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TESTING FOR LIQUIDITY CONSTRAINTS IN EULER EQUATIONS WITH COMPLEMENTARY DATA SOURCES

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Abstract

Previous tests for liquidity constraints using consumption Euler equations have frequently split the sample on the basis of wealth arguing that low wealth consumers are more likely to be constrained. We propose alternative tests using different and more direct information on borrowing constraints obtained from the 1983 Survey of Consumer Finances. In a first stage we estimate probabilities of being constrained which are then utilized in a second sample, the Panel Study of Income Dynamics, to estimate switching regression models of the Euler equation. Our estimates indicate stronger excess sensitivity associated with the possibility of liquidity constraints than the sample splitting approach.

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1. Introduction

It is now widely believed among applied economists that the rational expectations-permanent income model of consumption in its most simple form is inconsistent with the data. There is much less agreement as to why we observe the empirical failure of the model. Is it just that preferences are in fact more complicated than in the simplest model? Or is the failure due to other features of the model, like the assumption of perfect credit markets? The existence of liquidity constraints, in particular, has important policy implications, for example with regard to taxation, financial market liberalization, growth and welfare (Hubbard and Judd, 1986; Jappelli and Pagano, 1995). It is therefore important to distinguish whether the rejection of the model results from borrowing constraints or from some other source.

The most influential microeconomic tests addressing the issue of liquidity constraints have relied on sample separation rules based on households' assets. However, assets alone are a rather imperfect predictor of potential constraints. Unfortunately, the United States surveys with consumption data do not have direct indicators of credit constraints, and the surveys with such indicators lack information on consumption. In this paper we combine data from the 1983 Survey of

Consumer Finances (SCF) with data from the Michigan Panel Study of Income Dynamics (PSID) using two-sample instrumental variables techniques. To capture liquidity constraints we obtain from the SCF a self-reported indicator whether people were turned down for loans as well as information on credit cards and other lines of credit. We relate the probability that an SCF household is constrained to demographic variables, and use these same variables in the PSID to impute the probabilities of credit constraints. We then estimate the Euler equation for consumption in the PSID as a switching regression using the stochastic sample separation information provided by the predicted probabilities. Compared to the asset-based sample splitting procedure of Zeldes (1989) and Runkle (1991), our approach relies on different and more direct information to assess the likelihood of a constraint. It therefore complements this earlier work. We find some evidence that liquidity constraints affect the consumption growth rate more strongly than suggested by the sample splitting approach.

In Section 2 we review the recent literature on liquidity constraints and Euler equations, motivate our methodology and describe how it differs from previous approaches. In Section 3 we describe the data used in the analysis and compare the indicators of liquidity constraints available in the SCF to asset-based sample separation rules previously used in the PSID. Section 4 presents the results of estimating the consumption Euler equation using switching regressions. Section 5 concludes.

2. Literature Review and Motivation

While the central implication of Hall's (1978) rational expectations-permanent income hypothesis is simple and powerful, there has been ample research documenting its empirical failure. The model has failed strongly in aggregate time series studies (e.g., Campbell and Mankiw, 1989) but much, if not all, of this failure can be explained by aggregation issues.[1] Studies relying on microeconomic data have not had as clear results. For example, Hall and Mishkin (1982) found excess sensitivity in the Panel Study of Income Dynamics, while Altonji and Siow (1987) did not.

The tests that reject the permanent income model do not point directly to the reason why the model fails. In the early literature following Hall, excess sensitivity was generally held to be due to the presence of credit market imperfections, in the form of interest rate differentials or credit rationing (Flavin, 1985; Hubbard and

[1]See Galí (1990), Attanasio and Weber (1993), Goodfriend (1992), and Pischke (1995).

Judd, 1986; Hayashi, 1987). In fact, credit constraints break the powerful implication of Hall's model: current consumption is no longer a sufficient statistic for everything the consumer knows about the future. This leads to an intertemporal dependence in the Euler equation for consumption. However, as more recent literature has emphasized, such dependence would not have to stem from the budget constraint. Similar dependence could be generated by non-separable preferences, durability of goods or slow adjustment of consumers. While the empirical implications for the Euler equation of all these extensions are rather similar to liquidity constraints (Browning, 1991; see also Attanasio, 1995, for discussion)[2] intertemporal dependence originating from the preference side has vastly different policy implications than credit constraints.

Recent empirical work has therefore tried to incorporate additional information to detect the presence of liquidity constraints. One such approach, pioneered by Juster and Shay (1964) and recently used by Zeldes (1989) and Runkle (1991), relies on an assets-based sample separation rule. They argue that assets can be used to separate households that are likely to be liquidity constrained (the low-

[2]Meghir and Weber (1993) circumvent this problem in clever fashion. They exploit the fact that liquidity constraints should affect all commodities similarly while the same is not true if preferences are non-separable. Comparing within period marginal rates of substitution and intertemporal Euler conditions, they find no evidence for the existence of liquidity constraints.

wealth group) from those that have access to credit markets or have no need to borrow (the high-wealth group). If the only violation of the model is due to the existence of liquidity constraints, excess sensitivity should arise only in the low-asset group. If instead excess sensitivity is due to preference misspecification, there is no reason to believe that the results for the two groups should differ. Zeldes indeed finds a violation of the theory in the low-asset group: the coefficient of lagged income in the Euler equation is significant and twice as large (in absolute value) as for the high-asset group. Runkle, on the other hand, does not find significant effects of lagged income in the Euler equations for either of the two groups. Zeldes' results have also been criticized by Keane and Runkle (1992) on econometric grounds.

While adding outside information improves the power of the test for liquidity constraints and ties potential rejections more clearly to a specific alternative, splitting the sample on the basis of wealth has a number of drawbacks. First of all, a simple split on the basis of wealth is a good indicator of liquidity constraints only if there is a roughly monotonic relation between the two. But poor households are not necessarily identical to constrained households. For instance, households which are able to borrow without full collateral have negative wealth by definition, but are obviously not credit constrained. According to Wolff (1994), about 15 percent of the SCF sample has negative net worth (including housing, real estate and pension wealth as part of assets). Even considering measurement errors, this indicates that a significant fraction of the population might be able to borrow without full collateral. Figure 1 plots a nonparametric regression function of the SCF indicator of whether a household was turned down for a loan on the net financial wealth to income ratio. The dependent variable is the same indicator we utilize below; it is described in more detail in the next section. The figure indicates that households with negative net wealth are more likely to be constrained than households with positive assets. But the relationship is non-monotonic. Households are most likely to be constrained if their net wealth is close to zero, but this likelihood initially falls as net wealth becomes negative.

