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Liquidity constraints and labor supply

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Abstract

In this paper we shed some light on how restrictions in financial markets, the so called liquidity constraints, might act in affecting labour supply decisions of Italian workers. One way to neutralize the existence of binding liquidity constraints is simply by supplying additional labor, instead of reducing consumption. We estimate whether resorting to additional labor supply as a smoothing consumption device is at work by using the Survey of Households Income and Wealth (SHIW). The longitudinal dimension of the SHIW dataset allows to control for individual unobserved heterogeneity. We also develop an IV strategy to address the endogeneity of our measure for credit constraints in labor supply equations due to time varying factors.

Our results show that liquidity constraints increase the intensity in the supply of men's labor. Constrained men work, on average, 4 hours more than their unconstrained counterpart. Self-employed workers turn out to be more sensitive to binding liquidity constraints, possibly because they are more flexible in adjusting the intensity of their labor supply.

Keywords: Labor supply, liquidity constraints, life cycle, panel data.
JEL: D1, JE.

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1. Introduction and motivation

Imperfections in the functioning of credit markets have been advocated as the reason why households are forced to deviate from their optimal plans and make suboptimal choices. In the literature of life cycle/permanent income, liquidity constraints have been identified as one of the main reasons behind the failure of the life-cycle/permanent income model in explaining the consumption behaviour of households (Attanasio and Weber, 2010; Deaton, 1992). The fact that household consumption tracks income too closely might be imputed to imperfections existing in the credit markets, resulting in a lack of credit availability. Households foreseeing an increase in income, will be forced to delay the consequent growth in consumption until the actual increase in income occurs; this happening because they are not allowed to borrow so as to incorporate the anticipated income increase. Suboptimal choices are then made, as the credit market is far from being perfect.

A large strand of literature has focused on how liquidity constraints can shape households decisions when they are binding, by empirically testing the impact of liquidity constraints on consumption or savings trajectories.[1] Flavin (1981), among others, in a seminal contribution, argues that the significance of predicted changes in income affecting consumption growth is a signal that liquidity constraints are binding. Garcia et al. (1997) show that liquidity constraints are shaping consumption profiles, by highlighting asymmetries in consumption response to income shocks. In other words, if liquidity constraints play a role rather than myopia, consumption should react asymmetrically. Consumption will increase in response to income increases while it should exhibit no sensitivity to income decreases. Jappelli et al. (1998) show that the probability of

[1] A particular aspect of consumption choices that received attention in the economic literature relates to housing consumption. For empirical studies on the effect of credit markets on homeownership see, for instance (Chiuri and Jappelli, 2003) and Trucchi (2015).

being liquidity constrained, using a switching regression model, explains excess sensitivity of consumption.[2]

Another channel likely to be affected by financial market frictions is the labour market, by making labor choices depending on features of the credit market. One way to circumvent the obstacle of being unable to borrow is to simply supply more labor. Working more might (partially) neutralize the binding credit constraints. At young ages, if future incomes are predicted to be more flourishing than current income, or, put differently, if permanent income is above the current income level, people should borrow to keep constant their living standards. By borrowing, households would be better off and able to keep their consumption at a higher level than the one allowed by current income. Being able to do so is related to an increasing income profile over time, which allows them to repay the loan. Financial institutions may not give loans until current income reaches the average in life, locking households into suboptimal choices. Along with cutting their expenditures on market goods, constrained households may reduce their leisure, in order to equalize the marginal utility of consumption and leisure and, thus, being better off. Our paper focuses on this (almost unexplored) channel, and examines how financial imperfections might be responsible for an additional labor supply, which is provided as a way to mitigate credit market imperfections. It addresses new empirical questions: How do impediments to borrow, even if never experienced directly but actually binding, change the hours supplied into the labour market? Do people respond to borrowing restrictions and impediments by working more to achieve a higher level of consumption?

The literature on consumption has largely supposed that saving and borrowing are the only actors at work in smoothing out income fluctuations and keeping consumption constant. The underlying hypothesis is that the quantity of labor supplied tends to be fixed, either full time or nil. Indeed, the role of

[2]For a study investigating how liquidity constraints versus precautionary savings act on consumption see, for instance, Guariglia and Rossi (2002).

labor supply might also be important as a way to overcome the effect of liquidity constraints, and additional labour supplied in the market could represent a natural device to overcome the binding liquidity constraint and increase welfare. All in all, the life cycle saving literature has always neglected this possible channel by focusing on saving and borrowing as the only tool to achieve desired consumption. Our paper fills in this important gap in the literature by looking at labour supply as a device to achieve desired consumption under binding liquidity constraints.[3]

Some recent papers examine the link between labor supply and consumption/wealth. They relate to our work inasmuch they relax the assumption of fixed labor supply. However, they investigate different margins, namely how labor supply respond to financial (Benito and Saleheen, 2013; Cheng and French, 2000; van Huizen, 2014; Henley, 2004) or unemployment shocks (Ortigueira and Siassi, 2013), and to which extent it acts as an insurance device against future income (Attanasio et al., 2005) or permanent income risk (Blundell et al., 2008).

Three papers by Fortin (1995), Del Boca and Lusardi (2003) and Bottazzi (2004) analyse female labor supply and examine whether it is affected by having a mortgage in, respectively, Canada, Italy and the UK. They show that women with a greater mortgage commitment are more inclined to participate to the labor market. Similarly, Bottazzi et al. (2007) examine the positive association between mortgage debt and the intensity of labor supply and show greater current mortgage commitments leading to greater labour supply. Our paper departs from these works and looks at the *ex-ante* effect of being restricted in the financial market on the current outcome in the labour market. Our goal is to add evidence in the cross-literature between consumption and labour, which is largely unexplored.

In order to investigate the effect of liquidity constraints on labor supply of Italian workers, we exploit the Survey on Household Income and Wealth

[3]From a different perspective, Bertola and Lo Prete (2015) rely on country-level data and show the financial and the labour market to be interrelated.

(SHIW), a panel dataset collected by the Bank of Italy. Our variable of main interest is the potential of being restricted in the credit market. We alternatively use the definition of liquidity constraint and borrowing constraint as the impossibility to go underwater, even if optimally it would be coherent to do so. Being liquidity constrained is not observable as it is related to the optimality of borrowing, which is, by definition, not observable. This variable could be better described as a latent variable than an actual one. Indeed, being liquidity constrained implies the inability to go negative with total asset, despite the optimal plan requiring so. Even if unobserved, the pre-condition to be liquidity constrained is to show a minimal amount of wealth, despite this condition being only necessary and not sufficient (indeed for many households with zero asset it could just be optimal to have zero value). As a proxy for our variable, we use an indicator to measure whether households are constrained by credit market imperfections and restrictions (variables' description is illustrated more in details in Section 3 and Appendix B). We construct an indicator comparing the permanent level of income to the current one, so as to capture the stage of an individual within his/her life-cycle. Individuals with current income below its permanent level would optimally borrow (or dissave) to smooth their consumption over the life-cycle. Thus, we define liquidity constrained individuals as those with current income below its permanent level, who exhibit lack of financial assets (Zeldes, 1989; Johnson et al., 2006) and, thus, cannot rely on accumulated wealth to sustain higher expenditure levels. We also test the robustness of our results to alternative definitions of liquidity constraints (based, for instance, on credit denial by financial institutions).

We examine the impact of liquidity constraints on the men's intensity of labor supply. Since both liquidity constraints and labor market decisions can be correlated with unobserved individual characteristics, we use a fixed effect estimation strategy, which does not restrict the individual unobserved heterogeneity to be uncorrelated with the explanatory variables. Besides individual unobserved heterogeneity, reverse causality and the correlation of liquidity constraints with time-specific unobservables, particular labor demand shocks, may

bias (downward) our results. To deal with these issues, we develop an instrumental variable estimator, which exploits access to the credit market and/or the availability of alternative channels of access to parental wealth, notably receiving an inheritance, to sustain consumption expenditures.

Our findings suggest that liquidity constraints play an important role in shaping male labor supply. Young workers (aged 26-35) facing liquidity constraints increase the intensity of their labor supply, in the following year, by 4 hours per week (10% of the sample mean).

In order to shed light on the channels through which individuals increase their labor supply, we disentangle the impact of liquidity constraints on labor supply of employees and self-employed workers. The response to financial imperfections turns out to be mainly driven by the self-employed. Self-employed workers turn out to be more sensitive to binding liquidity constraints. We interpret this evidence as a result of self-employed being more flexible in adjusting the intensity of their labor supply compared to employees. We also find some evidence that liquidity constrained youth are more likely to have more than one job in the calendar year, but this does not reflect into an increase in the number of working or overtime hours.

