survey of the Household Income and Wealth

From January to July 2015, the Bank of Italy conducted the biannual Survey on Household Income and Wealth on 2014 covering 19,366 individuals and 8,156 households. Although the primary focus of the Survey is on income and wealth it also included some questions about the tax credit. Households were asked if they received the tax credit, the amount and if it was spent, saved or used to repay debt. In Table 1 we reported the percentage of recipient households and the average amount of the bonus. Just over a fifth of households (about 5.4 million) said they had benefited from this bonus, receiving on average 86€ per month.[4] The proportion of households that received the bonus is higher in the North (25 percent), among

[4]The under-reporting of transfer programs is well documented in the literature (see Meyer and Mittag, 2015 for a recent contribution). According to the government estimates the tax credit entailed a transfer of almost 7 billion of €, compared to 3,2 billion of € declared in the survey.

those whose with household head younger than 45 years (37 percent) or foreign born (33 percent). As pointed out in the previous Section the rebate does not take into account the economic situation of the whole family and as a consequence, households with more income recipients have benefited more than the others.

Table 1: **Distribution of beneficiary households and average amount received.**

Characteristics)	Beneficiary households	Average monthly amount (euro)
34 and under	37.5	89
35 - 44	37.5	85
45 - 54	30.6	85
55 - 64	25.1	87
over 65	2.4	82
Educational qualification		
none	2.2	69
primary school certificate	4.6	89
lower secondary school certificate	28.1	85
upper secondary school diploma	28.7	87
university degree	20.8	84
Work status		
Employee	42.2	87
Self-employed	10.8	77
Not employed	3.2	81
Number of income recipients		
1	14.8	76
2	28.2	90
3	35.6	89
4 or more	43.7	120
Geographical area		
North	25.4	86
Centre	19	89
South and Islands	18.5	83
Country of origin		
Italy	20.8	86
Other	33	89
Total	**21.9**	**86**

Notes: Author's calculation from the SHIW. Sample weights included. Individual characteristics refer to the head of household, i.e. the member with the highest income.

By dividing the population according to their level of prosperity, measured by equivalent income at their disposal, the individuals belonging to the lowest fifth of the distribution (with an equivalized income below 9,000 €) received about 10 percent of total amount allocated; those in the highest fifth (with an income equivalent of more than 25,000 €) have received a total of approximately 17 percent of funds (see Figure 1). The remaining three-quarters of the amounts are flowed over almost equal to the other three fifths (Table 2).

The Survey also includes a direct question about the use of the tax credit. The tax

Table 2: **Distribution of tax credit by percentiles of equivalent income.**

Percentile of equivalent income	Share of tax credit received	Share of recipient households
1st fifth	9	13.3
2nd fifth	20.5	24.2
3rd fifth	25.4	25.6
4th fifth	28.2	28
5th fifth	16.9	16.7

Notes: Author's calculation from the SHIW. Sample weights included.

rebate module begins by briefly summarizing the tax rebate (see Section Appendix A) and then addresses the household's response to the rebate. Specifically, the key question asks, giving a value of 100 to the bonus, how it was divided in percentage terms between consumption, saving and the repayment of debt. The question is designed to map responses into well-defined economic concepts, though it is expressed in everyday language. Giving a value of 100 to the rebate, households reported that ninety percent of the bonus was spent on consumption. This percentage is higher for richer households but it has not a great variability. This might signal the difficulty in answering the question, since it may be difficult to disentangle the effective use of a relatively small amount of money (which represents about 3 percent of households' income). The quality of those replies should therefore be considered with caution. The way the question is formulated mostly resembles the one used in the pioneering paper by Shapiro and Slemrod (2003a), although they ask households whether the bonus was (mostly) spent, saved or used to repay debt. Although not directly comparable, our numbers are higher than the one reported in Shapiro and Slemrod (about 20 per cent; 2003a, 2003b and 2009) for the 2001 and 2008 US stimulus payment and in Leigh (about 40 percent; 2012) for the 2009 Australian fiscal stimulus. This higher declared spending rate may be reported when households have already the rebate in hand; additionally receiving the rebate confirms that the household is entitled to it and hence can add it to its lifetime resources available for spending (Shapiro and Slemrod, 2003b). Some authors (Sahm et al. 2012) have also argued that the role of mental accounts may be important when households reply to the questions, as when we ask people about their consumption they should have in mind a counterfactual state of the world in which they received no tax credit (Shapiro and Slemrod, 2003b). The issue is not whether the survey reflects actual behavior, but how

accurately it measures actual behavior compared to a counterfactual scenario.

As an attempt to understand the way consumer reply to the use of the tax rebate, Shapiro and Slemrod (2003a) find that the concept of expenditure has a short horizon (one month), while the one of saving and repaying debt means using the rebate to increase wealth over a horizon of at least a year. Estimating MPC out of the Regan tax cut, Souleles (2002) underlines that the Consumer Expenditure Survey asks people to remember expenditure on detailed goods and so it is possible that survey answers might not reflect households' actual behavior (see also Shapiro and Slemroad, 2003b).

Italian households have also been asked whether or not they think the fiscal rebate will also be confirmed in the future. In December 2014 the Stability Law extended the bonus in the coming years; given that the interviews were conducted from January to July 2015, at the time of the interview all households should have known the rebate to be permanent. In this case the permanent income model of consumption would warrant an increase in consumption that could at least be the same size of the rebate. Nevertheless, about half of the households reported expecting the tax credit to be a permanent intervention, while the other half believed that it will last no longer than 5 years (see Figure 2). These different perceptions of life have not, however, induced significant differences in the use that families said they made with the bonuses received which range around the average of 90 percent for both groups.

3 Micro evidence on the tax credit

3.1 The empirical methodology

Given the eligibility conditions defined on the basis of the gross annual income between 8,145€ and 26,000€, one would ideally use a regression discontinuity approach at the lowest and highest threshold to address the effect of the tax rebate, as those who earn less than 8,145€ or more than 26,000€ are not getting the tax credit. However, households report their net income instead of the annual gross income, so that this strategy cannot be applied

in our case.[5]. We have thus resorted to a difference in difference approach.

To estimate the marginal propensity to consume out of the fiscal stimulus we compare expenditure for households that received the payment with expenditure for those that did not receive the payments but were otherwise similar in some key respects. Of the 1,514 households receiving the bonus, 862 were also surveyed in the previous wave (2012), so we can exploit the panel dimension of the survey and work with households' actual level of consumption. The comparison group (non-recipient households) is chosen using the propensity score matching (as in Brzozowski, 2007): this is intended to insure that those in the comparison group who do not receive the payment had similar characteristics to payment recipients.

The characteristics of households receiving the bonus are likely to be quite different to those that did not receive it: for example they are likely to be in a particular age group, be employed, living in the North (see Table 1). This implies that their expenditure patterns may be different from the rest of the population, and hence comparing the expenditure of households that received the bonus to that of the wider population would be inappropriate. This circumstance may create a bias (usually called non-random program placement), as the impact of the program could be due to the effects of the pre-existing disparities. To minimize the selection issue driven by observable pre-treatment disparities (that is, the potential effect of X on the outcomes), we compare eligible (D=1) and non-eligible (D=0) households that display strong similarities before the start of the program (in 2012). This is accomplished by using the Propensity Score Matching.

Table 3 shows the balancing properties for the baseline sample (based on panel households) selected by Propensity Score Matching (PSM).[6] The Propensity Score is estimated for each households using a Probit model:

$$P(D_i = 1|x_i) = \Phi(x_i'\beta)$$

[5]Gagliarducci and Guiso (2015a and 2015b) use this identification strategy matching household budget survey data with administrative income data.