Second, empirical measures of wealth are bound to be highly imperfect because assets and asset income are often poorly measured. Zeldes' and Runkle's sample split is partly based on a direct question in the PSID, asking whether households currently have liquid assets in excess of two months' income. For other survey years, lacking this question, a corresponding variable is created based on information on asset income. Liquidity constraints are unlikely to be perfectly correlated with this particular indicator. For example, we do not really know that two month's income is the exact cutoff below which assets are low enough to indicate a binding constraint. Survey measurement error may further obscure the relationship. If this is the case, the high-asset sample contains some constrained households, while the low-asset group is contaminated by the presence of unconstrained households. This reduces the power of the statistical test since it moves the excess sensitivity coefficients closer together for the two groups. As will be seen, we instead classify a household as liquidity constrained if it was refused loans or discouraged from borrowing, or if it has no credit cards or other lines of credit. Even though these criteria are subject to problems of their own, they use different and more direct information on liquidity constraints than the sample split based on assets.

A further problem, inherent to most tests for liquidity constraints, is that in empirical work the Euler equation is usually linearized, and so omits second and higher order terms of the conditional distribution of consumption growth. As was pointed out by Zeldes (1989) and Carroll (1992), this may create a correlation between consumption growth, lagged income and assets leading to spurious evidence in favor of constraints. Our indicators of constraints and unconstrained might not completely avoid this problem either. However, the problem might be less severe, if the correlation of the omitted terms with our indicators is smaller than that with the asset-based indicators.

To contrast the asset-based sample splitting technique to related work, including our own, it is useful to consider the Zeldes and Runkle model as a switching regression. There are two separate Euler equations

$$\Delta \ln c_{it+1} = \alpha_1 + \beta_1' X_{it+1} + \gamma_1 \ln y_{it} + \epsilon_{it+1}^1 \qquad \text{if } \pi' Z_{it} \geq u_{it}$$

$$\Delta \ln c_{it+1} = \alpha_2 + \beta_2' X_{it+1} + \gamma_2 \ln y_{it} + \epsilon_{it+1}^2 \qquad \text{if } \pi' Z_{it} < u_{it}, \tag{2.1}$$

the first equation referring to constrained households and the second equation to unconstrained households. The vector X_{it} includes preference shifters and, possibly, the interest rate; y_{it} is disposable income. The instruments Z_{it} and the random variable u_{it} indicate whether a household is constrained or not in period t. Zeldes and Runkle treat the asset-income ratio as an indicator $L_{it} = I(\pi' Z_{it} \geq 0)$, where $I(\cdot)$ is an indicator function, Z_{it} contains only the asset-income ratio and the cutoff point (two months' income), and set $\sigma_u^2 = 0$. If the permanent income model holds and the Euler equation is correctly specified, γ_2 should be zero; if liquidity constraints are responsible for excess sensitivity, γ_1 should be negative and significantly different from zero. The test is even somewhat more robust. If γ_2 is not exactly zero, due to non-time-separable preferences, for example, then $\gamma_1 < \gamma_2$ would still indicate the presence of liquidity constraints, if the non-separability affects both groups in a similar fashion.

To address the measurement problems associated with the asset-income ratio, one could recognize explicitly that L_{it} is only an imperfect predictor of liquidity constraints. This leads to a switching regression model analogous to that proposed by Lee and Porter (1984) in a different context. Hajivassiliou and Ioannides (1991) extend this idea one step further. They consider not only uncertainty about regime classification, but also relate to demographic characteristics the cutoff of the asset-income ratio below which the liquidity constraint is assumed to be binding. In terms of the formulation above, these variables become part of the Z_{it} vector. They estimate the Euler equations both with a two-step procedure and with full information maximum likelihood. Both cases involve a binary regression of the asset-income ratio on demographic variables and lagged values of the dependent variable. While their approach acknowledges the fact that the sample separation rule is an imperfect indicator of liquidity constraints, it nonetheless retains the assumption that liquidity constraints vary monotonically with the asset-income ratio. As we pointed out, this rules out the possibility that individuals can borrow without full collateral and therefore have negative net worth.

Garcia, Lusardi and Ng (1995) proceed in a similar fashion to Hajivassiliou and Ioannides, but use a switching regression model without extraneous sample separation information. The instruments Z_{it} are again demographic variables; however, the instruments are not related to any prior indicator of liquidity constraints. Instead, the instruments Z_{it} are used directly to find differentials in the slope coefficients of the Euler equations for the two regimes. There are various problems with this approach. First, it is not clear which regime should be labeled as the constrained regime and which one as the unconstrained. Garcia, Lusardi and Ng propose to identify the two regimes by comparing the signs of the coefficients of the Z_{it} vector with the logit coefficients of Jappelli (1990), relating the indicator of liquidity constraints in the SCF to demographic variables . We incorporate this eye-balling procedure formally into our estimation method. A second shortcoming is that, without extraneous sample separation information, the switching regression model's demands on the data are extremely high. Nevertheless, Garcia, Lusardi and Ng find significant excess sensitivity in one regime but not in the other. Maddala (1986) reports that disequilibrium studies without extraneous information on regime classification have also frequently found surprisingly good results, while Monte Carlo experiments reveal that such results are not likely to be expected.

In this paper, as in Zeldes and Runkle, we use extraneous information to identify liquidity constrained households, but our measures of liquidity constraints differ from those in the previous literature. We use a direct question on liquidity constraints and alternatively information on credit cards available in the SCF. If this information were also available in the PSID, we could easily split the PSID sample, and apply a switching regression model with known sample separation. Since our direct information on liquidity constraints is only available in the SCF, our approach is best thought of as an application of two sample instrumental variables techniques,[3] although here instrumental variables estimation is not necessary for consistency but just serves to link the two samples. It is useful to rewrite the switching regression model in (2.1) in a single equation as

$$\Delta \ln c_{it+1} = \theta_2' W_{it+1} + (\theta_1' - \theta_2') W_{it+1} L_{it} + \epsilon_{it+1}, \tag{2.2}$$

[3]See Angrist and Krueger (1992) and Arellano and Meghir (1992). Other applications of two-sample techniques in the context of consumption are Lusardi (1995), Carroll and Weil (1994), and Garcia, Lusardi, and Ng (1995). Carroll and Weil also use the PSID and SCF in conjunction.