The rest of the paper is organized as follows. Section 2 outlines the theoretical framework and derives the testable implication. Data and the empirical strategy are described, respectively, in Sections 3 and 4. Section 5 illustrates the main findings and Section 6 concludes.

2. Conceptual Framework

To conceptualize the problem, we suppose for simplicity that agents live for two periods ($t = 1, 2$). In the first period the agent supplies labor and in the second period the agent retires. In each period, utility is derived both from consumption (c_t) and from leisure (l_t). However, the amount of leisure can be chosen only during the working life (period one) while during retirement it is exogenously fixed, as all the time available is devoted to leisure ($l_2 = L$). The

conceptual framework we use is a standard utility maximisation context where each individual maximises her utility under the budget constraint. For the sake of simplicity we also set to zero the interest rate and the subjective discount rate. Agents maximise the following utility function:[4]

$$U = \sum_{t=1}^{2} u(c_t, l_t) = u(c_1, l_1) + u(c_2, L)$$

with decreasing and concave marginal utility of c and l and a positive cross derivative ($u'_x < 0$, $u''_x < 0, x = c_t, l_t$). Supposing that the initial asset is zero and bequests are also zero, the following intertemporal budget constraint applies:

$$w(1 - l_1) + Y_r = c_1 + c_2$$

where w is the wage rate and Y_r is income at retirement. In period one consumption and leisure are set at their optimal level while in period two, corresponding to retirement, agents devote all their time to leisure.

Without market imperfections, and ignoring the constraint on participation, the marginal utility of consumption is kept equal over time, as well as the marginal utility of consumption in period one is set equal to the marginal utility of leisure. The first order conditions are as follows:

$$u'_{c_1}(c_1, l_1) - u'_{c_2}(c_2, L) = 0$$

$$-w u'_{c_1}(c_1, l_1) + u'_{l_1}(c_1, l_1) = 0.$$

The first equation implies the usual smoothness of consumption marginal utility across time, while the second implies the equality between marginal utility of consumption and leisure, within the same period, scaled by the wage.

If a liquidity constraint is added to the model, agents are forced to borrow below a certain threshold, i.e. assets at the beginning of period two (A_2) must be greater than the threshold B ($B \leq 0$):

$$A_2 \geq B.$$

[4] More details about the model assumptions and solution are provided in Appendix A.

Necessary condition for this constraint to be binding is the expectation of increasing future income, namely current income being below its permanent level. If the constraint binds, wealth is equal to B, namely below or equal to zero, and individuals have no choice but reducing their consumption in period one. Marginal utility is higher in the first period than in the second one, while consumption and leisure are set such as the intra-period marginal utility of consumption and leisure are equal. Thus, consumption and labor supply are characterized as follows (we denote with the upscript C the constrained case):

$$u'^{C}_{c_1}(w(1-l^C)+B,l^C) = \frac{u'^{C}_{l_1}(w(1-l^C)+B,l^C)}{w} > u'^{C}_{c_2}(c_2^C, L).$$

The last inequality indicates that the marginal utility of consumption in period two is lower than in period one, implying that consumption in period two is higher than in the unconstrained case. Consumption in period one is lower than without the constraint as borrowing is limited. If leisure is kept stable in period one as in the unconstrained case, the marginal utility of consumption does not equate that of leisure. To equalize the marginal utility of leisure and consumption within period one, the agent has the only option to work more and reduce leisure.

Our testable implication is, thus, that the more the constraint becomes binding, the stronger is the incentive to work more for the economic agent, as the only available way to offset the limited access to credit. The rest of the paper is centered on testing whether this prediction holds true.

3. Data

The empirical analysis is based on the Bank of Italy's Survey on Household Income and Wealth (SHIW) and relies on data for the years 2000-2010. The SHIW dataset is a representative sample of the Italian resident population and covers about 8,000 households in each wave. It is collected every two years and contains a panel component: in each wave, part of the sample has consisted of households that were interviewed in previous surveys (approximately 4,000

households). The identification strategy we use in the empirical analysis posits some data restrictions. First, in order to use the fixed-effect estimator, we need individuals to be observed at least twice. Second, in using a lagged measure of liquidity constraints, we lose the first time period. Therefore, for the purpose of this analysis, we can rely on an unbalanced panel covering 5 waves, ranging from 2002 to 2010. We extend the dimension of the dataset used for the permanent/life cycle income variable generation (see above in this Section for further details), for which we use additional waves of the SHIW dataset, from 1991 onwards, so as to exploit all possible information about individual labor earnings over the life cycle.

For the purpose of our analysis, we restrict our sample to men who are either the head of household or his spouse, and who are aged between 26 and 35 years. Households younger than 25 are excluded since there should be some form of selection in the choice of household formation, this selection being particularly relevant in Italy where most young adults live with their parents. We focus on individuals in the first phase of their life-cycle (younger than 36) and, thus, potentially exposed to liquidity constraints, as we want to rule out dynamics of the labor market that are less likely to be affected by liquidity constraints. After excluding men who do not work (6.6% of the sample: 75% of them reporting to be unemployed and the others being either students or recipients of disability pensions) and outliers (4 respondents working more than 120 hours per week), we end up with a sample of 544 observations. On average, each respondent in our sample is observed almost three times in the time span we consider.

The SHIW dataset collects detailed information on household composition, income, wealth and the labor market status of the household members, including the number of weeks and average weekly working hours they worked in the previous year. We examine the extensive margin, namely the average number of hours per week supplied by the worker over the same time frame. In order to shed light on the mechanisms through which the increase in labor supply takes place, we investigate the effect of liquidity constraints on the number of hours over time and on the number of jobs during the reference year.

Indicators for binding liquidity constraints

To investigate the potential effect of credit rationing, we exploit information allowing us to detect liquidity constrained individuals. The construction of the liquidity constraints variable is crucial to our analysis and conceptually challenging. The existence of financial constraints captures the inability, for some households, to resort to debt even if, from an optimal standpoint, it would be rational to do so as future income prospects are better than the current ones. To build our indicator we combine two conditions, which identify constrained workers when jointly fulfilled: Current income being below its permanent level and financial assets close to zero. We illustrate hereafter these two conditions and we discuss alternative definitions for binding liquidity constraints.

One neat prediction of the standard life cycle/permanent income theory is that individuals in early stages of their careers would like to borrow (optimally) to anticipate future income increase. Put differently, if current income is below the average one, the so called permanent income, individuals should optimally borrow. Therefore, the first the necessary condition is current income being below the permanent one. Key to permanent income variable is how to measure expected future earnings.[5] We assume individuals formulate their expectations on the earnings of "reference" individuals, namely workers with the same gender and educational level observed in the previous 10 years and living in the same area of the respondent. Under this assumption, we use the observed value of income of the reference individuals at different ages to infer the expected value of earnings of the respondent over his working life.[6] A graphical representation

[5] Details on the procedure used to measure expected future earnings are provided in Appendix B.

[6] More precisely, we use the 1991-2010 waves of the SHIW and we regress labor income on age, age squared, education level and dummies for the geographical area of residence. In order to allow the age profile of earnings to be different for different level of education, we add the interaction of age with education dummies. For each year in the sample, we use information on income of respondents in the current wave and previous four ones (10 years basis). The predicted value of income of the "reference" individuals at different ages provides a measure

of the expected value of annual earnings (for a man living in northern Italy in 2004) over the working period is depicted in Figure 1. While earnings are comparable at the beginning of the life-cycle (age 25) across educational groups, they rise at a faster pace for high educated workers later on. The expected life-cycle earning path is increasing and concave in age, and it becomes relatively flat (or even decreasing for low educated respondents) after the age of 45-50. Turning to retirement, male workers are assumed to retire at the age of 60 and to live until the age of 80; the replacement rate of retirement benefits with respect to the last wage is set to 80%. We use these information to compute the present value of expected future labor income at time t (H_t). Permanent income is calculated according to the formula (Deaton, 1992):

$$y^P = \frac{r}{1+r}\left[1 - \frac{1}{(1+r)^{(T-t)}}\right]^{-1}[H_t + A_t],$$

where the interest rate r is set at 2%, t is the age of the respondent and the lifetime horizon T is equal to 80. Individual resources consist of the present value of expected future labor income (H_t) and wealth (A_t), which includes total assets net of liabilities.

The second information we use is based on the lack of financial assets. According to the standard life-cycle, a necessary condition for households to be liquidity constrained is owning zero financial assets. In fact, an individual is defined liquidity constrained if she would like to have, optimally, negative wealth given the prospect of increasing future incomes upon which to borrow. We thus define liquidity constrained workers as those who, along with having current income below it permanent level, own less than 1000 euro.