[6]We use the routine proposed by Leuven and Sianesi (2003). Matches are selected by the method of the nearest neighbor without replacement and within a caliper (0.01 percentage points), on the common support of fitted probabilities (see Dehejia and Wahba, 2002).

where D_i takes value one if the household is in the treatment group and zero otherwise and x_i is a vector of household characteristics. We include a number of variables to control for the propensity of receiving the bonus (bracket of income, work status), the demographic characteristics (geographical area, education, age, number of equivalized components, sample weights, variation in number of employee and in the number of older people in the household) and general economic conditions of the household. To account for the quality of households' responses to the SHIW questionnaire we also control for the subjective evaluation of the interviewer about households' responses to income questions.[7] All variables refer to 2012, that is, one SHIW's wave before the tax credit was put in place. As it is well-known (see, for instance, Blundell et al., 2004) systematic differences in levels between treated and control groups are not a concern, as they can be controlled for using the diff-in-diffs methodology. However, violation of the parallel trend assumption may invalidate the estimates.

As a result of the PSM, the sample includes 785 treated and 785 control households, both in 2012 and 2014. In Table 3 we report the mean and standard deviation for treated and control for each of the explanatory variable. The two groups appear very similar for all observables.[8]

3.2 The response of expenditure to the tax credit

Once a suitable control sample has been formed we compare the difference in the (weighted) conditional means of expenditure for the treatment and control group to get an estimate of the MPC. In practice we estimate:

$$c_i = \beta_1 + \beta_2 POST + \beta_3 BONUS + \beta_4 BONUS * POST + \epsilon_i \tag{1}$$

where c_i is the average consumption for household i, POST is a dummy variable taking value one in 2014 and it accounts for the general time trend effect; BONUS is a dummy variable equal one if the household is treated and it accounts for the effect of receiving the tax rebate on the consumption level of the households; the interaction term POST*BONUS captures

[7] This variable was inserted as we know that some households were reticent in declaring they received the bonus.

[8] Only the variable number of equivalised component has a border t-statistics (t-stat=1.7).

Table 3: **Balancing properties for the baseline sample.**

	Control		Treated		Mean differences	
	Mean	St.Dev	Mean	St.Dev	Mean	St.Dev
No. of components (equiv.)	1.991	0.575	1.943	0.546	0.048	0.028
Income (bracket)	3.538	1.382	3.497	1.282	0.041	0.067
Geographical area (bracket)	1.924	0.902	1.876	0.883	0.047	0.045
Age (bracket)	3.255	0.999	3.266	0.984	-0.011	0.050
Education (bracket)	3.460	0.946	3.471	0.846	-0.011	0.045
Work status (bracket)	1.638	0.851	1.608	0.886	0.031	0.044
Make ends meet	2.907	1.313	2.890	1.158	0.017	0.062
Δ(No. of employee) 2014-2012	-0.017	0.575	-0.017	0.485	0.000	0.027
Δ(No. of older people) 2014-2012	0.051	0.307	0.028	0.246	0.023	0.014
Sample weight	1.070	1.032	1.025	0.983	0.044	0.051
Quality of income responses	8.332	1.524	8.330	1.535	0.003	0.077

Notes: Author's calculation from the SHIW. All characteristics refer to the household head (HH). No. of components are equivalised giving weight 1 to the HH and 0.5 (0.3) to the other household members with age >=14 (<14). Income includes 5 brackets (in fifths); geographical areas are North, Center and South; age is reported in 5 classes (34 and under; 35-44; 45-54; 55-64; over 65); education is divided in 5 classes (none, primary school, lower and upper secondary school, university degree); work status includes employees, self-employed and not employed; general economic conditions of the household is captured by its ability in making ends meet, i.e. 1. with great difficulty, 2. with difficulty, 3.with some difficulty, 4. fairly easily, 5. easily, 6. very easily. Quality of income responses is a subjective evaluation of the interviewer about households' responses to income questions (on a scale from 1 to 10).

the effect of the bonus for treated households in 2014 and it is our variable of interest. We focus on different aggregated measures of consumption expenditure as in Johnson et al. (2006) and Parker et al. (2013). In particular we consider food, which include food consumed away from home and at home as a proxy of non durable expenditure. Durable expenditure is calculated for 1) transportation and 2) other durable goods. In particular, for 1) transportation we computed the total value of the objects bought (cars and other means of transport like motorcycles, caravans, motor boats, boats, bicycles) net of the total value of objects sold; 2) other durable goods we considered the expenses made for furniture, furnishings, household appliances and sundry equipment.

In Table 4 we present diff-in-diff estimates for the three outcomes. We find that a household receiving the rebate in 2014, on average increased its expenditure per month by 15€ on food and 27€ on transportation (Model 1). The expenses for other durable were mainly unchanged. These results are not statistically significant due to the higher variability of the expenses reported by the treated and control groups. In particular, the estimated effect of the bonus of food consumption is the difference-in-difference between an increase of 20€ for the treated group (555 and 575€, respectively for 2012 and 2014) and an increase of 6€

Table 4: **Baseline results.**

	Dep. Variable				
	Obs.	Food	Cars	Other durables	Implied MPC
Model 1	3,140	14.5 €	27.2 €	-0.1 €	0.48
		21.2	283.2	147.5	
Model 2	3,180	18.0 €	23.0 €	12.5 €	0.62
		20.3	287.6	118.4	
Model 3	3,440	13.6 €	19.1 €	12.3 €	0.52
		19.6	280.2	112.2	
Model 4	2,668	17.9 €	21.7 €	16.4 €	0.65
		21.6	272.8	111.2	

Notes: Author's calculation from the SHIW. All characteristics refer to the household head (HH). Standard errors in the second line of each Model. In Model 1 matches are selected by the method of the nearest neighbor without replacement and within a caliper (0.01 percentage points), on the common support of fitted probabilities. In Model 2 matches are selected by the method of the nearest neighbor with replacement and within a caliper (0.001 percentage points), on the common support of fitted probabilities. In Model 3 matches are selected by the method of the nearest neighbor with replacement and within a caliper (0.01 percentage points), on the common support of fitted probabilities. Treated and controls for models 1, 2, 3 are recovered from probabilities estimated under the balancing properties defined in Table 3. In Model 4 matches are selected by the method of the nearest neighbor without replacement and within a caliper (0.001 percentage points), on the common support of fitted probabilities. Treated and controls in Model 4 are recovered from a probit model that also includes the class of wealth the household belongs to, the change in the number of components with a university degree, the change in the sample weight of the household and a variable that captures a general feeling of the interviewer about the quality of the household's responses.

for the control group (604 and 610€, respectively for 2012 and 2014). The higher standard errors for cars and other transportation mainly reflects the variability of these expenses and the capability of households to afford means of transportation belonging to different segment of prices. The estimated average effect of the bonus is thus recovered from an average annual expenditure of 1036€ for treated (against 968€ for controls) in 2014 and 650€ (908€) in 2012. The purchase of other durable goods was broadly unchanged for the control and treated groups across the two years, although their level was different (620 and 525€ per year, respectively). The implied average marginal propensity to consume is slightly lower than 0.5, meaning that out of 100€ of increase in earnings, about half is consumed within the same year. We also noticed that the increase in transportation expenditure is higher compared to the one for other durables (furnishings, household appliances, etc..), that is, in turn, also lower than the one for food.

As a robustness check that the way the matches (treated and control) are selected is not affected by the method (nearest neighbor without replacement) and the caliper (0.01 percentage points) used, in Table 4 we also reported the average euro increase in expenditure induced by the tax rebate when nearest neighbor for the treated are selected with replacement and a caliper of 0.001 in Model 2 or 0.01 in Model 3. These two models confirm that the

average food expenditure increased by less than 15€ per month in Model 3 and 20€ in Model 2. In both models the sum of durable expenses is about 30€. The average MPC is thus between 0.5 and 0.6. Notice also that allowing a higher caliper (0.01) increases the number of matches (860 in Model 3 compared to 798 in Model 2), but does not reduces the standard errors to improve the efficiency of our estimates.