where $\theta_j' W_{it+1} = \alpha_j + \beta_j' X_{it+1} + \gamma_j \ln y_{it}$, and L_{it} refers to the indicator of a binding liquidity constraint from the SCF. Next, take expectations conditional on Z_{it}, the instruments used to predict liquidity constraints. Note that Z_{it} includes the variables in W_{it+1}, therefore

$$E(\Delta \ln c_{it+1} \mid Z_{it}) = \theta_2' W_{it+1} + (\theta_1' - \theta_2') W_{it+1} E(L_{it} \mid Z_{it}) + E(\epsilon_{it+1} \mid Z_{it}). \quad (2.3)$$

The orthogonality condition for the model is $E(\epsilon_{it+1} \mid Z_{it}) = 0$, i.e. all variables in Z_{it} and not just those in W_{it+1} need to be orthogonal to the Euler equation error. Since L_{it} is not available in the PSID, we need to add a first stage to the model of the form $E(L_{it} \mid Z_{it}) = \pi' Z_{it}$, which will be estimated in the SCF by regressing the indicator of liquidity constraints on the demographic variables Z_{it}, to get $\widehat{\pi}$. While the assumption that the conditional expectation of L_{it} is linear in Z_{it} is a strong one, we found that using a probit or logit function gave very similar results. Equation (2.2) will then be estimated in the PSID by replacing L_{it} by $\widehat{\pi}' Z_{it}$. We demonstrate consistency of the estimator in the appendix and show how we construct standard errors.

W_{it+1} will include variables like age and changes in family size to proxy for changes in preferences over the life-cycle. In order to be able to construct changes in the SCF we exploit the panel aspect of the 1983 and 1986 waves of the SCF. This in turn requires that we use three year differences in consumption in the PSID as well. Thus, the equation we are estimating is

$$\ln c_{it+3} - \ln c_{it} = \theta_2' W_{it+3} + (\theta_1' - \theta_2') W_{it+3}(\hat{\pi}' Z_{it}) + \epsilon_{it+3}. \qquad (2.4)$$

We use three different indicators of liquidity constraints; each of them is only available in the 1983 SCF.[4] The first indicator defines a liquidity-constrained household as one which gave an affirmative answer to the following question: "In the past few years has a particular lender or creditor turned down any request you (or your husband/wife) made for credit or have you been unable to get as much credit as you applied for?" In addition, some consumers may not apply for credit because they think that, if they did, they would be turned down. So we add to the group of liquidity constrained these "discouraged borrowers," i.e. households who reported an affirmative answer to the question: "Was there any time in the past few years that you (or your husband/wife) thought of applying for credit at a particular place but changed your mind because you thought you might be turned down?" Excluding from the group of credit constrained those who reapplied for

[4]See Avery and Kennickell (1988) for a description of the SCF.

a loan and received the desired amount results in 350 households out of a total of 2139 (16.4 percent of the sample) who reported themselves as being liquidity constrained.[5]

Several studies have adopted the same definition of liquidity constraints. Jappelli (1990) describes the characteristics of households for which they are binding. With some identifying assumptions, Perraudin and Sorensen (1992) estimate the separate determinants of the supply and demand for loans. Cox and Jappelli (1993) and Duca and Rosenthal (1993) estimate that desired debt for those who reported themselves as liquidity constrained exceeds actual debt. Gale and Scholz (1994) find that borrowing constraints substantially reduce contributions to IRAs. Gropp, Scholz, and White (1995) find a small of effect of state personal bankruptcy laws on the probability of being constrained. Eberly (1994) uses the constraint indicator to split the sample and to test for excess sensitivity in Euler equations for the stock of automobiles.

One problem with the measure defined above is that it refers to the "past few years." Thus, while a household might have been rejected for a loan some time ago, it might have subsequently been able to obtain credit. To mitigate this

[5]Our SCF sample excludes the high-income subsample and includes only households reinterviewed in 1986. See the next section for details.

problem, we construct a second measure where we exclude from the constrained group all households which report that they have a credit card or a line of credit. According to this definition 6.3 percent of the sample is constrained.

Another objection to either indicator of liquidity constraints is that the questions about being turned down for loans may pertain mostly to consumers who intend to borrow for the purchase of a house, car or other durable which serves as collateral. The Euler equation, instead, is about nondurable consumption. Since banks look at similar variables for any type of loan application, whether collateralized or not, our first stage regressions should still give a good picture of who is likely to be constrained. In fact, our first stage results reported below qualitatively resemble those reported by Boyes, Hoffman, and Low (1989) using data on applications made to a particular credit card company. Nevertheless, in order to address the problem that our constrained consumers include those seeking collateralized loans we also use as a third indicator of liquidity constraints those households which have neither a credit card nor a line of credit at a bank. 22 percent of households are constrained according to this indicator. This indicator has its own shortcomings in turn. Some household might have already borrowed up to their credit limit on their credit card or credit line, so they are still constrained; others do not have credit cards simply because they do not want to borrow. Unfortunately, the 1983 SCF does not allow us to distinguish these households.

The information on liquidity constraints comes from a single cross-section, while we impute the constraint probabilities in the PSID for the whole 1971-84 period. The first stage equation for liquidity constraints is a reduced form reflecting not only desired borrowing for consumption, but also the nature of the constraint imposed by lenders on consumers. It is reasonable to assume that the demand-side consumption rule changes slowly at best; the hypothesis of unchanging supply-side behavior of financial intermediaries is less tenable. The supply of credit, in fact, responds to a variety of factors, such as the monetary and regulatory regimes and the institutional developments in the credit market. For instance, for a given set of characteristics, a household's constraint in the 1970s might have been more severe than in the 1980s, when consumer credit became more liberal and credit card use increased. Unfortunately, there is no evidence on borrowing constraints for the early 1970s similar to the question in the 1983 SCF. Given our operational definition of liquidity constraints, there is no satisfactory way of incorporating any "supply side" effect in the analysis. Thus, in using the estimated coefficients from the SCF in years other than 1983, we must assume that lenders' behavior remains constant through time. If the relationship between household characteristics and borrowing constraints changed over time, the precision of the predicted probabilities of being refused credit is reduced, and our test is biased against detecting liquidity constraints.