We also check the robustness of our findings to alternative definitions of the liquidity constraint indicator. First, since illiquid assets are not fungible, real estate may not be used as a tool to smooth consumption. For this reason, we use an alternative definition of permanent income, based on future earnings and financial assets and excluding real estate. Second, we rely on self-reported vari-

of expected income over the life-cycle.

ables capturing whether someone in the household would like to borrow, but credit market frictions prevent him from doing it. This measure is drawn from the approach by Jappelli et al. (1998), according to which liquidity constrained households as those who either: a) applied to a financial company to ask for a loan and the application was rejected; or b) wanted to apply for a loan but decided against because of fear of rejection. We then combine this variable with measures for zero assets and current income below the permanent one, and build up six additional indicators for liquidity constraints (see Appendix B for a detailed variables' description).

Labor market frictions may hamper the instantaneous adjustment of labor supply, which may take time to respond to binding liquidity constraints. Therefore, in the empirical analysis, we examine the response of labor supply to liquidity constraints measured one period ahead.

To illustrate the correlation between labor supply and liquidity constraints, Figure 2 plots the (unconditional) distribution of the intensity of male labor supply for constrained and unconstrained workers. While the average number of working hours is not statistically different across the two groups, the distribution for unconstrained men (dashed line) is more concentrated with respect to constrained workers (solid line). This graphical representation does not point out a clear-cut evidence of constrained workers working more than the unconstrained ones. Two main reasons may, however, hid a response of labor supply to credit imperfections. First, confounding factors, both observable (e.g. education, age) or unobservable (preferences for leisure, time discount), may be associated to both labor supply and the probability of being liquidity constrained. Second, there may be a reverse causality issue: workers may be credit constrained *because* they work more. These mechanisms may partly explain the higher fraction of constrained men working less than the full time schedule (the percentage of those working less than 40 hours is, respectively, 26% and 19% among constrained and unconstrained individuals).

Descriptive statistics of the outcome variables and the covariates are reported in Table 1. Respondents work, on average, 42 hours per week, self-employed

working significantly more than employees (respectively, 51 and 40 hours); employees report almost 2 hours to be overpaid. The percentage of constrained respondents is 16% according to our baseline definition. Turning to individual variables, the average respondent is roughly 33 years old and earns approximately nine euro per hour. More than 85% of the sample work in the private sector, while about 20% are self-employed. 75% of respondents are married, while only less than 40% have a working spouse.

4. Empirical strategy

This paper aims to analyze the effect that liquidity constraints have on labor supply. More precisely, we examine the intensive margin, namely the number of working hours for working respondents (i.e., the subsample of those who supply a positive number of hours). The estimating equation is:

$$W_{it} = Z'_{it}\gamma + \delta LC_{it-1} + c_i + u_{it} \tag{1}$$

where W_{it} is the number of working hours supplied by individual i in period t and Z_{it} is a matrix of covariates (some of them are measured in period $t-1$).[7] The error term consists of the individual unobserved heterogeneity (c_i) and an idiosyncratic component (u_{it}); γ and δ are the coefficients to be estimated. LC_{it-1} is equal to one when the household is constrained in the credit market. As adjusting labour supply is likely to take a while, the increase in labor supply may not be instantaneous and, therefore, our measure for being liquidity constrained is lagged by one wave. We start estimating the correlation between being liquidity constraints and the intensity of labor supply using standard OLS techniques.

[7] In the baseline regression Z_{it} includes age and age squared, hourly wage and its squared value, a dummy for being married or cohabiting with a partner, two dummies for the number of children (one, two or more; the reference category is no kids), a dummy for working in the private sector and a dummy for self-employment. We also control for the lagged value of the spouse's working status and her labor income and the lagged logarithm of net wealth. Finally, we include regional unemployment rate and year dummies.

The OLS estimate of δ in equation 1 may be biased, because of individual unobserved heterogeneity. If individual characteristics that shape the intensity of labor supply, (e.g. preferences for leisure, the intertemporal discount rate or factors that affect workers productivity, like a permanent disability) are correlated to the likelihood of being liquidity constrained, the OLS estimate of the δ is biased. Since we expect these unobserved factors to reduce the intensity of labor supply and to increase the probability of being constrained (or viceversa), the OLS estimate of the δ would be biased downward. In order to address this issue, we rely on the panel component of our dataset and we estimate equation 1 using a fixed effect panel estimator, which does not require any restriction on the correlation between individual unobserved heterogeneity and the regressors, notably LC_{it-1}.

Another source of endogeneity may be related to time varying factors. Hence, LC_{it-1} may be endogenous in the estimating equation because of idiosyncratic shocks, such as an injury, which may be affecting both the labor supply and the probability the liquidity constraint is binding. More precisely, the fixed effect estimator provides a lower bound for the true causal effect when unobserved time-varying factors are negatively correlated with the intensity of labor supply and positively linked with the indicator for binding liquidity constraints (or vice versa). Similarly, our indicator for liquidity constraints may be correlated to volatility in income or other time-varying factors that we do not observe, but the bank does when deciding to give a loan (e.g. the worker may be on a temporary contract or have fluctuations in hours). In addition, there may be a reverse causality issue. The estimate of the equation above is biased if individuals are liquidity constrained *because* they are working less. These channels push downwards the coefficient δ and, thus, the fixed effect estimator of δ provides a lower bound for the true causal effect. Finally, measurement error in LC_{it-1} may determine an attenuation bias in the estimate of the coefficient δ.[8]

[8]Measurement error might be caused, for example, by the difficulty in estimating the subjective income perceived rather than the estimated average one.

Even if, in principle, these channels may substantially bias the fixed effect estimation results, we argue that, in our framework, bias due to time-varying factors is weakened by the timing variables are measured. The time we measure the dependent variable and the indicator for liquidity constraints binding are not contemporaneous, but the latter is measured with one lag (two years) with respect to labor supply. It follows that the fixed effect estimator is biased whenever the time varying component of the error term (u_{it}) is correlated with liquidity constraint at time t and the intensity of labor supply at time $t-1$ (two years before). We argue this timing weakens the relevance of the time-varying source of endogeneity, which is potentially driven by shocks which are persistent but not time-invariant. Moreover, this timing in the measure of the dependent variable and the liquidity constraints indicator dilutes the importance of the reverse causality issue. Nonetheless, since we cannot rule out *a priori* this endogeneity issue nor the attenuation bias due to measurement error, we carry out an instrument variable procedure in the framework of a fixed effect estimator to estimate equation 1.

Let us describe the rationale behind the instruments. The possibility of resorting on the formal credit market and/or the availability of alternative tools to access to wealth of other family members may provide young workers with resources to sustain their consumption at the permanent income level, which, in turn, translates into non-binding liquidity constraints. Thus, the first instrumental variable we use hinges upon the role of inheritance as a liquidity buffer to rely upon. Young workers receiving an inheritance would be able to better rely on additional resources, hence sustaining their consumption at their permanent income level and liquidity constraints will stop to be binding. Second, we exploit widely documented geographical and time variation in the development of the banking sector in Italy (Guiso et al., 2004; Bertola et al., 2005; Casolaro et al., 2006; Benfratello et al., 2008; Trucchi, 2015) to measure credit market conditions in the area where the respondent lives. Local financial development fosters access to credit and, thus, we expect the probability of being liquidity constrained to be decreasing with banking sector development. More in detail,

we use the following instruments. In order to capture the resources to rely upon originated from additional inheritance, we build up a dummy variable taking the value of one if at least one parent of the household head is not alive. This variable would be a proxy for additional easiness to resort to a liquidity buffer. In addition, we want to capture the supply side of the credit market. To do so, we use the bank branch density as an instrument, which would proxy the availability of credit at province (and year) level. To allow for these two channels to interplay, we also include an interaction term between the two variables described above. Since the link between financial market conditions and the individual probability of being liquidity constrained may weaken during the Great Recession, we focus on the subsample including years before 2007 in order to implement this analysis. Table 2 illustrates the variability of bank branch density in our sample. On average, in Italy, there are almost six bank branches every ten thousands inhabitants; most of the variability in branch density being driven by differences across provinces rather than its variation over time.[9]

Since the endogenous variable is lagged by one period, the instruments refer to the wave before the interview. Exclusion restrictions hinge on the assumption that, conditional on the other covariates, the instruments are not correlated with the dependent variable other than through LC_{it-1}. Parental variables are not expected to have a direct impact on men's labor choices. This is particu-