Finally we also tested that the specification of the probit model used to estimate the propensity score is not driving our findings (Model 4 in Table 4). Apart from the variables illustrated in Table 3, Model 4 also includes the class of wealth the household belongs to, the change in the number of components with a university degree (from 2014 to 2012), the change in the sample weight of the household (from 2014 to 2012) and a variable that captures a general feeling of the interviewer about the quality of the household's responses. The estimated marginal increase in expenditure (18€, 22 and 16 for food, transportation and other durables) are close in magnitude to those estimated in Models 1-3 and remain statistically non significant. The estimated marginal propensity to consume is 0.65.

Overall, the results across the various specification in Table 4 are quite consistent, implying that slightly more than half of the rebate was spent in 2014. The expenditure was higher for transportation compared to the purchase of other durable goods, which, in turn, was lower than the one allocated to purchase food.

3.3 Testing the liquidity constrain assumption

This Section analyzes heterogeneity in the response to the tax credit across different types of households and purchased goods.

The presence of liquidity constraints is a leading explanation for why household spending might increase in response to a tax rebate. The reaction of liquidity constrained household to an increase in current income is not univocal in the literature. Some authors (Shapiro and Slemrod 2009; Leigh 2012; Berger-Thomson et al. 2010) have argued that there is no systematic relationship between household income and spending rate, as low-income households are needy today, and because they are expected to be needy in the future, they do not necessarily use the rebate to increase spending (see also Sahm et al. 2012). On the other hand Johnson et al. (2006) find that, consistent with the liquidity constrain assumption,

households with low levels of liquid assets or low income spend a significantly greater share of their rebate than typical households.

Table 5: **Results for low cash on hand households.**

		Dep. Variable			
	Obs.	Food	Cars	Other durables	Implied MPC
Low cash on hand	1,172	34.5 €	47.6 €	-14.6 €	0.79
		31.4	350.9	164.3	
Low cash on hand (cars)	1,172	34.5 €	31.2 €	-14.6 €	0.59
		31.4	270.6	164.3	
Condgen=1	480	47.8 €	19.4 €	5.4 €	0.84
		35.0	282.0	104.5	

Notes: Author's calculation from the SHIW. All characteristics refer to the household head (HH). St. errors on the second line.

We consider the level of income, other financial constrains and a subjective evaluation about the ability of the household in making ends meet as indicator of liquidity constraints.

Our first measure of liquidity constrain is based on net financial wealth and labour income: we define a household as having low cash-on-hand if its net financial wealth (the difference between financial activity and financial liability) is smaller than half of its labour income (as in Broda and Parker, 2014). To match the treated and control group we selected the low cash-on-hand households in 2012 that were also in the panel component of the survey; we then looked for households to be used as controls within this group. We ended up with a sample of 1,172 households as reported in Table 5. The estimated MPC goes from 0.6, when only cars are included in the transportation category, to 0.8. After the tax credit the expenditure of food increased by about 35€ per month, while the one for transportation by 50€; about 65% of the former increase is due to the net (buy-selling) purchase of cars. The coefficient for other durables is negative and it reflects an annual decrease (from 2014 to 2012) of 105€ for treated and an increase of 70€ for the control. The larger share of the bonus devoted to food and cars, together with a negative change in expenditure for other durables, may be due to a grater allocation of the extra income to the satisfaction of basic (and not easy to compress) needs at the expense of leisure goods (like furnishings, household appliances, etc..). We also repeated the same exercise looking at high cash-on-hand households, defined as having net financial wealth greater than half of their labour income and found an average marginal propensity to consume of about 0.5, hence lower

than for low cash-on-hand's households.

Our second measure of constraints comes directly from the SHIW and it is provided by a subjective evaluation households give about their general economic condition in making ends meet. A dummy variable is created for households that reported that their income was hardly sufficient to see the household through to the end of the month. Slightly less than one fifth of the households (over 8,156) reported they had great difficulty in making ends meet; out of the 1,514 receiving the bonus, 15% reported great difficulty and were classified as low cash on hand. Only 129 of these households were also interviewed in 2012 and could be used for our analysis. After applying the propensity score matching only 120 treated could be matched with the controls: we estimate that the tax rebate, on average, increased the expenditures on food by 50€, on transportation by 20€ and on other durables by 5€ for households with greater difficulty to see them through to the end of the month (Table 5). Notice also that the implied marginal propensity to consume rises to 0.8, with a higher contribution of expenditure on non durables compared to durables.

Overall, we find that constrained households tend to spend more of their extra income compared to the average population. The estimated marginal propensity is between 0.6 and 0.8.

4 A model of consumption responses to the tax credit

In this section we use a dynamic structural model of household behavior to replicate the empirical estimates of the MPCs out of the tax credit. We build an overlapping generation model where households derive utility from the consumption of both a non-housing good (a composite good made up of durables and nondurables) and housing services, that can be rented or bought. There is a minimum house size that has to be bought to access homeownership. House sizes are not continuous but come in predetermined and quite large sizes. This implies that a house upgrade always represents a rather big cost. Houses cost twice as much the non-housing good, whose price is normalized to one. Houses are illiquid in that a transaction costs has to be paid when the house is bought or sold. Households can get into debt to finance up to 80 per cent of the value of a house through a long-term mortgage

contract. Mortgage debt has to be repaid by retirement in fixed parts, comprising a fraction of the principal plus interest payments every period. Households are born with zero housing or liquid saving and belong to 1 of 5 different levels of deterministic life-time earnings. There are stochastic innovations to earnings that can be either persistent or transitory. We fix the size of those stochastic innovations to equal the size of the Italian tax credit. Upon retirement households enjoy a social security replacement income that equal a fraction of their last working-year earnings. All the details of the model and of the calibration are in the Appendix B.

We contribute to the literature on the consumption responses to shocks by showing that housing lumpiness is key in achieving MPC's levels that are in line with data estimates, both against persistent and transitory positive shocks. The framework most similar to ours is Kaplan and Violante (2014), where the absence of housing lumpiness and the inaction region it introduces is circumvented by an increase in housing transaction costs and, at the same time, a negative real returns to liquid savings. In Kaplan and Violante (2014), the (risk-adjusted) return on the liquid asset is negative and high transaction costs on housing are needed to ensure that households do not find it profitable to liquidate their housing good to smooth out a transitory earnings shocks. When households receive a transitory shock then, they readjust non-housing consumption for two reasons: on the one hand, liquid savings are 'taxed' since their rate of return is negative; on the other hand tapping liquidity from the housing good (in the case of a negative shock) is extremely costly because of the very high transaction costs. Household then end up consuming a fraction of their earnings shock.

In the next section we report the result from the simulation of our model.

5 Results

5.1 Results

In this section we show that a structural model of households consumption with two goods, housing and non-housing, can replicate the empirical estimates of the MPC out of the Italian

bonus we provided in Section 3. We don't make any specific assumption on the information structure of the tax rebate. In particular, we treat the rebate as a positive random earnings shock that can be either persistent or transitory. We do so because survey respondents in the SHIW where almost evenly split among households that considered it to be permanent and households that expected it to be transitory (see Section 2.1).

Our model delivers an average MPC out of the bonus equal to 0.57, a magnitude that is broadly in line with the result of our econometric estimation: out of 100 euros of a positive earning shock slightly more than half is consumed within the same year.[9] Figure 3 shows the evolution of MPCs by age up to retirement. There is a decreasing dynamics by age that is influenced by households' liquidity holdings. We report results splitting households by low and high cash-on-hand, as in Broda and Parker (2014). The authors divide households in two groups and find very strong (and statistically significant) evidence that households with a low ratio of liquid assets to income spend at least twice as much as the average household. Also Souleles (1999) studies the consumption response to anticipated tax refunds. When the sample is split between low and high liquid wealth to earnings ratio households, the former are found to have statistically significant larger responses to the refund (Souleles, 1999, Table 4).