3. Data and Measures of Liquidity Constraints

In the construction of the PSID sample and of the relevant variables we follow Zeldes (1989) closely. Nevertheless, there are a variety of differences in our sample as well. Here we describe broad characteristics of the data; details are given in the Appendix. The main drawback of the PSID is that the only consistently available consumption measure is food expenditures. In order to estimate the Euler equation we must therefore invoke separability between food and other expenditures. The validity of this assumption is questionable. Meghir and Weber (1993), using data from the Consumer Expenditure Survey, find that expenditures on food at home, transport and services are not weakly separable either from each other or from food out of home, clothing, and fuel. Lusardi (1995), using the same data set, finds instead that Euler equations are very similar for food and for broader aggregates of nondurable expenditures; in each case she rejects the Euler equation.

Zeldes uses data from the PSID up to 1982, while our sample extends to 1987. Our final PSID sample contains three year consumption changes for 1971 and for 1974 to 1984. Other years are lost in forming changes of the variables, and because the food expenditure question was not asked in 1973. Income and wealth measures in the PSID are deflated by the price index of personal consumption expenditures (base year 1982-84); food expenditures are deflated by the price indices for food at home and away from home. Unlike Zeldes we include the low income subsample in our analysis and provide weighted estimates. Poorer households may be more likely to be affected by binding liquidity constraints, so it seems wise to exploit this additional part of the sample.

We try to match our SCF sample and variables as closely as possible to the PSID counterparts. The high-income subsample in the SCF is excluded. We only use households who were reinterviewed in 1986 and exclude households with changes in marital status in the intervening period. The final SCF sample includes 2,139 observations; details are again given in the Appendix.

We recreated the three sample splits used by Zeldes which are based on the ratio of assets to current disposable income. In most years the PSID does not ask directly about the level of assets. In some years a question is available asking "Do you have any savings [that] amount to as much as two months' income or more?" This cutoff is the basis for the first sample split that Zeldes uses: everyone with assets worth less than two months' income is included in the constrained group. The question is not available in all years. In these years the level of assets is estimated by dividing asset income by the current interest rate, i.e. by "blowing up" asset income. The second split is more stringent. The constrained group consists only of households with no asset income, and the unconstrained sample of those with assets worth more than six months' income. The intermediate part of the sample is discarded. The third split adds a measure of net housing wealth to liquid assets; otherwise it is similar to the first split, also using the two months' income cutoff.

In the remainder of this section we compare sample means of demographic variables in the PSID and in the SCF, present various measures of assets available in the two surveys and compare the resulting sample splits with our direct indicators of liquidity constraints. For comparison with the SCF, in some cases we present data from the 1984 PSID wave, which contained direct questions on the level of assets. Table 1 reports sample means for income and various demographic variables for both the PSID and the SCF. Column (1) contains means for the pooled PSID sample over the years 1971 to 1984. Column (2) singles out the year 1984 when information on asset stocks was available. This year should also be more comparable to the SCF, which was conducted in 1983. The SCF sample means are displayed in column (3). The means in the two datasets are reasonably similar and the existing differences do not seem to follow any particular pattern. This is comforting, as the two samples used in the estimation need to stem from the same population.

The final two columns in Table 1 compare sample means for constrained and unconstrained households in the SCF using the first indicator of liquidity constraints, namely whether a household was turned down for a loan. There are pronounced differences between these two groups. Constrained households have less income, are younger and more likely to be single and black than unconstrained households.

We next provide some evidence on the quality of the asset information used by Zeldes and others and its implications for classifying households as liquidity constrained.[6] The upper panel of Table 2 reports percentiles of the distribution of various measures of liquid assets in the 1984 PSID and in the SCF. While the latter does not provide direct questions about the asset-income ratio, it contains detailed information on the level of assets and on asset income. We use this information to mirror the available data in the PSID as closely as possible. We report only data for the 1984 PSID because we want to compare the blown up measure of wealth, derived from asset income, with the direct measures of wealth stocks available in 1984. Asset income in the PSID refers primarily to interest, dividends, and rent; households with substantial business income are excluded. We use two alternative measures of asset levels for comparison. The "narrow" definition excludes bonds and stocks because these include holdings in IRAs. The reason for this is that it is unclear (and doubtful) if respondents include interest and dividend income from IRAs when reporting income from assets. Furthermore, IRAs are not very liquid and it is hard to borrow against them. However, the narrow definition also excludes any other holdings of bonds and stocks; these are part of liquid assets, whose income should be reported by PSID respondents.

[6]The samples used in Tables 2 and 3 differ from those used below in the estimation. Here we exclude the poverty subsample of the PSID and we do not exclude observations which had missing values in variables that are used below but are not related directly to the blowing-up of asset income. The distributions are also unweighted. This corresponds more closely to Zeldes (1989).

Therefore we also compute a "wide" definition of assets that includes all bonds and stocks (inclusive of IRAs).

Comparison of either the narrow or wide definitions of asset levels with the blown-up measure reveals similar patterns in both datasets. The left tail of the distribution (up to the 50th percentile) of the blown-up measure lies below those of the stock distributions, suggesting that asset income may be under-reported at low levels of assets. At high levels of wealth (above the 75th percentile) the pattern reverses: the right tail of the distribution of the blown-up measure is thicker than that of the stocks. This probably derives from the fact that asset returns vary across households in a way that is not accounted by the implicit assumption in the asset income inflating procedure, i.e., that each asset yields the same return. The lower panel of Table 2 shows that one obtains similar results if one adds to each of the three definitions of assets an estimate of the stock of housing, although the distribution functions cross at a lower percentile, around the median, in this case.

Potential biases in constructing sample splits arise from the underestimation of assets in the left tail of the distribution, because the cutoff-point to separate low and high-wealth groups occurs at fairly low levels of assets. Therefore the comparison between the various wealth measures suggests that splits that use asset income to impute wealth will tend to overstate the size of the constrained group.

The upper panel of Table 3 shows how sample splits based on a blown-up measure of assets may affect the classification of households into constrained and unconstrained. The panel refers to the 1984 PSID and contrasts the sizes of the constrained and unconstrained groups resulting from splitting the sample according to the actual stock of liquid assets (narrow definition) with that resulting from splitting according to blown up asset income (for brevity, Zeldes' splits). Each row in Table 3 reports, respectively, the sample size, the number and fraction of households that are constrained according to both sample splits, constrained according only to Zeldes' split, constrained only according to the asset stock split, and unconstrained in both cases; the percentages in each row therefore sum to 100. Following Zeldes, three different splits are reported: split 1 defines as constrained those with liquid assets below two months' income; split 2 those with liquid assets equal to zero; and split 3 those with net worth below two months' income.