[9] We also test the robustness of our results to an alternative set of instruments, aimed to capture the possibility of resorting on informal credit by the spouse. Hence, the more the alternatives available to resort to additional financial resources when needed (informal credit) the less likely the liquidity constraints will be binding. Therefore, the probability of being liquidity constrained is expected to be higher for respondents whose partner is less likely to be credit constrained or endowed with less (liquid) wealth. More precisely, we use as regressors a dummy variable that captures whether the spouse is liquidity constrained, and the age of the spouse, which is expected to be positively correlated with her wealth. The validity of these instruments hinges on the assumption that, once the direct effect of the spouse's labor earnings are controlled for, the indicator for the partner being constrained is assumed not to affect individual labor supply other than through the availability of a source of informal borrowing.

larly true in a Italy, where the male spouse is often the breadwinner. Moreover, Italy is the European country where men spend less time in domestic activities (Bloemen et al., 2010). Therefore, in the Italian settings it is common that both elderly-care and child-care are carried out by women.[10] As for financial development, Guiso et al. (2004) and Casolaro et al. (2006) argument that geographical heterogeneity in banking development is partly driven by differences in the stringency of reforms implemented in 1930s and, thus, does not reflect local economic conditions. In our regressions we control for individual fixed effect, which embeds province fixed effect and, thus, the impact of economic and cultural variables that are specific of a certain area. Moreover, our estimated effect is net of regional labour market conditions, captured by the regional unemployment rate.[11]

5. Results

We start our analysis by focusing on the OLS and fixed effect estimate of the intensity of the labor supply (Table 3). OLS estimate results (first column) confirms what emerges from Figure 2, namely a negative, although not significant, association between liquidity constraints and the intensity of labor supply. Constrained workers appear to work, on average, one hour less than their unconstrained counterpart. The second column in Table 3 reports the estimate results when the panel dimension is taken into account via the fixed effect estimation technique, which is ideal as it wipes out individual unobserved time invariant characteristics that could be driving the endogeneity. Under this specification, we now detect a positive and significant effect of binding liquidity

[10] The effect of inheritance as additional available wealth is controlled by our regressors, which include the level of net wealth (in log). Wealth, indeed, shapes the intensity of labor supply through its effect on the reservation wage. Thus, we argue that the effect of bequests on the probability of being liquidity constrained is *net* of the impact of wealth that goes through the reservation wage.

[11] Our results are confirmed when branch density and unemployment rate are both measured at the regional level (a region includes several provinces).

constraints on hours supplied in the labour market. Constrained men increase their intensity of labour supply by four hours per week.

Moving from the positive average effect shown Table 3, we examine *who* respond more to financial imperfections and through *which channels* workers increase the intensity of their labor supply. To this purpose, we start by allowing the effect of liquidity constraints to differently affect the labor supply of employees and self-employed workers, the latter being possibly more flexible in adjusting their working hours. Table 4 reports OLS and fixed effect estimate results of the baseline model, enriched with the interaction term between the indicator for liquidity constraints and the self-employment dummy. Fixed effect results show self-employed respond more to financial restrictions with respect to the employees. While the effect of liquidity constraints on hours supplied by employees is positive, but small in size and not statistically different from zero at any conventional level, self-employed workers turn out to respond significantly to binding liquidity constraints by increasing their labor supply by more than 19 hours per week (that is 38% of the sample mean of hours supplied by self-employed). In order to gauge the magnitude of this effect, it is worth noting that it is similar to an increase form a part-time to a full-time schedule and, in addition, it is comparable to the difference between the first and the third quartiles in the distribution of working hours in the subsample of self-employed (working hours are, respectively, 40 for the first quartile and 55 for the third quartile of the distribution of working hours among the self-employed).

Workers may increase the intensity of their labor supply through different channels. Liquidity constrained individuals may change or take and additional job, as well as add overtime working hours so as to overcome the binding financial constraints [12]. As the SHIW dataset collects all these pieces of information, we estimate, in a fixed effect framework, the impact of binding liquidity con-

[12] We cannot disentangle whether the respondent has more than one job at the same time, or changed his job during the reference year.

straints on extra hours of work (only for employee workers) and having more than one job variable, also distinguishing between employees and self-employed. Fixed effect results for these two margins are reported in Table 5. We find a positive effect of liquidity constraints on the number of jobs (first panel of Table 5), which is consistent with an impact of financial distress on having a second job and/or of changing job, possibly a job with long hours. The average effect turns out not to be different between self-employed and employees, as reported in the second panel. We are aware, though, that increasing the number of jobs is not that easy to change, particularly in a country like Italy, where labour market features are very rigid. Finally, we focus on the extent to which employees respond to binding liquidity constraints by increasing their overtime work (the third panel of Table 5), controlling for the working type, i.e. whether self-employed or employee. Fixed effect estimate show an effect that is small in magnitude and not statistically significant.

All in all, the estimate results in tables 4 and 5 contribute to draw a picture of the channels determining the average effect of liquidity constraints on working hours, estimated in Table 3 (4 hours per week). We identify an important channel at work. Those who are driving the response to an increase in the liquidity constraints binding are the self-employed. Indeed, we find evidence of a significant and substantial effect of binding liquidity constraints on working hours supplied by self-employed workers, who are possibly more flexible in adjusting the intensity of their labor supply. Even if we do not detect a significant effect on working hours supplied by employees, our results point to a response of their labor supply to binding liquidity constraints. The latter reflects into an increase in the probability of having more than one job over the calendar year, which is consistent with liquidity constrained workers changing their job and/or adding a second job to the main occupation. Failure in detecting a significant effect on the intensity of labor supply of employees may possibly depend on more severe rigidities on the labor demand side.

We then move to an additional extension, where we control for the possible

endogeneity of liquidity constraints, beyond what is captured by unobserved heterogeneity (Table 6). The positive effect of financial constraints on the intensity of labor supply is confirmed. Looking at our preferred specification, reported in the first column, constrained men turns out to work about 11 hours more than their unconstrained counterpart.[13] The magnitude of the estimated effect in the second column is slightly lower, namely 8 hours per week. In both specification the response in terms of working hours is significant at the 5% level.

Turning to the instruments, the first column in the second panel of Table 6 shows that they have the expected sing in the first stage equation. The interaction between financial market development and the possibility of resorting on inherited bequest turns out to be positive and significant. Bank branch density weakens liquidity constraints as well as parents having passed away (although the single coefficients are not significant at conventional levels). The first term indicates that a more developed supply in the banking sector gives more potential for credit.[14] Second, parents passed away captures the availability of additional inherited resources that, in turn, reflects into a lower likelihood to optimally resort to credit, or having the credit denied. The positive coefficient for the interaction term is consistent with the two channels, financial markets and inheritance, being somehow complementary. The credit supply (branch density) is less determinant if parents are not alive, as well as the density of branches makes the importance of windfall assets less pronounced. F-statistic from weak identification test shows that the instruments are not weak in any specification.[15] Looking at the over-identification test, the Hansen J statistic

[13] It is worth noting, however, that this specification refers to a different sample period, namely before the Great Recession.

[14] We want to rule out the possibility that credit markets might foster labor supply of self-employed also by easing the expansion of their activity. Indeed, by adding the number of workers in the self-employed business as an additional control results are not affected.

[15] Staiger and Stock (1997) indicate a rule of thumb suggesting that the F-statistic should be greater than 10 to rule out weak identification problems.

does not reject the null hypothesis of exogeneity of the instruments at all conventional levels of significance.

Workers may have different degrees of sensitivity to good or bad events. Therefore, becoming or ceasing to be liquidity constrained may differently affect individual labor supply. We investigate this issue by relying on two auxiliary variables. The first one ("*Switch U to C*") is a dummy taking value one if the respondent was unconstrained and switches to constrained status; the second variable ("*Switch C to U*") is equal to one when ceasing to be liquidity constrained.[16] To examine asymmetric responses, we use, alternatively, these two variables as regressors in the equations for labor supply. Fixed effect estimate results are reported in Table 7. Estimate results in the first column shows that respondents who become liquidity constrained (upper panel) work, on average, four more hours with respect to unconstrained workers. Turning to the lower panel, namely the effect of switching from constrained to unconstrained status, the estimated coefficients have, as expected, a negative sign: Ceasing to be liquidity constrained determines a reduction in the intensity of labor supply by almost nine hours per week. This finding is consistent with the following mechanisms at work. Labor market rigidities from the supply side may dilute the effect of liquidity constrained starting to be binding. Therefore, supplied working hours may take more than one period of time in order to fully adjust. On the opposite, our results are consistent with labor demand being more flexible to accommodate a contraction in number of working hours.
In the second column on Table 7 we allow the effect of the two indicators for switching liquidity constraint status to be different depending on the type of job.