We define households as having a low level of cash-on-hand when they hold an amount of liquid saving that is smaller than half of their yearly earnings; conversely, households are defined as having high cash-on-hand when their liquid saving are bigger than half of their yearly earnings. When we consider only households with low levels of cash-on-hand with respect to earnings, the average MPC against any type of shock is 0.84 and has a strongly decreasing pattern over the life-cycle, see Figure 4. Indeed, within households defined as having low liquidity, the young are the age-group that has comparatively less liquidity. On the contrary, households with high levels of cash-on-hand have a lower average MPC (0.45), and the decreasing dynamics of the MPCs over the life-cycle is attenuated. MPC's are

[9]The MPCs in the model are estimated in the following way: optimal policy functions are used to run a Monte Carlo experiment and create a sample of consumption changes and earnings shocks. Then we regress changes in log consumption on changes in earnings innovation to estimate the MPCs. The average MPC estimated on different samples (splitting by shocks durability or not, by liquidity levels or not) are hence not completely comparable as different samples may sometimes give rise to rather average different estimates.

found to be decreasing by liquidity levels also by Jappelli and Pistaferri (2014; see Figure 2), where the MPCs out of a transitory shock declared by survey respondents themselves in the 2010-SHIW data show a clear decreasing pattern by levels of cash-on-hand.

We further explore the differences between a positive shock to earnings of the size of the Italian bonus that is considered to be transitory and one that is considered to be persistent, always considering different liquidity levels. Table 6 shows that transitory shocks have higher MPCs only for low cash-on hand households.

The theoretical benchmark against which to interpret these results is given by the standard permanent income hypothesis (PIH thereafter), which is usually framed within a one asset's, one consumption good's model. The permanent income hypothesis suggests that consumption should react to unanticipated income shocks, and that the response should be higher for permanent than for transitory innovations to income. Risk-averse households make optimal consumption plans that imply a strong form of consumption smoothing: a transitory positive innovation to income should be almost completely saved away in order to leave consumption as stable as possible, while a shock that raises permanent income should map into a rise in both the levels of consumption and life-time saving.

Contrary to the standard PIH, we use a life-cycle model where households derive utility from two goods: a housing good and a non-housing composite good. The former is also an asset since it can be liquidated at any time, subject to paying a transaction cost. Moreover, housing can be used to alleviate market incompleteness: households can borrow against their housing asset and hence limit the amount of saving they need to access homeownership, while at the same time freeing up resources for their non-housing consumption. All these characteristics makes housing a valuable good to purchase especially early in the life-cycle, when the joint need to accumulate a target level of life-time saving and overcome borrowing constraints in the face of a rising deterministic income profile is more stringent.

Crucially, we assume that the housing good is available only in very different sizes. This implies that the very nature of housing makes its adjustment lumpy. For instance, households cannot decide to upgrade from a 50 squared meters house to a 51 squared meters house, they are forced to jump to a 80 squared meters house. Moreover, there is a minimum size house to become homeowners.

This double role of housing as both a consumption and a long-term saving good, coupled with collateral borrowing and the lumpiness in housing adjustment, profoundly changes the implication of the standard PIH model. In particular, given that housing services and the non-housing composite good are substitutes in the utility function, young households tend to compromise on their level of non-housing consumption to acquire their target level of housing services. This substitution towards housing will be more important the bigger is the minimum house size needed to become homeowner. Also, since housing is expensive most liquid saving are either used to buy the house directly or to enter a mortgage contract, so that many households are left with few liquidity. Once into homeownership households find it optimal to leave their housing choice as stable as possible, since house sizes are lumpy and there are transaction costs on purchasing a new house. The stability of the housing choice is all the more understandable in the presence of a small positive shock, like the one represented by the Italian bonus which amounted to just around 3 per cent of average households yearly earnings. Part of the positive earnings shock is used to increase the level of liquid saving, but since the majority of households have either a considerable amount of wealth (compared to their earnings) tied in their house or are saving to become homeowners, their incentive to use the proceeds from the bonus to increase their liquid saving is reduced. To sum up, since households have a consumption basket that is skewed towards housing during their working years and don't move easily the lumpy housing good in which they have stored a considerable amount of wealth, they rebalance their consumption basket by allocating a fraction of the positive tax credit to non-housing consumption. This rebalancing leads to higher MPCs compared to a model without lumpy housing, especially when households are young and have few liquidity.

Indeed, when we observe the dynamics of the simulated MPCs over the life-cycle, these are higher for young households - most of them initially renters - and progressively decrease later on, see Figure 3. This is so because the utility benefit from rebalancing towards non-housing consumption is bigger at the beginning of the life cycle, when the discounted utility from a superior consumption plan over the life-cycle is higher. As households age much of the rebalancing towards non-housing consumption has already occurred in the previous years and few periods are left before retirement, hence the incentive to further shift the

consumption basket in favor of non-housing consumption decreases.

The other source of 'excess sensitivity' of consumption to shock is well known and depends on the level of cash-on-hand with respect to earnings. Indeed, the MPCs are higher when cash-on-hand with respect to earnings is low, see Figure 4. When liquidity is sufficiently low, the current marginal utility of consumption is high relative to future periods. Therefore a positive shock raises current consumption, always assuming that the shock is not large enough to overcome completely the liquidity constraint. Moreover, when the household has a low level of cash-on-hand, it will be relatively constrained in its housing choice, leaving its non-housing consumption's MPC out of the positive persistent shock be comparatively higher than that of a household that has accumulated a higher level of liquidity and can pay more easily the downpayment and transaction costs required to become an homeowner.

In the model, low levels of liquidity are correlated with relatively low levels of income and a consumption basket skewed towards housing. In Figure 5 we compare the housing wealth to non-housing consumption ratio by age of households with low cash-on-hand versus the average population. The ratio is almost twice as big for low cash-on-hand households with respect to the average household in the economy from age 30 to 60. The income of the average household in the economy is 20 per cent bigger than that of low cash-on-hand households over the same years. This show that low income households optimally choose to deplete their liquidity to access the housing good and, in so doing, compress their non-housing consumption levels.

We now focus on the responses of non-housing consumption to shocks of equal size but different durability. The main difference between two such shocks lies in their discounted present value. Indeed a transitory shock is fairly small, in present value terms, compared to a persistent increase in earnings of the same size, especially if the two shocks happen early in the life cycle. In a standard one asset-one consumption good model a transitory shock entails too little additional consumption and hence it is optimally saved to preserve a stable consumption path. MPCs out of transitory shocks should then be considerably lower than out of persistent shocks.

But what happens in a two-goods model, where most households already hold an important amount of housing wealth or, as renters, are already saving to become homeowners? In

Table 6: MPCs by liquid assets and shock's persistency

	Persistent	**Transitory**
Low cash	0.60	0.75
High cash	0.41	0.42

that case the incentive to further save is considerably reduced, while at the same time it will not be generally feasible for the household to allocate the earnings increase to buy a bigger house, since the adjacent house size is much bigger and expensive than the one it currently owns. The household will then tend to allocate a substantial share of the shock to rebalance its non-housing consumption path, even if transitorily, and the more so the closer it is to be liquidity constrained.

Our results do indicate that the MPCs out of a transitory innovation to earnings are high and bigger for low cash-on-hand households, see Table 6. The MPC out of a transitory shock for low cash-on-hand households is 0.75. The same MPC for high cash-on-hand households is almost half that much (0.42), but still around 40 per cent of the shock is consumed within a year. These MPCs' magnitudes out of a transitory shock are in line with the findings of Jappelli and Pistaferri (2014), which studied the survey responses by Italian households in the 2010-SHIW panel about how much of an unexpected transitory income change they would have consumed. The authors find that for households with low cash-on-hand levels the MPCs vary between 0.6 and 0.8, decreasing to between 0.3 and 0.4 for high cash-on-hand households. It must be noticed that our MPCs, both estimated and out of the model, refer to a sample characterized by an average income considerably lower than the one considered in the survey responses studied by Jappelli and Pistaferri (2014). MPCs out of persistent shocks for cash constrained households are 0.6 (against 0.75 when the shock is transitory), while they stand at 0.41 for households that hold enough liquidity. When we calculate the MPCs splitting the sample between persistent and transitory earnings shocks (thus mixing up households characterized by different liquidity levels), we find that the two MPCs are

almost equal,[10] in line with our empirical results: the average MPC out of a persistent or transitory shock is 0.46.