The interesting columns are (3) and (4). Column (3) indicates that Zeldes' constrained group is contaminated by people who instead possess considerable amounts of assets. The extent of this contamination is substantial, especially for liquid assets: 11 percent of the sample is classified as constrained according to split 1 and 7 percent according to split 2, but unconstrained if the reported stock of assets is used to split the sample. Column (4) shows that the contamination of the unconstrained group with households reporting low asset stocks is somewhat less severe, in particular for splits 2 and 3 (3 percent). Even if the probability of being liquidity constrained were directly related to the level of assets, using the available asset income in the PSID leads to some misclassification.

The lower panel of Table 3 refers to the SCF and presents similar tabulations of the direct indicator of being turned down for a loan against Zeldes' splits. The extent of misclassification of each of Zeldes' splits is much larger. Splits 1 and 2 are good indicators for the unconstrained, but poor indicators for the constrained: About 50 percent of those having access to loans or not interested in borrowing are in fact included in the constrained sample (column 3). Only 3 percent of the sample reports being denied loans or discouraged from borrowing and yet has assets in excess of two months' income. Split 3, using net wealth, works much better in sorting out constrained households: only 21 percent of the sample constrained according to split 3 reports not being denied credit. However, split 3 does not do quite as well in identifying the unconstrained (8 percent is misclassified).

These patterns are obviously conditional on the assumption that credit status is a superior indicator of liquidity constraints than assets-based cutoff points. Given this condition, Zeldes' testing strategy is rather inefficient. Using splits 1 or 2, only about a quarter of the observations with low assets is really unable to borrow (0.18 / (0.18+0.49) in split 1); about one third using split 3. This implies that the "true" coefficient of lagged income in Zeldes' regression should be three or four times as large, in absolute value, than what he finds in the data.

Table 4 reports linear probability models of being liquidity constrained using the various constraint indicators in the SCF (columns 3 to 5), which will later be used to impute the probability of being constrained in the PSID. For comparison, we report analogous estimates using as the dependent variable Zeldes' split 1 in the 1971-84 PSID (column 1) and in the SCF (column 2). These regressions include demographics (age, sex, marital status, race, dummies for family size, and changes in family size), five dummies for education, three regional dummies, and the log of household disposable income and its square, the head's employment status, the employment status interacted with the education dummies, and a dummy for whether the household owns or rents its home. The regressors are levels of demographics or lagged behavioral variables which should not belong in the Euler equation independently. For most regressors the definitions in the SCF and in the PSID are basically the same. There is a slight problem with the timing of the constraint indicators. In the Euler equation for changes between years t and year $t + 3$, the variables about the constraint should refer to year t. This would be 1983 in the SCF. Recall that the question about being denied credit was asked in 1983 but refers to the past few years. It therefore does not strictly correspond to the same year as other variables which are measured at a point in time like employment or income. While this is less of a problem for the demographic variables which do not change or only change slowly, we do need to include income in the first stage equation because it is also a regressor in the second stage.

The pattern of results in Table 4 is similar to that found by Jappelli (1990). According to the first two indicators of liquidity constraints, which are based on households being denied loans (columns 3 and 4), constrained households tend to be younger, are more likely black, include larger families, and live more often in the West. The education variables have little impact on the probability of being a rejected loan applicant or discouraged borrower once income is controlled for. Income is significant but not of utmost importance. This is likely to result from the fact that richer households tend to ask for larger loans, and lenders are primarily interested in obligation ratios (the ratio of loan to income) or ability to pay (see e.g. Munnell et al., 1992). This is further evidence that the relationship between liquidity constraints and variables like wealth or income is not a simple one, thus casting further doubts on sample splits based on these variables.

Whether households with credit cards or credit lines are excluded from the constrained group (in column 4) makes little difference to the pattern of coefficients but tends to weaken the results. When we use simply the presence of a credit card or credit line as our constraint indicator (column 5), we obtain some different results. The region effects are reversed and education now matters strongly. The education effects resemble those found in both the PSID and SCF, when the indicator function based on the asset-income ratio (split 1) is used as the dependent variable. The regional dummies are unimportant for the asset split, on the other hand.

4. Euler Equation Estimates

In this section we present estimates of the Euler equation in the PSID. The specification and estimation strategy differ somewhat from Zeldes'. Unlike Zeldes, we do not perform fixed effects estimation. The reason is that there is not enough variability in the imputed probabilities of liquidity constraints within individual households over time. The main variation, in fact, stems from households' aging; but age is part of the Euler equation, because it captures changes in preferences directly related to the intertemporal allocation of consumption. Controlling for age, the interactions of the predicted probabilities of a constraint with the Euler equation variables (the term $W_{it+3}(\hat{\pi}Z_{it})$ in equation (2.4) above) are basically not identified anymore within households. We must therefore rely on the variability of the constraint probabilities across households, and assume that individual effects, like differential discount rates or differences in the expected variability of consumption, are uncorrelated with the probability of being liquidity constrained. While this is a strong assumption, it is unlikely that these demographic differences follow the same pattern as liquidity constraints.[7]

We also do not include time dummies in the estimated Euler equation. The

[7]Hajivassiliou and Ioannides (1991) and Garcia, Lusardi, and Ng (1995) also do not control for fixed effects in the Euler equation for consumption.

reason for this is mainly due to computational difficulties in constructing the variance-covariance matrix of the estimates. However, given that we have 12 years of data including two recessions and recoveries, macro effects should largely average out in the estimation. We also estimated all reported models including time dummies and the point estimates are hardly different. A further difference with respect to Zeldes concerns the variables included in the Euler equation. Instead of using his measure of changes in food needs (capturing changes in family composition) we directly control for the change in the number of adults and the change in the number of children. We found these variables to be superior indicators for the food consumption profile. We control for age and age squared in the Euler equation. These variables are introduced in the previous stage, and we want to rule out the possibility that the imputed probabilities capture age-related changes in preferences. Finally, we include lagged disposable income to test for excess sensitivity.

An additional difference is that we use three year changes in food consumption in the PSID rather than one year changes as Zeldes. The reason for this is compatibility with the 1983-86 SCF. Using three year changes, we are able to construct analogues to all the regressors in the SCF. Given that the Euler equation error follows a martingale, using overlapping three year changes of consumption will introduce serial correlation in the errors up to the second lag (abstracting from additional within-year time-aggregation). Because there are missing data so that not all households are present for the same years, the autocorrelation in the errors will be household specific. We adjusted the covariance matrix for this household specific autocorrelation pattern. Since the pattern is known given the years for which we have data for a specific household, we also performed GLS estimates but these turned out to be almost identical to the OLS estimates. We present OLS estimates in the tables below.