[16] We measure the effect of switching to a certain status (constrained/unconstrained) with respect to those who are not in that status. More precisely, we define the regressor "*Switch from U to C*" as a dummy variable taking value one if the respondent is liquidity constrained (in period t, year of the interview) but was not constrained in previous wave ($t-1$) and taking value zero if liquidity constrained are not binding at time t. The "*Switch C to U*" variable is defined in a similar way.

Labor supply of self-employed turns out to react to changes in the constrained status in both directions, the magnitude of the effect being not statistically different (but with opposite sign). Looking at employees, we find a significant response of working hours only for those who stop being liquidity constrained. These findings further support the role of labor market rigidities in diluting the effect of liquidity constraints on labor supply, these frictions being more severe for employees and for an increase in working hours with respect to a contraction.

5.1. Discussion

In order to further validate the robustness of our findings and to investigate their relevance over different phases of the life cycle, we explore alternative definitions for liquidity constraints and the extent to which our results holds across age bands. As discussed more in details in Section 3, detecting whether liquidity constraints are binding, namely a condition where individuals would optimally borrow but are prevented from doing so, is a challenging issue. Therefore, we check the robustness of our findings to alternative indicators by using a different measure of permanent income, which excludes real assets, and by constructing a measure for credit denial, based on self reported information. We combine these indicators and we build up seven measures for binding liquidity constraints (details on variable definition are illustrated in Appendix B). We also enlarge the age bands by also including in the sample, respectively, workers aged until 40 and 45 years.

Fixed effect estimate results for different indicators and age bands are shown in Table 8. Results in the first column allow to gauge the robustness of our results to alternative definitions of the dependent variables in the baseline sample. The first four regressors give comparable results, with an average increase in the number of working hours that ranges between 3 and 4, when statistically significant. The bottom definitions do not allow us to estimate a precise effect, given the low number of respondents who are liquidity constrained according

these definitions based on credit denial.[17] Looking at broader age bands, the estimated coefficients are comparable for all the seven measures, even though the level of significance worsens.

The comparison of estimation results across age groups (columns 3 to 5) points to a dilution in the effect of credit market imperfections with age. Younger men (aged 26-35) resort to 3-4 additional working hours to cope with credit constraints, while for middle age men (up to 40 or 45) the effect shrinks to, respectively, 2-3 and 1-2. We interpret this result as more difficult to reshape labour decision after the age of forty. It is consistent with two channels being at work. First, the Italian labour market is much more rigid for older people. Moreover, the intensity of the binding constraint reduces with ages, the older the worker the lower the potential indebtedness. Hence, the intensity of the labour reaction is decreasing for older workers, consistently with our estimates.

We also check the robustness of fixed effect IV estimate results to alternative definitions for being liquidity constrained. The two panels of Table 9 report the second stage estimated coefficients based on the two alternative sets of instruments illustrated in Table 6.[18] The magnitude of the impact of liquidity constraints on the intensity of labor supply turns out to be robust to the use of most of the alternative indicators, although the precision of the estimated coefficients slightly worsens. Similarly to results illustrated in Table 8, the limited number of constrained respondents according to the definition based on credit denial increases the weakness of the instruments, particularly for the estimate shown in the lower panel (the F-test on excluded instruments, reported in the last rows of each panel, is far below the rule of thumb of 10).

[17] They range between 12 observations, according to definition 7, and 18 according to definition 6.

[18] Note that, by construction, we cannot estimate the second specification (based on the additional instruments "Age partner, lag" and "Partner constrained, lag") when the liquidity constraint indicator is constant within the family, namely for variables *Constrained 3*, *Constrained 4* and *Constrained 5*.

Wrapping up the gist of the paper, we want to test how much the labour supply device might act as a smoother to the consequences of credit limitations in the financial market. It has to be stressed that credit limitations are not equivalent to low level of financial (liquid) wealth, despite the two being strongly correlated. Showing little wealth could in fact both signalling poverty or credit rationing. However, even if the two are difficult to distinguish as they are observationally equivalent, credit restrictions would act on the non poor only. Detecting who is credit rationed, despite the variable being "intangible" is thus a difficult task. We argue that we were able to detect the binding credit constraints, or restrictions, in the market by building an indicator capturing the low wealth but also the potentials to obtain higher level of income in the future. Let us remind again that existing credit constraints might not be relevant if not binding. This is the case of poor people with low wealth. Liquidity constraints bind only for people who would optimally borrow, but they are impeded to do so. As a consequence, the only alternative to overcome the financial barrier is to work additionally.

As for the direct and indirect effect of wealth (through the liquidity constraints channel), we argue that the effect of the indicators for liquidity constraints is net of the direct impact of wealth, which is captured by the wealth measure included in the set of regressors. This claim is confirmed by the comparison of alternative measures for liquidity constraints that may rely or not on the low asset indicator. The last three regressors in Table 8 do not rely on the indicator for wealth below the 1000 euro threshold to measure binding liquidity constraints. If we disregard the first age group, for which the number of constrained respondents according to credit denial are not enough for the identification, the comparison between different definitions points out that, although less precisely estimated, the magnitude of the estimated coefficients associated to the last three regressors are comparable to the other ones. For instance, looking at the second column (respondents aged 26-40), we estimate an impact of liquidity constraints of 2/3 hours according to definitions 1-4 and of 4 hours (although not statistically significant) for definitions 6 and 7. We interpret these findings

as supportive of the reliability of our measures for binding liquidity constraints.

Constrained workers may increase the intensity of their labor supply by changing job, possibly a job with long working hours. We argue, however, that this is a short term reaction driven by the willingness of increasing the intensity of labor supply combined with the rigidity in the working schedule (that may not allow overtime hours), rather than a programmatic choice that involves long term job career decisions. By controlling for individual fixed effect, which includes ability, tastes and other individual characteristics that may determine choices about job career and sector of employment, we argue that we rule out this channel.
Similarly, if individuals select into sectors with high job training, they would exhibit high permanent income and low current one, being, thus, more likely to be liquidity constrained. We claim this channel is ruled out by controlling for the employment sector (public/private) and the type of job (self-employment). Moreover, the individual unobserved heterogeneity possibly includes tastes for different types of jobs or career perspectives.

Our results are hence suggesting that frictions in the credit markets are not diluted and confounded with other factors, as discussed above, and show an important impact on the labour supply.

6. Conclusions

This paper contributes to the literature by adding a bridge between the financial and the labour markets. We explore whether labor supply decisions might be driven by inefficiencies in the financial markets such as restriction to credit. Credit and labor markets are strongly related, and reforms affecting one market are likely to also have an impact on the other one. Using the conceptual framework of the life cycle model enriched with the possibility of choosing the labor supply in the working phase of life, we argue that the presence of more binding liquidity constraints are likely to increase the labor supply. This is

because one way to overcome credit frictions is to work more hours so as to earn additional income, necessary to accomplish consumption smoothing. In our paper we test this hypothesis by using the SHIW dataset provided by the Bank of Italy. Our findings suggest that, after controlling for the correlation of unobserved heterogeneity with the regressors and the endogeneity of being liquidity constrained, this channel is certainly at work for the intensity of labor supply of men. Credit market restrictions are responsible for additional hours worked (on average 4 hours per week), mostly determined by a response of self-employed workers, who are possibly more flexible in adjusting the intensity of their labor supply. We also find some evidence that liquidity constrained youth are more likely to have more than one job in the calendar year, but this does not reflect into an increase in the number of working or overtime hours.

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Tables

Table 1: Summary statistics: Men 26-35

Variable	Mean	Std. Dev.	Obs.
Dependent variables			
Working hours	42.077	10.817	544
More jobs	0.037	0.188	544
Overpaid hours	1.742	3.372	431
Working hours (employees)	39.767	8.287	432
Working hours (self-employed)	50.985	14.316	112
Liquidity constraint indicators			
Constrained, lag (baseline def.)	0.160	0.367	544
Constrained 2, lag	0.151	0.358	544
Constrained 3, lag	0.241	0.428	544
Constrained 4, lag	0.268	0.444	544
Constrained 5, lag	0.033	0.179	544
Constrained 6, lag	0.024	0.154	544
Constrained 7, lag	0.022	0.147	544
Covariates			
Age	32.518	2.066	544
Wage	8.87	6.194	544
Private sector	0.858	0.349	544
Self-employed	0.206	0.405	544
Married	0.75	0.433	544
Working partner, lag	0.388	0.488	544
Income partner, lag	5.22	7.533	544
1 Child	0.292	0.455	544
2+ Children	0.276	0.447	544
Log net wealth, lag	15.148	5.472	544
Unemployment rate	7.592	4.692	544
Year 2004	0.188	0.391	544
Year 2006	0.182	0.386	544
Year 2008	0.208	0.406	544
Year 2010	0.182	0.386	544
Instrumental variables			
Parent passed away, lag[a]	0.188	0.392	313
Branch density (prov), lag[a]	5.834	1.944	313
Age partner, lag	19.342	15.022	544
Partner constrained, lag	0.142	0.349	544

Notes: [a] these variables refer to the period before 2008.