6 Sensitivity

In this section we show how a lower relative price of the housing good, the absence of housing transaction costs or a smaller minimum house size can impact on the level of the simulated non-housing consumption MPC out of the tax rebate.

6.1 Lower relative price of housing

The degree to which the housing good is expensive with respect to non-housing is key in explaining the levels of MPCs out of a positive shock. When we make the housing good be less expensive and normalize to one its relative price, as usually done in the literature, the MPCs out of a positive transitory shock are halved for low cash-on-hand households and reduced by 13 and 31 per cent, respectively against persistent and transitory shocks, for high cash-on-hand households.

When the housing good is less expensive, achieving the desired level of housing services is considerably less costly in terms of both forgone liquidity and non-housing consumption. In particular, the non-housing consumption life-time path does not need to be as steep as before, since young households don't have to compress so much their non-housing consumption to achieve their desired level of housing services. This can be seen in Figure 6, where the steepness of the non-housing consumption profile when housing prices equal 1 is lower than for the baseline economy where housing prices equal to 2.

In a sense, when housing prices are lower, the profile of non-housing consumption over the life-cycle is more smooth. As a result of that, given a positive shock the need to rebalance the consumption basket in favor of non-housing decreases. Consistently with the intuition we have provided, the reduction in non-housing MPC is bigger for low cash-on-hand households, for whom the cheaper housing good represents a bigger advantage in view of achieving a smoother non-housing consumption profile.

[10] We calculate the MPCs always by age from 31 to 55 and then average them out over different ages.

6.2 No transaction costs

The importance of transaction costs has been extensively studied in the literature. In most models, the illiquidity of the housing good is actually the main driver of the MPCs, especially against transitory shocks. The higher transaction costs are, the more illiquid is the housing good and hence the more households prefer to leave housing constant and instead change non-housing consumption upon receiving a shock.

In our model on the contrary, transaction costs are of second order relevance with respect to house relative prices and - most importantly - housing lumpiness. Indeed, even when transaction costs are completely removed the MPCs against transitory shocks continue to be quantitatively important. This is so because there still exists an inaction region for which, given the shock, households don't move their housing consumption. The existence of this inaction region is guaranteed by the lumpiness and high relative price of housing. With no transaction costs, low cash-on-hand households still consume almost 56 per cent of the tax credit while high cash-on-hand households consume 37 percent of the tax credit.

6.3 Lower minimum house size

When we lower the minimum house size in order to make it almost non-binding for first home buyers, MPCs against both persistent and transitory shocks, both for high and low cash-on-hand households decrease. MPCs for low cash-on-hand households decreases to 0.54 (from 0.81 in the baseline) against a transitory tax credit and to 0.47 (from 0.56 in the baseline) against a persistent tax credit. For high cash-on-hand households the MPCs decrease to 0.28 and 0.31 against a transitory and persistent tax credit (from 0.36 and 0.31 in the baseline, respectively). This counterfactual shows that a high minimum size influences considerably the level of MPCs, by forcing households (especially low income ones) to skew their consumption basket towards housing services. When the minimum size is non-binding, the consumption basket is more balanced between the two types of goods and much less rebalancing is needed upon reception of the tax credit.

7 Conclusions

We estimate the change in consumption expenditure induced by the income tax credit introduced by the Italian Government in May 2014, using the Survey of Household Income and Wealth.

We exploit the panel component of the SHIW to estimate the actual purchasing attitude of Italian households towards non durable (mainly food) and durable goods after the implementation of the tax rebate, using a difference-in-difference methodology. Our identification strategy is based on the matching of a sample of treated and control households that display similar characteristics before the start of the program. The estimated average marginal propensity to consume out of the bonus is between 0.5 and 0.6; the expenditure responses are relatively larger for households with low liquid wealth or income (0.8), a finding that is consistent with the presence of liquidity constraints. The results are robust to different specification of the estimated model but, due to the low sample size, estimates are not statistically significant. In order to further support our empirical findings we used an overlapping generation model where households consume housing and a composite non-housing good.

We show that housing's lumpiness makes households' consumption basket be skewed towards housing, especially if households have low income. Since the tax credit is too small to allow for an housing upgrade, households tend to use it to rebalance their consumption basket and increase their non-housing consumption, giving rise to MPCs out of the shocks that are in line with our empirical estimates. The MPCs are higher when households have low cash-on-hand, as in our empirical estimates, and the shock is believed to be transitory.

A Selected questions from the Survey of Household Income and Wealth

E18. Is your household's income sufficient to see you through to the end of the month ?

1 with great difficulty

2 with difficulty

3 with some difficulty

4 fairly easily

5 easily

6 very easily

Since May 2014, there has been a bonus in the paypackets of payroll and similar kinds of workers whose gross earnings are between €8,000 and €26,000 (called the "Renzi bonus").

E19. Did anyone in your household benefit from this bonus in 2014?

- Yes ...1 (If "Yes") How many of you?

- No ...2 → E22

E20. How much did your household receive overall each month in €? .... a month

E21. How was the bonus used by your household? Giving a value of 100 to the bonus, how was it divided up in percentage terms between:

- consumption

- savings

- repayment of debt

Total 100

E22. In your opinion, for how many more years do you expect the bonus to be paid?

- n. of years

- for ever

E26. During 2014, were there times or periods when your household was considerably behind (90 days or more) in paying utility bills (gas, electricity, telephone, etc.)?

1 Yes

2 No

B The Model

B.1 Environment

We build an overlapping generations model with housing and non-housing consumption. Households' utility depends on consumption of a non-housing good and housing services, which can be obtained by renting or owning a house. Houses are illiquid and transaction costs are sustained when the housing size or tenure is changed. Households make a mortgage downpayment when buying a house and then they can use accumulated housing equity as collateral for loans. The mortgage loan takes the form of a long-term contract: in each period indebted households sustain a fixed repayment of their principal plus interests on outstanding debt. Borrowing carries a premium over the risk free interest rate. The tenure choice is based on different user costs for owners and renters. Specifically, renters pay the rental rate, defined as the sum of the risk free interest rate and the depreciation rate of rental units multiplied by the house price level. The user cost for owners includes the depreciation rate, the house price level, and the transaction costs. Households start their life with zero housing and financial assets wealth. They face idiosyncratic uninsurable earnings risk and receive their first period labor productivity shock according to a random draw from the stationary labor shocks' distribution. The specifics of the model follow.

B.2 Demographics

There is a continuum of households of measure one at each point in time. Each household lives at most J periods. In each period $j \leq J$ of his life the conditional probability

of surviving to period $j+1$ is denoted by $\alpha_j \in (0,1)$. Define $\alpha_0 = 1$ and $\alpha_J = 0$. The probability of survival, assumed to be equal across households of the same cohort, is independent of other households' characteristics, such as income or wealth. We assume that α_j is both the probability of survival for a particular household and the fraction of agents that, having survived until age j, will survive to age $j+1$. Annuity markets are assumed to be absent. After death, a household is replaced by a descendant who starts its life with zero financial and housing wealth and its first period productivity level is determined by a random draw from the stationary distribution of earnings shocks. In each period a number $\mu_1 = \left(1 + \sum_{j=1}^{J-1} i = 1^j \alpha_i\right)^{-1}$ of newborn households enter the economy, and the fraction of people in the economy of age j is defined recursively as $\mu_{j+1} = \alpha_j \mu_j$, with $\mu_{j+1} = \alpha_J = 0$. Let $\mathbf{J} = \{0, 1, ..., J\}$ denotes the set of possible ages of a household. Households are assumed to be renters in the first period of their life. Bequests are accidental and taxed away at a confiscatory rate by the government.