We included the poverty subsample of the PSID in the estimation since it will contain many households which are likely to be liquidity constrained. To adjust for the oversampling and to achieve comparability with the SCF we weighted the second stage estimates by the PSID family weights. Since it did not affect our results, we do not weight the estimates in the SCF, which is a representative dataset.

Unlike Zeldes we omit the interest rate from the Euler equation; this avoids the need to use instrumental variables in the estimation of the Euler equation since all regressors are part of the household information set. Similarly, but like

Zeldes, we do not condition on other variables like labor supply which might be non-separable from food consumption. We would also need instruments in the SCF for the conditioning variables. Since a natural instrument for a variable like the change in employment status of the head is its lag, this is not feasible. Zeldes (1989) argued that such non-separabilities, as long as they affect both the constrained and unconstrained consumers alike, should show up in the coefficients for the unconstrained regime as well. The differences in the coefficients between the two regimes should still give an idea of the impact of constraints.

In order to compare our results to the previous literature, we present in Table 5 the coefficients of an Euler equation estimated on the full sample and estimated separately for the low and high wealth samples, using Zeldes' split 1 based on liquid assets. Column (1) shows the results for the pooled sample. There is no significant evidence for excess sensitivity in the entire sample. Columns (2) and (3) refer to the high wealth and low wealth subsamples, respectively. For the high wealth group we find no evidence of excess sensitivity while for the low wealth group the coefficient on lagged income is significantly different from zero. The evidence for excess sensitivity is somewhat weaker than in Zeldes' original work but more pronounced than in Runkle (1991). Some of the difference with Zeldes' results stems from the differences in the sample periods. As Mariger and Shaw (1988) pointed out, the income-consumption correlation in the PSID varies substantially from year to year. In particular, consumption growth is characterized by excess sensitivity in the 1970s; inclusion of the 1980s tends to reverse the results. If we restrict the sample to Zeldes' sample period (up to 1982), we find more pronounced effects. The coefficient on lagged income is -0.018 with a standard error of 0.006 for the low wealth group instead of -0.012 in our longer sample. For the high asset sample the coefficient is equal to zero and insignificant in the earlier sample period.

Table 6 reports the coefficients of the switching regression model described in Section 2. The four columns in the table refer to different indicators to identify constrained households. The first column uses the measure whether households were turned down for loans or discouraged from borrowing which has been used previously as an indicator for liquidity constraints by Jappelli (1990) and others. Column (2) uses the same measure but reclassifies households as unconstrained when they have a credit card or credit line. Column (3) simply uses as an indicator whether a household has a credit card or credit line. In addition, for further comparison of these measures to the asset-based split, we also apply our two sample procedures to Zeldes' asset-based split (split 1) to produce the results in column (4).

Using the constraint indicator in column (1), the point estimate on lagged income for the constrained group is -0.036, substantially larger in absolute value than the corresponding estimate obtained with splitting the sample in Table 5 (column 3). This coefficient is, however, only significant at the 10 percent level. While our results are consistent with a stronger role for liquidity constraints than found with Zeldes' methodology, our two sample method is not very efficient in giving precise estimates. To gauge the source of this inefficiency, compare the results in column (1) to those in column (4) using Zeldes' asset-based split as the constraint indicator but employing our two sample method, and to the results in Table 5 splitting the sample directly. The standard error for the constrained group increases from 0.005 in column (3) in Table 5 to 0.008 in column (4) in Table 6 using our two sample method. In comparison, using the indicator for being turned down for a loan in column (1) yields a standard error of 0.022, which is almost three times as large as for the asset split. Notice also that all the coefficients in column (1) of Table 6 for the constrained group are estimated much less precisely than those for the unconstrained group. Typically, the standard errors are three to four times as large. The reason for the relatively poor results for the constrained group is due to the fact that the imputed probability of a constraint tends to be very small. Figure 2 displays a histogram of the imputed probabilities for the regression in column (1) including the poverty subsample and weighting the data. The predicted probabilities are clustered between 0 and 0.4, with very few observations having a probability above 0.5. This indicates that there is relatively precise information on which households are very likely to be unconstrained but there is much uncertainty on which particular households will face binding constraints. This is reflected in the larger standard errors for the constrained regime. Using the asset to income ratio to split the sample results in a much larger constrained group, and therefore more precise results. However, as we argued above, many of the consumers classified as constrained by that method are likely to be truly unconstrained, so that we regard the asset split as inferior to the alternative measures. The result of this is that the difference in the excess sensitivity coefficients for the constrained and unconstrained regime tend to be much smaller in the regression using the asset split compared to our preferred specifications.

In columns (2) and (3) we employ two alternative definitions for being constrained. According to the measure in column (2), which classifies households as unconstrained if they have a credit card or credit line even though they report being turned down for a loan, only 6 percent of all households are constrained. The point estimate on lagged income is larger in absolute value, while the standard error for the constrained group rises further due to the smaller number of households in this group. We also realize that the group that was denied credit may contain many households who wanted to buy houses or durables. In order to focus more directly on nondurable consumption loans, we use simply the indicator of whether the household has a credit card or credit line. This measure classifies 22 percent of all households as constrained. The point estimate on lagged income for the constrained group is -0.028, again much larger in magnitude than for the unconstrained group, whose coefficient is insignificant. The estimate for the constrained group is much more precise in this case because of the larger group size. In fact, the coefficient on lagged income in column (3) is significant at the 1 percent level.

The point estimates using liquid assets as constraint indicator in column (4) fall inbetween the results for the other indicators for liquidity constraints and the results obtained in Table 5 using the deterministic sample split. The estimated excess sensitivity coefficients for the constraint group using our preferred measures of liquidity constraints in columns (1) to (3) are larger in absolute value in each case. For the liquid asset measure it is unnecessary to rely on the SCF for the first stage regression because this indicator is also available in the PSID. Running the first stage regression in the PSID yields very similar results to those in column (4) of Table 6 (not reported). This is a further check on the compatibility of the SCF and PSID samples and thus the validity of the two sample method.