Table 2: Descriptive statistics: banks branch density

Variable		Mean	Std. Dev.
Branch density (prov), lag	overall	5.880	2.004
	between		2.126
	within		0.085

Notes: Observations: 78 provinces (included in the estimation sample of Table Appendix B). 46 provinces observed, on average, 1.7 times.
Branch density measures the number of branches per ten thousands inhabitants, calculated at the province level.

Table 3: OLS and Fixed Effect estimate (dep. var.: working hours)

	OLS	FE
Constrained, lag	**-0.996**	**3.894****
	(1.396)	**(1.660)**
Age	4.909	-1.276
	(6.248)	(7.590)
Age sq.	-0.072	-0.054
	(0.097)	(0.128)
Wage	-0.943***	-0.010
	(0.188)	(0.459)
Wage sq.	0.007***	-0.013**
	(0.002)	(0.006)
Private sector	2.674***	1.512
	(0.953)	(3.167)
Self employed	10.311***	10.712
	(1.362)	(7.541)
Married	-0.644	7.579*
	(1.418)	(4.316)
Working partner, lag	-0.439	-2.551
	(1.711)	(3.303)
Income partner, lag	0.037	0.164
	(0.098)	(0.162)
1 Child	0.142	-3.974
	(1.085)	(3.363)
2+ Children	0.295	-4.988
	(1.215)	(4.203)
Log net wealth, lag	-0.005	-0.252
	(0.101)	(0.160)
Unempl. rate	-0.046	-0.805
	(0.101)	(0.557)
Year dummies	Yes	Yes
Constant	Yes	Yes

Notes: Number of observations: 544. $^{*}p < 0.1$,** $p < 0.05$,*** $p < 0.01$.
Estimated coefficients are reported. Standard errors (in brackets) are robust to heteroskedasticity.

Table 4: OLS and Fixed Effect estimate, employee and self-employed (dep. var.: working hours)

	OLS	FE
Constrained, lag	**-2.382***	**0.986**
	(1.270)	**(1.192)**
Constrained (lag)* self-empl.	**8.289***	**19.377*****
	(4.895)	**(5.156)**
Age	5.874	-2.544
	(6.283)	(7.221)
Age sq.	-0.086	-0.032
	(0.098)	(0.120)
Wage	-0.933***	0.197
	(0.189)	(0.431)
Wage sq.	0.007***	-0.016***
	(0.002)	(0.006)
Private sector	2.975***	1.697
	(0.970)	(3.175)
Self employed	9.153***	11.916
	(1.379)	(7.407)
Married	-0.770	5.567
	(1.431)	(3.748)
Working partner, lag	-0.466	-3.201
	(1.666)	(2.995)
Income partner, lag	0.043	0.210
	(0.094)	(0.147)
1 Child	0.077	-4.535
	(1.073)	(3.187)
2+ Children	0.409	-5.530
	(1.201)	(3.729)
Log net wealth, lag	-0.003	-0.163
	(0.100)	(0.119)
Unempl. rate	-0.035	-0.636
	(0.100)	(0.526)
Year dummies	Yes	Yes
Constant	Yes	Yes

Notes: Number of observations: 544. $^{*}p < 0.1$,** $p < 0.05$,*** $p < 0.01$.
Estimated coefficients are reported. Standard errors (in brackets) are robust to heteroskedasticity.

Table 5: OLS and Fixed Effect estimate: Channels

	OLS	FE
Dep. var.: More jobs		
Constrained, lag	0.034	0.108**
	(0.030)	(0.052)
Other controls	Yes	Yes
Dep. var.: More jobs; employees and self-employed		
Constrained, lag	0.052*	0.121**
	(0.031)	(0.058)
Constrained (lag)* self-empl.	-0.109	-0.089
	(0.084)	(0.060)
Other controls	Yes	Yes
Dep. var.: Overtime hours (employees)		
Constrained, lag	-0.176	0.180
	(0.455)	(0.843)
Other controls	Yes	Yes

Notes: Number of observations: 544 in the top two panels; 431 in the bottom panel (only employees). Also included: age; age squared,; hourly wage and its squared value; dummy for being married or cohabiting with a partner; two dummies for the number of children (one, two or more; the reference category is no kids); dummy for working in the private sector; dummy for self-employment; lagged value of the spouse's working status and her labor income; lagged logarithm of net wealth; regional unemployment rate; year dummies. $^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$.
Estimated coefficients are reported. Standard errors (in brackets) are robust to heteroskedasticity.

Table 6: Fixed Effect IV estimate: Second stage and First stage estimate results

Second stage (dep.var.: Working hours)		
Constrained, lag	10.635**	7.627**
	(4.987)	(3.329)
Other controls	Yes	Yes
F-test	11.402	23.067
Hansen J	2.034	0.486
p-value	0.362	0.486
First stage (dep.var.: Constrained, lag)		
Parent passed away, lag	-0.837	
	(0.721)	
Branch density (prov), lag	-0.421	
	(0.292)	
Parent passed away* br. dens, lag	0.234**	
	(0.090)	
Age partner, lag		-0.013***
		(0.005)
Partner constrained, lag		0.709***
		(0.105)
Other controls	Yes	Yes

Notes: Number of observations: 313 in first column (sample period: 2002-2006); 544 in second column. Also included: age; age squared,; hourly wage and its squared value; dummy for being married or cohabiting with a partner; two dummies for the number of children (one, two or more; the reference category is no kids); dummy for working in the private sector; dummy for self-employment; lagged value of the spouse's working status and her labor income; lagged logarithm of net wealth; regional unemployment rate; year dummies. $^{*}p < 0.1,^{**}p < 0.05,^{***}p < 0.01$.
Estimated coefficients are reported. Standard errors (in brackets) are robust to heteroskedasticity.

Table 7: Fixed effect estimate of becoming liquidity constrained or ceasing to be liquidity constrained (dependent variable: working hours)

	FE	FE
Becoming liquidity constrained		
Switch from U to C, lag	4.274*	1.455
	(2.212)	(1.812)
Switch (lag)*self-empl.		15.390***
		(4.765)
Other controls	Yes	Yes
Ceasing to be liquidity constrained		
Switch from C to U, lag	-10.808***	-9.443***
	(2.273)	(2.029)
Switch (lag)*self-empl.		-14.454**
		(6.083)
Other controls	Yes	Yes

Notes: Number of observations: 477 in the top panel and 103 in the lower panel. Also included: age; age squared; hourly wage and its squared value; dummy for being married or cohabiting with a partner; two dummies for the number of children (one, two or more; the reference category is no kids); dummy for working in the private sector; dummy for self-employment; lagged value of the spouse's working status and her labor income; lagged logarithm of net wealth; regional unemployment rate; year dummies.
Estimated coefficients are reported. Standard errors (in brackets) are robust to heteroskedasticity.

Table 8: Fixed effect estimate: Robustness to alternative measures for liquidity constraints and different age bands (dep. var.: working hours)

	Age 26-35	Age 26-40	Age 26-45
Constrained (baseline), lag	3.894**	2.131*	1.178
	(1.660)	(1.270)	(0.853)
Constrained 2, lag	4.272**	2.929**	1.713*
	(1.823)	(1.335)	(0.917)
Constrained 3, lag	3.098*	1.531	1.086
	(1.684)	(1.108)	(0.824)
Constrained 4, lag	2.332	1.882*	1.023
	(1.540)	(1.064)	(0.739)
Constrained 5, lag	-0.549	2.609	0.803
	(1.610)	(2.760)	(1.684)
Constrained 6, lag	-0.334	3.994	2.006
	(1.655)	(3.915)	(2.719)
Constrained 7, lag	-0.278	4.178	2.021
	(1.809)	(4.514)	(3.215)
Other controls	Yes	Yes	Yes

Notes: Number of observations: 544 for age band 26-35; 1500 for 26-40 and 2836 for 26-45. Also included: age; age squared,; hourly wage and its squared value; dummy for being married or cohabiting with a partner; two dummies for the number of children (one, two or more; the reference category is no kids); dummy for working in the private sector; dummy for self-employment; lagged value of the spouse's working status and her labor income; lagged logarithm of net wealth; regional unemployment rate; year dummies. $^{*}p < 0.1$,** $p < 0.05$,*** $p < 0.01$.

Estimated coefficients are reported. Standard errors (in brackets) are robust to heteroskedasticity.