B.3 Preferences and endowments

Households are endowed with one unit of time in each period that they supply inelastically in the labor market. Households differ in their labor productivity due to differences in age and realizations of idiosyncratic uncertainty. The labor productivity of a household of age j is given by $\varepsilon_j \eta$, where $\{\varepsilon_j\}_{j=1}^{J}$ denotes the age profile of average labor productivity. The stochastic component of labor productivity, η, follows a finite state Markov chain with state space $\eta \in \mathbf{E} = \{\eta_1, ...\eta_N\}$ and transition probabilities given by the matrix $\pi(\eta'|\eta)$. Let Π denote the unique invariant measure associated with π. We assume that all agents, independent of age and other characteristics face the same Markov transition probabilities and that the fraction of the population experiencing a transition from η to η' is also given by π. This law of large numbers and the model demographic structure assure that the aggregate labor input is constant. We assume that households cannot insure against idiosyncratic labor productivity by trading contingent claims. Moral hazard problems may be invoked to justify the absence of these markets.

Households derive utility from consumption of the non-housing good, c, and from the housing services acquired either through the rental market, $g(f)$, or trough homeownership

$g(h')$. Housing services are a function $g(\cdot)$ of the housing stock purchased or rented. The choice between homeownership and renting is exclusive at each period, and represented by the indicator function $I \in \{0, 1\}$. Households value streams of consumption and housing or renting services $\{c_j, g(s)_j\}_{j=1}^{J}$, where $s = (1 - I)f + Ih'$, according to

$$E_0 \left\{ \sum_{j=1}^{J} \beta^{j-1} u(c_j, g(s)_j) \right\} \tag{2}$$

where β is the time discount factor and E_0 is the expectation operator, conditional on information available at time 0. We assume one unit of housing stock, either rented or owned, provides one unit of housing services. The per-period utility function $u(c, g(s))$ is assumed to be strictly increasing in both arguments and obeys the Inada conditions. The instantaneous utility from being dead is normalized to zero and expectations are taken with respect to the stochastic processes governing survival and labor productivity. We assume that the per-period utility function is of the CRRA form

$$u(c, g(s)) = \frac{(c^{\gamma} g(s)^{1-\gamma})^{\sigma} - 1}{1 - \sigma} \tag{3}$$

where σ is the coefficient of relative risk aversion and $c^{\gamma} g(s)^{1-\gamma}$ is the Cobb-Douglas aggregator between non-housing consumption and housing services.

B.4 Debt contract

Households can access the mortgage market through a long-term debt contract. We have chosen this typology of contract instead of the more standard one-period one since the latter implies the possibility of mortgage refinancing, which is not a widespread feature of the Italian market. Once the households have paid the downpayment, they sustain a fixed per-period installment which includes interest and principal payments. In particular, the principal is repaid in fixed predetermined amounts and the interest rate on loans, which carries a premium over the risk-free rate, is exogenous and applies to the outstanding debt. Households can also decide to repay entirely their remaining mortgage debt, but in this case they are not allowed to take on immediately a new loan. We assume that total debt has to be repaid before retirement. This implies that the length of repayment is endogenous for

each households, since it depends on the age at which the contract has been originated. The amount of mortgage debt is a state variable, since per-period debt repayments depend on the amount of outstanding debt.

B.5 Household's optimization problem

Let denote by p^h the relative price of one unit of residential housing stock in terms of non-housing consumption. In each time period t, households are characterized by their holdings of financial assets a, outstanding mortgage debt m and housing stock h, as well as by their labor productivity shock η and age j. The five variables state-space of a household in each period is then denoted by (a, m, h, η, j). Let by $\Phi(a, m, h, \eta, j)$ denote the measure of households of type (a, m, h, η, j). We normalize the price of the non-housing good to equal one. The price of renting units is denoted by $i \equiv r + \delta^f$, where δ^f is the depreciation rate of renting units. We allow rental units to have a different depreciation rate δ^f than owner occupied housing δ^h, possibly reflecting moral hazard reasons linked to tenure. Let r and w denote the interest rate and the wage rate per efficiency unit of labor, respectively. Households access the mortgage market through a long-term debt contract. They can only borrow up to $(1-\theta)$ of the value of their desired housing stock. The interest rate on outstanding debt is r^m, and carries a mark-up with respect to the risk-free rate. The per-period principal repayment of mortgage debt M is given by $\frac{m}{jr-1-age}$. The household's problem can now be formulated recursively in the following way

$$V(a, m, h, \eta, j) = \max_{c, a', m', h', \{O,R\}} u(c, h') + \beta E\mathcal{V}(a', m', h', \eta', j+1)$$

$$s.t.$$

If owners (O):

$$c + p^h h' + p^h \tau(h, h') + \frac{m}{jr - 1 - age} + r^m m + a' = w y_{jt} + (1+r)a + m' + p^h(1-\delta^h)h$$

$$m' \leq (1-\theta)p^h h', \quad \theta \in [0, 1]$$

$$m' = m - \frac{m}{jr - 1 - age}$$

If renters (R):

$$c + (r + \delta^f)p^h h' + p^h \tau(h, h') + a' = w y_{jt} + (1 + r)a + p^h(1 - \delta^h)h$$

$$a' \geq 0$$

$$c \geq 0, I \in \{0, 1\}$$

After retirement, households receive a Social Security replacement income. We define $h^{\min}$ as the minimum house purchasing size while $\tau(h, h')$ stands for non-convex housing stock's adjustment costs

$$\tau(h, h') = \left\{ \begin{array}{cc} 0 & \text{if } h' \in [(1 - \mu)\, h, (1 + \mu)\, h] \\ \rho_1 h + \rho_2 h' & \text{otherwise} \end{array} \right\}$$

This formulation of transaction costs allows households to change their level of housing consumption by undertaking housing renovation up to a fraction of μ the value of house or by allowing depreciation up to a fraction of μ the value of house as an alternative to moving. If the housing depreciates by more than a fraction μ of the value, or if the value of the stock increases by more than a fraction μ of the value, we assume that the stock has been sold. In those cases, the household has to pay the transaction costs as a fraction ρ_1 of its selling value and ρ_2 of its buying value.

C Calibration

Some parameters of the baseline model are exogenous and based on microeconomic evidence, while others are calibrated to match selected long-run averages of the Italian economy in the stationary equilibrium. In particular, our calibrated parameters are set to reproduce the housing stock to disposable income ratio, the financial assets to disposable income ratio, and the homeownership rate of the Italian economy (see Tables 7, 8 and 9).

C.1 Demographics

The model period is one year. Households enter the labor market at age 26 and retire at age 62, in line with the average retirement age found in the 1998-2010 SHIW waves. After retirement, households receive a constant replacement income equals to 67 percent of total average wages in economy.[11] Workers die with certainty at age 92. Survival rates are taken from the Italian national statistic institute (ISTAT).

C.2 Discount factor and interest rate

We fix the risk-free real interest rate to 2 percent. We calibrate the discount factor β to match an aggregate housing wealth to disposable income ratio of 4.0.[12]

C.3 Income Process

Instead of modeling a once and for all shock to earnings, we consider an earnings process that has a persistent and a transitory component. We do so because respondent households in the SHIW considered the bonus as transitory or persistent almost in equal amounts. The earnings process is a parsimonious way of simultaneously taking into account both types of shocks. The logarithm of the income process y_{it} is specified as the sum of an AR(1) component z_{it} and an *i.i.d.* component ϵ_{it}.

$$y_{it} = z_{it} + \epsilon_{it} \tag{4}$$

where z_{it} follows the AR(1) process

$$z_{it} = \rho z_{it-1} + \eta_{it}$$

[11] We do not consider replacement rates linked to individual households wages. Doing so would considerably increase the computational burden of the model while not adding much to the focus of our paper.

[12] Italian housing wealth to disposable income ratio have been increasing from 3.95 in 1995 to 5.38 in 2008, see Bartiloro et al. (2008). The average target of 4.0 has been calculated subtracting housing structures from total housing wealth

with persistency parameter ρ, where $\eta_{it} \sim N(0, \sigma_\eta^2)$. ϵ_{it} is an i.i.d. normal with zero mean and σ_ϵ^2. We calibrate the deterministic age profile for the income process using data from the SHIW.