5. Conclusion

Relying on sample separation rules based on household wealth to classify households as liquidity constrained and unconstrained is a technique often adopted in the applied consumption literature. Sample separation rules based on wealth pose several problems, however. If the resulting low-wealth subsample includes many unconstrained households, the excess sensitivity coefficient is biased towards zero. We show that for the sample split used by Zeldes (1989) as many as 75 percent of the households in the low-wealth group may in fact have access to credit. This finding alone is not necessarily damaging to Zeldes' conclusions, because he still finds significant evidence of liquidity constraints in a sample contaminated by unconstrained households. In this paper we check the robustness of the asset-based sample splitting approach using an alternative method.

The alternative that we propose is to identify liquidity constrained households as those which have been denied loans or discouraged from borrowing. We also consider whether households own credit cards or have a line of credit to focus more directly on consumption loans. Such information is available in the Survey of Consumer Finances, and allows us to relate the probability of being liquidity constrained to a set of demographic variables. Using a first stage model estimated on the SCF, we impute the constraint probabilities in a second sample, the Panel Study of Income Dynamics, which contains information on food consumption. We then estimate Euler equations for constrained and unconstrained households using a switching regression model with imperfect sample separation. Ultimately, the estimation procedure relies on detecting a correlation between consumption growth and the demographic variables used in the first-stage estimation. Time-invariant demographic variables are well suited as instruments because they are certainly part of households' information set. Problems arise only if the instruments are correlated with omitted variables in the Euler equation, for instance with proxies for the variance of future consumption growth or with individual rates of time preference.

Our point estimates suggest that liquidity constraints affect the allocation of food expenditures more strongly than estimates based on splits by assets. Our excess sensitivity coefficients for the constrained group are two to five times as large as those found by splitting the sample. However, our results are also more noisy.

Since many researchers have come to expect no detectable effects of liquidity constraints in Euler equations estimated with microdata, in particular just using food consumption (see Attanasio, 1995, for an example of this argument), our methods seem rather successful in detecting impacts of constraints on the intertemporal allocation of consumption. We should stress, however, that our results suggest that the effects of liquidity constraints on aggregate expenditures is likely to be small. According to our measures of liquidity constraints, only 6 to 22 percent of all households are constrained. Since the magnitudes of excess sensitivity we estimated are also still modest, this implies that aggregate spending will change little due the presence of binding liquidity constraints.

6. Appendix

6.1. Standard Errors

Our second stage regression can be written as

$$\Delta \ln c_{it} \equiv y_{it} = \theta_1' W_{it} + \theta_2' L_{it} W_{it} + \varepsilon_{it}$$

Define $X = \begin{bmatrix} W & \text{diag}(L)W \end{bmatrix}$ where W is an $n \times k$ matrix and $\theta' = \begin{bmatrix} \theta_1' & \theta_2' \end{bmatrix}$ to rewrite this as

$$y = X\theta + \varepsilon.$$

Regarding the first stage we make

Assumption 1 $E(L \mid Z) = Z\pi$

which says that the conditional expectation of the liquidity constraint is a linear function of Z. This implies that the error term $v = L - E(L \mid Z)$ is independent of Z.

Let subscripts on variables denote datasets; a 1 referring to the SCF and a 2 referring to the PSID. We make the following assumption of sample independence (note that $W \subset Z$).

Assumption 2 The data $\{L_1, Z_1\}$ and $\{y_2, Z_2\}$ are jointly independent.

Define $\widehat{L}_{21} = Z_2\widehat{\pi}_1$ as the imputed constraint probability, where $\widehat{\pi}_1 = (Z_1'Z_1)^{-1}Z_1'L_1$ is the coefficient vector from a linear probability model, and $\widehat{X}_{21} = \begin{bmatrix} W_2 & \text{diag}(\widehat{L}_{21})W_2 \end{bmatrix}$ as the complete matrix of cross-sample fitted values. Our estimator is then

$$\widehat{\theta} = (\widehat{X}_{21}'\widehat{X}_{21})^{-1}\widehat{X}_{21}'y_2.$$

Standard substitutions yield

$$\widehat{\theta} = (\widehat{X}_{21}'\widehat{X}_{21})^{-1}\widehat{X}_{21}'X_2\theta + (\widehat{X}_{21}'\widehat{X}_{21})^{-1}\widehat{X}_{21}'\varepsilon_2.$$

The following lemma establishes consistency of the estimator.

Lemma 1. *plim* $n_2^{-1}\widehat{X}_{21}'\widehat{X}_{21} =$ *plim* $n_2^{-1}\widehat{X}_{21}'X_2$.

Proof: Using the component blocks of the matrix $X'X$

$$\begin{aligned}
\text{plim}\ n_2^{-1}W_2'\text{diag}(\widehat{L}_{21})W_2 &= \text{plim}\ n_2^{-1}W_2'\text{diag}(Z_2\widehat{\pi}_1)W_2 \\
&= \text{plim}\ n_2^{-1}W_2'\text{diag}(Z_2\pi)W_2 \\
&= \text{plim}\ n_2^{-1}W_2'\text{diag}(Z_2\pi + v_2)W_2 \\
&= \text{plim}\ n_2^{-1}W_2'\text{diag}(L_2)W_2
\end{aligned}$$

where the second equality follows from consistency of $\widehat{\pi}_1$, and the third equality follows from assumption 1. A similar argument establishes

$$plim\ n_2^{-1}W_2'diag(\widehat{L}_{21})diag(\widehat{L}_{21})W_2 = plim\ n_2^{-1}W_2'diag(\widehat{L}_{21})diag(L_2)W_2. \ \square$$

The asymptotic covariance matrix for the estimator is derived by a straightforward extension of Proposition 2 in Angrist and Krueger (1995). Define the moment condition $g_n(\theta) = n_2^{-1}\widehat{X}_{21}'y_2 - n_1^{-1}\widehat{X}_{11}'X_1\theta$ and let $n_2 = kn_1$ for some fixed constant k. By assumption 2 $\sqrt{n_1}g_n(\theta) \sim N(0, k\phi + \omega)$ where ϕ is the limiting covariance matrix of $n_2^{-1}\widehat{X}_{21}'y_2$ and ω is the limiting covariance matrix of $n_1^{-1}\widehat{X}_{11}'X_1\theta$. Then

$$\sqrt{n_1}(\widehat{\theta} - \theta) \sim N(0, \Sigma_{xx}^{-1}(k\phi + \omega)\Sigma_{xx}^{-1}).$$

An estimated version of $\Sigma_{xx}^{-1}(k\phi+\omega)\Sigma_{xx}^{-1}$ is easily computed from two regressions. Note that premultiplying $\widehat{X}_{21}'y_2$ by $(\widehat{X}_{21}'\widehat{X}_{21})^{-1}$ yields $\widehat{\theta}$ as computed in the PSID and premultiplying $\widehat{X}_{11}'X_1\widehat{\theta}$ by $(\widehat{X}_{11}'\widehat{X}_{11})^{-1}$ yields a regression of the predicted value of y (using the actual L) on $\widehat{X}_{11}$ (which uses $\widehat{L}$ instead of L) in the SCF. The covariance matrix of $\widehat{\theta}$ is simply the sum of the covariance matrices of these two regressions.