Def. 1 (baseline): net wealth is less than 1000 euro and current income is lower than the permanent one;

Def. 2: net wealth is less than 1000 euro and current income is lower than the permanent one (excluding real assets);

Def. 3: net wealth less than 1000 euro;

Def. 4: the respondent has been denied credit or was discouraged from applying or net wealth less than 1000 euro;

Def. 5: the respondent has been denied credit or was discouraged from applying.

Def. 6: the respondent has been denied credit or was discouraged from applying and current income is lower than the permanent one;

Def. 7: the respondent has been denied credit or was discouraged from applying and current income is lower than the permanent one (excluding real assets).

Table 9: IV Fixed effect estimate: Robustness to alternative measures for liquidity constraints (dep. var.: working hours)

Lag of:	Constr. base.	Constr. 2	Constr. 3	Constr. 4	Constr. 5	Constr. 6	Constr. 7
	First specification[a]						
Coeff.	10.635**	9.360**	8.629	9.826	7.111	2.712	8.360
St. err.	(4.987)	(4.700)	(5.510)	(6.096)	(14.962)	(19.357)	(19.627)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-test	11.402	14.736	11.929	9.109	2.467	3.054	3.340
	Second specification[b]						
Coeff.	7.627**	8.068**				1.480	232.341
St. err.	(3.329)	(3.697)				(33.742)	(342.579)
Other controls	Yes	Yes				Yes	Yes
F-test	23.067	17.684				0.835	0.283

Notes: Number of observations: 313 for the first specification (sample period: 2002-2006) and 544 for the second specification. Also included: age; age squared,; hourly wage and its squared value; dummy for being married or cohabiting with a partner; two dummies for the number of children (one, two or more; the reference category is no kids); dummy for working in the private sector; dummy for self-employment; lagged value of the spouse's working status and her labor income; lagged logarithm of net wealth; regional unemployment rate; year dummies. * $p < 0.1$,** $p < 0.05$,*** $p < 0.01$.

[a]: First stage also includes the following instrumental variables: Parent passed away, lag, Branch density (prov), lag, Parent passed away* br. dens, lag.

[b]: First stage also includes the following instrumental variables: Age partner, lag, Partner constrained, lag. Estimated coefficients are reported. Standard errors (in brackets) are robust to heteroskedasticity.

Def. 1 (baseline): net wealth is less than 1000 euro and current income is lower than the permanent one;

Def. 2: net wealth is less than 1000 euro and current income is lower than the permanent one (excluding real assets);

Def. 3: net wealth less than 1000 euro;

Def. 4: the respondent has been denied credit or was discouraged from applying or net wealth less than 1000 euro;

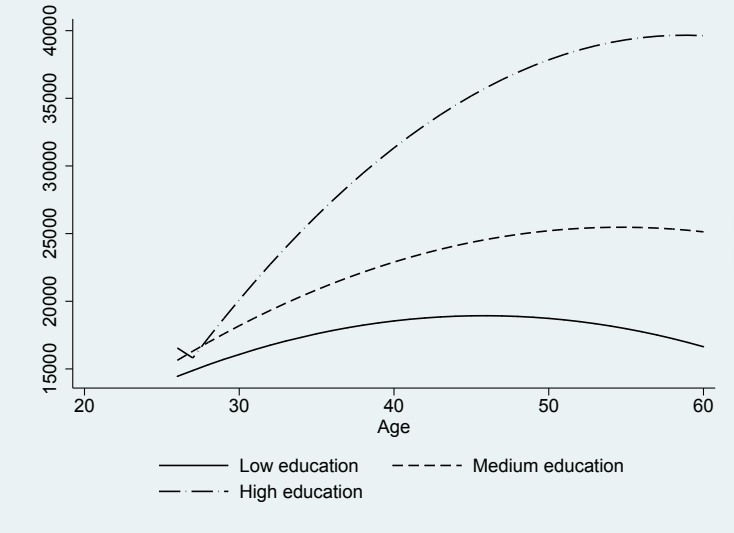
Def. 5: the respondent has been denied credit or was discouraged from applying.

Def. 6: the respondent has been denied credit or was discouraged from applying and current income is lower than the permanent one;

Def. 7: the respondent has been denied credit or was discouraged from applying and current income is lower than the permanent one (excluding real assets).

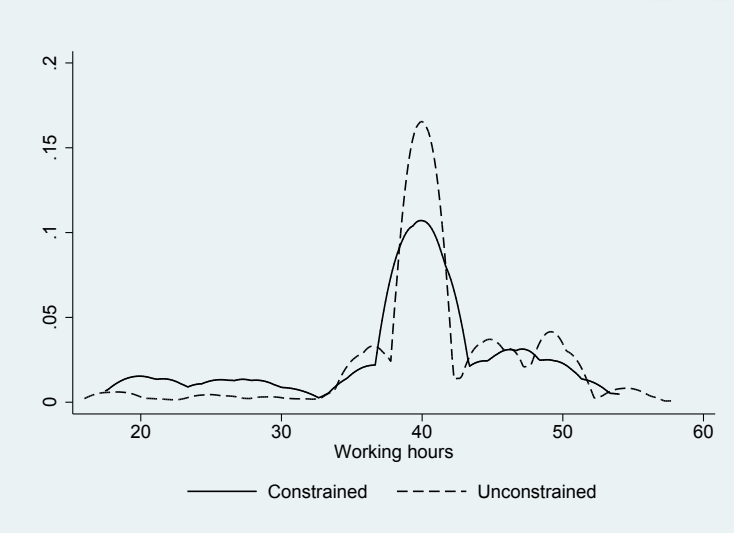
Figures

Figure 1: Expected life-cycle earnings



Notes: Expected value of annual earnings for a man living in northern Italy in 2004 over the working period. See Appendix B for details on the construction of the earning-age profile.

Figure 2: Working hours of constrained and unconstrained men



Notes: Constrained individuals are defined according to the variable *Constrained, lag* (the liquidity constraints indicator is, thus, lagged by one period with respect to working hours). They have current income below the permanent one and net wealth less than 1000 euro.

Appendix A. The model

Individual's optimization problem takes place in a two period setting. In each period individuals choose the level of consumption (c_t, $t = 1, 2$). In the first period individuals set their labor supply, i.e. they choose the share of time ($l_1 \in (0, 1)$) to spend for leisure, while in period $t = 2$ individuals retire ($l_2 = L$). Wealth (A_t) is timed at the beginning of the period while consumption (c_t) and leisure (l_t) are set at the end of each period. We assume initial wealth to be exogenous and equal to zero and agents to die with zero wealth ($A_3 = 0$). For simplicity, interest rate and subjective discount rate are set to zero.

Within this framework, individuals maximize the utility function

$$U = \sum_{t=1}^{2} u(c_t, l_t) = u(c_1, l_1) + u(c_2, L)$$

subject to the budget constraints

$$A_2 = w(1 - l_1) - c_1$$

$$c_2 = Y_r + A_2,$$

where w is the wage rate and Y_r is income at retirement, irrespectively on contribution paid. The last condition holds strictly since there is not a bequest motive.

The maximization problem can be written as:

$$\max_{A_2, l_1} U = u[w(1 - l_1) - A_2, l_1] + u[A_2 + Y_r, L].$$

Two additional constraints must hold. The participation constraint

$$(1 - l_1) \geq 0$$

and the liquidity constraint, according to which wealth cannot be less than an exogenous threshold B (not necessarily zero, but $B \leq 0$):

$$A_2 \geq B.$$

The Lagrangian function for this maximization problem is, therefore:

$$L = u[w(1-l_1) - A_2, l_1] + u[A_2 + Y_r, L] + \lambda[A_2 - B] + \gamma[1 - l_1]$$

and implies the following Kuhn-Tucker conditions:

$$\frac{\partial L}{\partial A_2} = u'_{c_1}(c,l) - u'_{c_2}(c,l) + \lambda = 0$$

$$\frac{\partial L}{\partial l_1} = -wu'_{c_1}(c,l) + u'_{l_1}(c,l) - \gamma = 0$$

$$\lambda[A_2 - B] = 0$$

$$\gamma[1 - l_1] = 0$$

where u'_x is the marginal utility with respect of x. If liquidity constraint are binding, assets at the end of period one are equal to the borrowing threshold ($A = B$), meaning zero or negative savings in the first period and $c_2 = Y_r - B$.

Supposing now a positive labor supply (γ equal to zero), we want to focus on the effect of liquidity constraints on the labor supply. To this purpose, we compare optimal consumption and labor supply choices of unconstrained and constrained individuals.