The persistency of the shocks depends on the autoregressive parameter ρ. We set it equal to 0.95.

Average net earnings of households that have received the bonus has been 23.288 euros, while the bonus amounted to 86 euros per month. In yearly terms then, the bonus was equal to a positive earnings shock of 4.4 per cent. We accordingly calibrate the variability of the persistent and transitory component of the earnings shock in order to get a 4.4 per cent shock.

Using Tauchen (1986)'s method, we approximate the continuous AR(1) processes and the *i.i.d.* component with respectively ten and three states Markov chain.

C.4 Preferences and Technology

The coefficient of risk aversion of the Cobb-Douglas utility function, σ, is set to 3, within the range of commonly used values. Housing services are assumed to be proportional to the housing stock, i.e. $g(s) = s$. The Cobb-Douglas aggregator can be considered as a special case of the constant elasticity of substitution (CES) function when the elasticity of substitution parameter is equal to one. We select a Cobb-Douglas production function $Y(K_t, L_t) = NK_t^\alpha L_t^\alpha$ as a representation of the technology that produces the final good. We normalize $N = 1$. We follow the construction of measures of output, capital and stock of houses from Díaz and Luengo-Prado (2008). We define capital as the sum of non-residential private fixed assets plus the stock of inventories plus consumer durables. Investment in capital is defined accordingly. H is private residential stock. Finally we need a measure of output. Output is defined as GDP minus housing services. We proceed as Cooley and Prescott (1995) to calculate the capital share of the economy. We do not make any imputation to output for government owned capital since our focus is on privately held wealth. The implied share of capital in output α is 0.25.

C.5 Market Arrangements

Households pay transaction costs whenever they change their house size or tenure. We consider non-convex costs of adjustment in the housing market, which results in infrequent changes of the housing stock. Transactions costs on housing sales and purchases are both set equal to 7 percent, a level based on OCDE calculations. We set the minimum down payment requirement θ (i.e. the share of the value of a house that cannot be borrowed and must be paid upfront by the buyer) equals to 20 percent and we allow households to optimally choose their own downpayment. The depreciation rate of owner occupied housing δ^h is calculated from national accounts; the renting depreciation rate δ^f is calibrated together with the minimum house size that is necessary to purchase to become an homeowner to match an aggregate homeownership rate of 70 percent. We calibrate the discount factor β to match a financial capital to disposable income ratio of 2.2 percent, its 1995-2008 average in the data. The parameter γ - the share of non-housing consumption in the utility function - has been calculated in the national accounts and set to 0.8. This value is also consistent with the housing expenditures share found in the SHIW. Finally, we choose the relative price of housing to get the right amount of indebted households along the life-cycle. All parameters are reported in Table 7.

D Model's computation

Non-convex adjustment costs to housing expenditure and a minimum purchasing house size break the smoothness of the optimization problem: first-order conditions could not be used to simulate the model. We resorted instead to discretization of the state space and value function iteration, which is computationally costly but very robust. The upper bounds on the grids for financial assets and housing are chosen large enough so that they are not binding on the optimization problem.

The choice of housing stock and renting units is found by grid search. The choice of financial assets and mortgages is found by one-dimensional optimization that doesn't use differentiability of the value function.

We use 40 points for financial assets grids and 20 points for the housing assets grid and 10 points for the mortgage holdings grid, a 30 states earnings Markov matrix and 5 states for the house price shock matrix.

We solve for the steady state equilibrium as follows:

1. Guess β and use the equilibrium conditions in the factor markets to obtain w.

2. Solve for the value function in the last period of life, then solve recursively for all other ages.

3. Compute the associated stationary distribution of households Φ.

4. Given the stationary distribution and prices, compute factor inputs demand and supplies and check market clearing.

5. If all markets clear, we found an equilibrium. If not, go to step 1 and update β.

All the programs needed for the computation of the model were programed in Fortran 90 and compiled in Intel fortran to run on a Unix cluster.

E Tables and Figures

Table 7: Parametrization

Parameter		**Value**
Preferences		
σ	risk aversion coefficient	2
Technology		
r	real interest rate	1.5%
α	capital share	0.25
δ^h	housing depreciation	0.024
Income Process		
ρ	persistency	0.96
σ_z	variance persistent shocks	0.014
σ_ϵ^2	variance transitory shocks	0.024
Housing market		
θ	minimum down payment	10%
ρ_1	housing transaction cost	5.0%

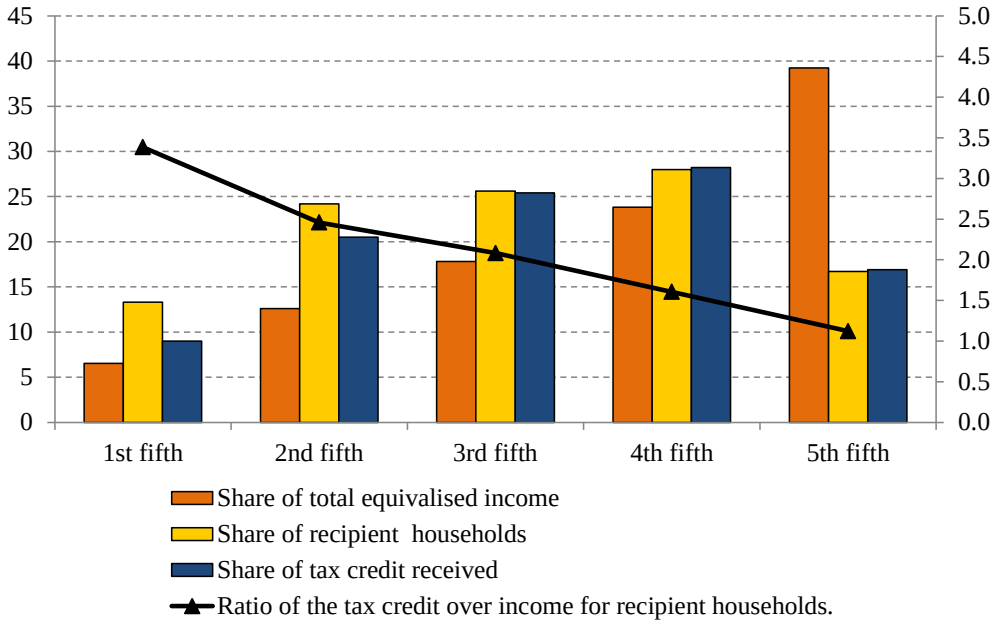
Table 8: Moments to Match

Target	**Value**
Housing to Disposable Income	4
Net Financial Assets to Disposable Income	2.2
Homeownership rate	70%
Average Mortgage Debt to Disposable Income	0.3

Table 9: Calibrated parameters

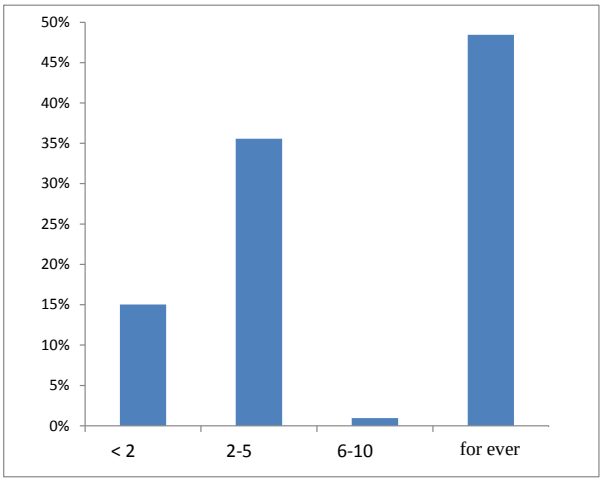
Parameter		**Value**
γ	weight of nondurable consumption	0.8
β	discount factor	1.0
r_m	mortgage interest rate	3.0%
δ^f	renting depreciation	0.027
p^f	relative price of housing services	2.0

Figure 1: Distribution of the amount received and total income by equivalized income



Notes: Our calculation from SHIW. Percentages.

Figure 2: Expectations about the years the bonus will be in place



Notes: Our calculation from SHIW. Percentages.

Figure 3: MPCs by age

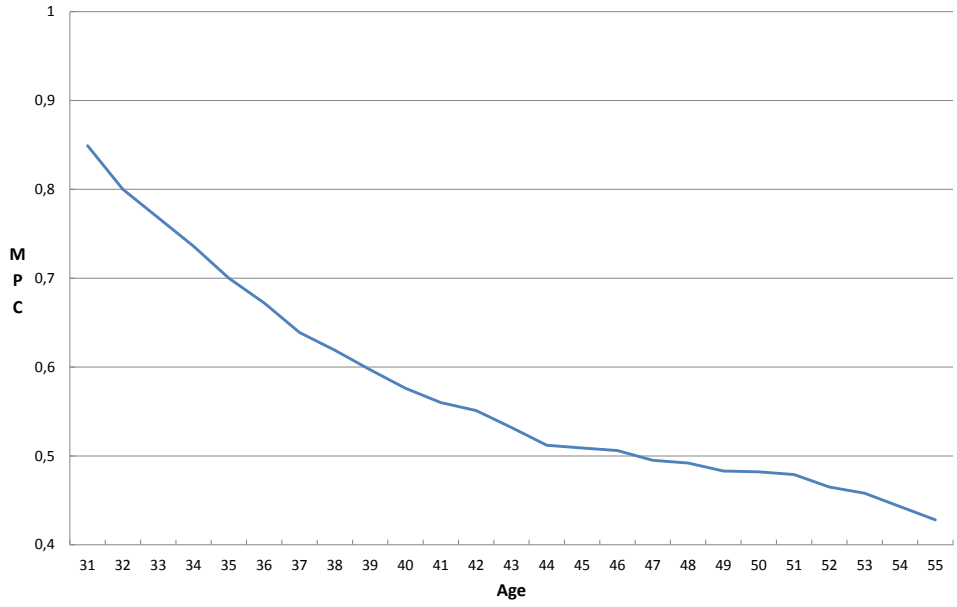


Figure 4: MPCs by age and cash-on-hand levels

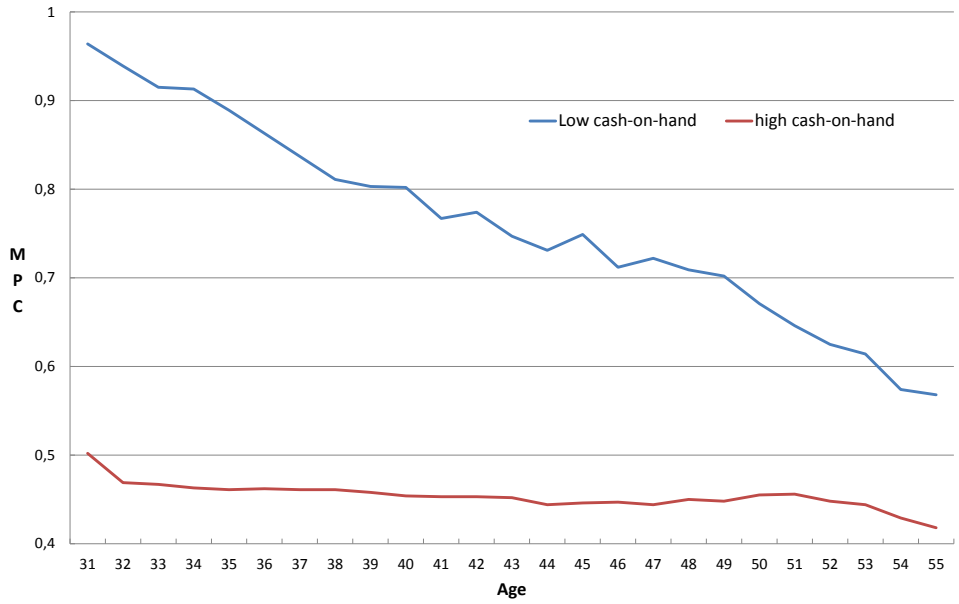


Figure 5: H/C ratio by age

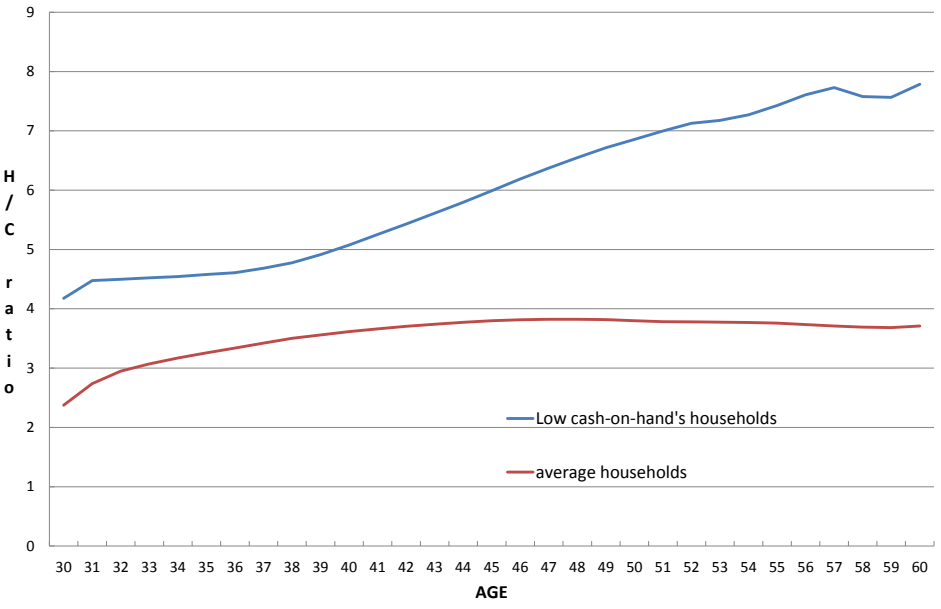
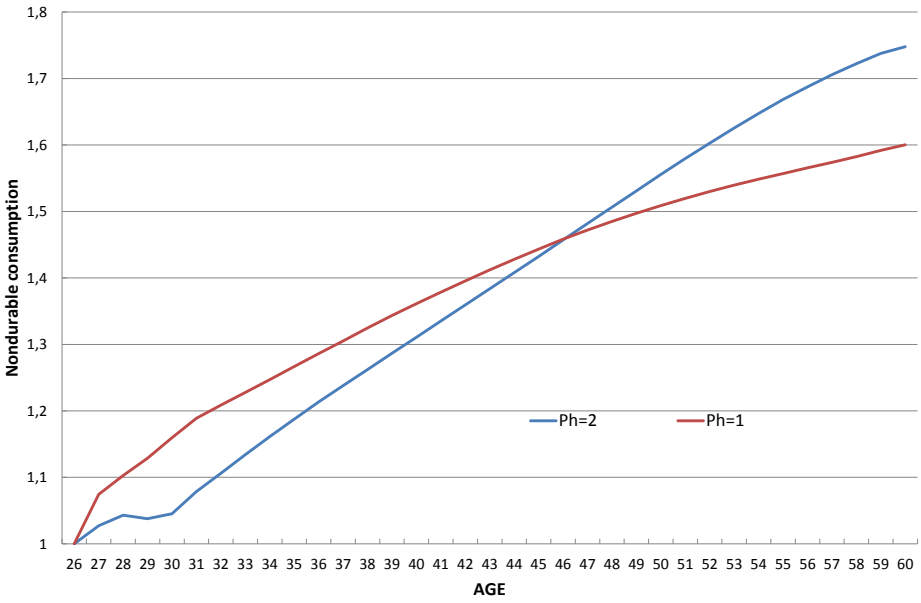


Figure 6: Nondurable consumption by age: ph=2 vs ph=1



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