In the unconstrained case (λ equal to zero), the first order conditions with respect to consumption and leisure imply, respectively:[19]

$$u^{NC}_{c_1}(c_1, l) = u^{NC}_{c_2}(c_2, L)$$

$$u^{NC}_{c_1}(c_1, l) = \frac{u^{NC}_{l_1}(c_1, l)}{w}.$$

Suppose that the threshold B increases and liquidity constraints start binding. Given that λ is positive, the Kuhn-Tucker conditions imply that

$$u^{C}_{c_1}(w(1-l) + B, l) > u^{C}_{c_2}(Y_r - B, L)$$

and

$$u^{C}_{c_1}(w(1-l) + B, l) = \frac{u^{C}_{l_1}(w(1-l) + B, l)}{w}.$$

[19] Let u^{NC}_x and u^{C}_x denote, respectively, the marginal utility with respect of x in the unconstrained and constrained case.

Combining the two above equations we obtain

$$u^C_{c_1}(w(1-l)+B,l) = \frac{u^C_{l_1}(w(1-l)+B,l)}{w} > u^C_{c_2}(c_2,L).$$

From the last inequality we derive that c_2^C is higher than without capital imperfection (where the inequality holds as an equality), as consumers cannot borrow money and, thus, they have to consume the income increase after its realisation. All else equal, consumption at time one will be necessary lower than without liquidity constraints. The only way to keep marginal utility of consumption equal to that of leisure in period one is, thus, to increase labor supply by reducing leisure.[20]

If liquidity constraints bind, labor supply increases as it acts as a channel to partially smooth marginal utility of consumption across times.
Similarly, individuals who, in absence of liquidity constraints, decide, optimally, not to participate to the labor market ($\gamma > 0$) may supply a positive number of working hours ($l < 1$) when the credit constraint switches to binding, in order to smooth consumption.

[20] In principle, consumption at time one could be kept at the same level of the unconstrained case by resorting on additional labor supply. But in this case, the equality between marginal utility of consumption and labor in period one cannot be fulfilled.

Appendix B. Description of the main variables.

Dependent variables.

- *Working hours*: The average number of working hours (per week) supplied over the year. For each job declared by the respondent, we exploit information on the average number of working hours per week and on the number of months the respondent was employed in that specific job. Combining these information for all the jobs of the respondent, we compute the total number of hours worked over the reference year and, thus, their weekly average. We exclude from the sample respondents who worked on a temporary basis, as we are not able to compute how many hours they worked, and we exclude outliers from our sample (namely, individuals who declare to work, on average, more than 120 hours per week).

- *Overtime*: The weekly average of overtime working hours supplied by the employees. We build this variable following the same procedure used for *Working hours*. Its value is missing for self-employed respondents.

- *More jobs*: Dummy variable that takes the value of one if the respondent worked a positive number of hours in more than one job during the reference year.

- *Switch from U to C*: Dummy variable taking value one if the respondent is liquidity constrained (in period t, year of the interview) but was not constrained in previous wave $(t-1)$ and taking value zero if liquidity constrained are not binding at time t.

- *Switch from C to U*: Dummy variable taking value one if the respondent is not liquidity constrained (in period t, year of the interview) but was constrained in previous wave $(t-1)$ and taking value zero if liquidity constrained are binding at time t.

Liquidity constraints indicators. Constrained, lag: net wealth is less than 1000 euro and current income is lower than the permanent one.

This indicator hinges on the comparison between current and permanent income. The former is the net annual labor income earned by the interviewed. Permanent income at time t (year of the interview) is related to total resources according to the formula (Deaton, 1992):

$$y^P = \frac{r}{1+r}\left[1 - \frac{1}{(1+r)^{(T-t)}}\right]^{-1}\left[H_t + A_t\right],$$

where the interest rate r is set at 2%, t is the age of the respondent and the lifetime horizon T is equal to 80. Individual resources consists of the present value of expected future labor income (H_t) and wealth (A_t), which includes total assets net of liabilities. For married or cohabiting respondents, we assume each partner to hold 50% of household's wealth (that is collected at the household level). To compute permanent income is, thus, crucial how to measure expected future earnings. To this purpose, we assume earnings' expectations to be based on earnings of "reference" individuals, namely workers with the same gender and educational level observed in the previous 10 years and living in the same area of the respondent (the relevant labor market). Under this assumption, we use SHIW data and we regress (the real value of) individual labor income on a set of covariates, separately for women and men. The sample includes working age respondents, namely men aged 26-60, observed in the wave of the interview or during the previous four waves (10 years). The covariates are two dummies for education (medium and high education; the reference category is low education), age, age squared, and two dummies for the geographical area (Central and Southern Italy; the reference category is northern Italy). In order to allow the age profile of income to be different for different education levels, we also include the interaction between age and education. We use predictions of the above earning equation to infer the value of expected earnings for each year of the working life.[21] Men are assumed to retire at the age of 60 and to live

[21] Consider, for instance, a men aged 40 living in northern Italy in 2010. To compute the expected value of permanent income, we use 2002-2010 SHIW waves and estimate the income equation described above. We use the estimate results to predict his earnings for ages 41-60.

until the age of 80. The replacement rate of retirement benefits with respect to the last wage is set to 80% and retirement benefits are assumed to be constant in real terms. The present value of future earnings and pension benefits at the age of the interview (H_t) is calculated assuming the interest rate to be 2%.

We exploit different definitions for liquidity constraints being binding in a robustness check. These measures are:

- *Constrained 1*: net wealth is less than 1000 euro and current income is lower than the permanent one;
- *Constrained 2*: net wealth is less than 1000 euro and current income is lower than the permanent one (excluding real assets);
- *Constrained 3*: net wealth less than 1000 euro;
- *Constrained 4*: the respondent has been denied credit or was discouraged from applying or net wealth less than 1000 euro. More precisely, respondents (or someone in the household) who has been denied credit or was discouraged from applying are defined as those who either: a) applied to a bank or a financial company to ask for a loan or a mortgage and the application was rejected; or b) answer positively to the following question "In [year] did you or any other member of your household consider the possibility of applying to a bank or a financial company for a loan or a mortgage but then change your mind thinking that the application would be rejected?";
- *Constrained 5*: the respondent has been denied credit or was discouraged from applying;
- *Constrained 6*: the respondent has been denied credit or was discouraged from applying and current income is lower than the permanent one;
- *Constrained 7*: the respondent has been denied credit or was discouraged from applying and current income is lower than the permanent one

(excluding real assets).

Covariates.

- *Age*: Age of the respondent.
- *Wage*: Hourly wage of the respondent, calculated as labor income divided by the number of working hours.
- *Married*: Dummy equal to one if the respondent is married or cohabiting with a partner and zero otherwise.
- *Working partner, lag*: Dummy taking value one if the partner (if any) supplied a positive number of working hours the previous period.
- *Income partner, lag*: Labor income of the partner (in thousand euros 2010), lagged value (one period).
- *1 Child; 2+ Children*: Dummy variables equal to one if the respondent has, respectively, one or more children; the reference category is "no children".
- *Log net wealth, lag*: Lagged value of the logarithm of per capita net wealth (in thousand euros 2010). To avoid the problem of the logarithm being undefined, we approximate its value to zero when wealth is equal to zero or negative.
- *Private sector*: dummy variable capturing whether the respondent does not work in the public sector. Public sector workers are those working in general government, defence, education, health, compulsory social contributions and social welfare until 2008; in the 2010 questionnaire the public sector is defined as "government department or public agency [...] this includes central government, social security institutes, roads agency, regional authorities, provincial authorities, town authorities, universities, hospitals and national parks. It does not include companies in which the

government is a stakeholder, such as ENEL, the postal service and the national railways."

- *Self-employed*: dummy variable equal to one if the respondent is self-employed. Self-employment includes the following categories: member of profession; individual entrepreneur; self-employed worker/craft worker; owner or member of family business; working shareholder/partner; atypical worker (continuous or occasional collaborator, project worker, etc.).

- *Unempl. rate*: unemployment rate (15+) in the region where the respondent lives, measured in the year the survey refers to (source: Istat).

Instrumental variables.

- *Parent passed away*: Dummy variable equal to one whether at least one parent of the household head is passed away; zero if both parents are alive. It is measured with one period lag.

- *Branch density (prov), lag*: The branch density is calculated as the ratio between the number of bank's branches operating in the province where the respondent lives in the first quarter of the year of the interview (source: Bank of Italy, Bollettino Statistico) and the inhabitant of the province at the beginning of the same year, measured in tens of thousands (source: Eurostat).

- *Age partner, lag*: Age of the spouse/cohabiting partner, measured the previous period.

- *Partner constrained, lag*: Dummy taking value one if the partner (if any) was constrained in the previous period.