There is one more complication to be taken care of. The errors in the PSID will have an MA(2) structure because we use three year changes in food consumption as the dependent variable but adjacent years of data. Thus, the covariance matrix of errors is going to be $\sigma_\varepsilon^2 A$, and A is a block diagonal matrix given by

$$A = \begin{bmatrix} B_1 & & & 0 \\ & B_2 & & \\ & & \cdots & \\ 0 & & & B_m \end{bmatrix}$$

where B_i is a $t_i \times t_i$ weighting matrix for household i. Since under the null hypothesis the Euler equation error follows a martingale for each household at the annual level (ignoring within year time aggregation), i.e.

$$\ln c_{it+1} - \ln c_{it} = \varepsilon_{it+1}$$

we will have for the three year changes

$$\ln c_{it+3} - \ln c_{it} = \varepsilon_{it+3} + \varepsilon_{it+2} + \varepsilon_{it+1}.$$

Assuming constant innovation variances, the weighting matrix is going to be of the form

$$B_i = \begin{bmatrix} 1 & \frac{2}{3} & \frac{1}{3} & 0 & & \\ \frac{2}{3} & 1 & \frac{2}{3} & \frac{1}{3} & 0 & \\ \frac{1}{3} & \frac{2}{3} & 1 & \frac{2}{3} & & \\ 0 & \frac{1}{3} & \frac{2}{3} & \cdots & \cdots & \cdots \\ & 0 & \cdots & \cdots & \cdots & \frac{2}{3} \\ & & & \cdots & \frac{2}{3} & 1 \end{bmatrix}$$

if there are complete data for t_i years available for the household. For many households some intervening years are missing, so that some of the elements on the first two off-diagonals will be zero instead. We constructed the household specific weighting matrices and estimated ϕ as $\widehat{\phi} = \widehat{\sigma}_{\varepsilon}^2(\widehat{X}_{21}'\widehat{X}_{21})^{-1}\widehat{X}_{21}'A\widehat{X}_{21}(\widehat{X}_{21}'\widehat{X}_{21})^{-1}$. For $\widehat{\omega}$ we use the White covariance matrix $(\widehat{X}_{11}'\widehat{X}_{11})^{-1}\widehat{X}_{11}'\widehat{C}\widehat{X}_{11}'(\widehat{X}_{11}'\widehat{X}_{11})^{-1}$, where $\widehat{C}$ is the matrix with elements $\widehat{v}_i^2$ on the diagonal, since this is the appropriate covariance matrix for the linear probability model.

6.2. Data: PSID

As in Zeldes (1989) the value of a PSID variable in "PSID year" t means the value reported in the survey of year t (even if the variable refers to the previous calendar year). Topcoded variables are generally left at their topcodes.

6.2.1. Constructed Variables.

Variables constructed following Zeldes (1989). We generally followed Zeldes' detailed appendix, sometimes elaborated upon in personal communication, in constructing the variables that appear in his analysis (i.e., food consumption, disposable income, non-housing wealth, and housing equity). Here we discuss only certain key constructions that either are not fully clear from Zeldes' appendix alone, that go beyond Zeldes' sample period since we extend the analysis to 1987, or where we deviate from Zeldes' constructions.

Food consumption. In 1968-1972 and in 1974 (when food stamps are not already included in expenditures on food), total real food expenditure in PSID year t includes the real value of food stamps received in the previous calendar year though reported in t. This latter real value is deflated by the average of the previous year's monthly CPI price indices for food at home.

Disposable income. The property tax for 1978 is estimated as the product of the house value in 1978 times the implicit 1977 tax rate (i.e. the ratio of property taxes paid in 1977 to the house value in 1977), if these are available and if the family did not move between April of 1977 and April of 1978. Else the analogous 1979 tax rate is used, if available and if the family did not move between April of 1978 and April of 1979. If neither of these estimates is available, but the family does not own its house in 1978, property taxes in 1978 are set to zero. In estimating social security taxes, the wife's wages were set to zero if missing, to avoid losing observations. The Euler equation for $\ln c_{t+3} - \ln c_t$ contains (the log of) the real disposable income whose components are reported in PSID year t (and so refer to calendar year $t-1$).

Liquid assets (non-housing wealth). From 1976 on, the asset income that is to be blown-up to estimate liquid assets is the sum of the head's variable for "dividends, interest, rent, trust funds, and royalties", and of the similar variable for the wife (which includes alimony). (Before 1984 it was not possible to distinguish rental income from dividend, interest, etc. income. To preserve comparability with these years, from 1984 on asset income is the sum of the variables for rent and for dividend, interest, etc. but not rent.) Before 1976 these variables are bracketed, so we instead blow-up "total asset income", defined as total taxable income of head and wife, minus the sum of the head's total labor income and the wife's annual wages. (From 1977 when it is first available, the alimony received by the head is also subtracted in forming total asset income, since it is included in total taxable income but does not represent asset income.) If the relevant measure of asset income is negative, liquid assets are set to missing. Otherwise, the first \$250 of asset income in PSID year t (so in calendar year $t-1$) is divided by the annual average passbook rate in calendar year $t-1$. The rest of such income is divided by the annual average yield of 3-month Treasury bills in $t-1$.

Since the blowing-up procedure implicitly assumes that most asset income is interest-like income, liquid assets are set to missing if the value of other types of asset income is too large. Before 1976, this is the case if total asset income is less than the sum of the lower brackets of the head's and wife's dividend, interest, rent etc. variables; or if greater than the sum of the upper brackets of these variables. (The upper bracket of the category "over \$10,000" is taken as \$9,999,999, the largest possible value for total asset income.) Since 1976, liquid assets are set to missing if the absolute value of "home business income" is greater than \$100. Home business income is total asset income minus dividends, interest, rent, etc. If any of these variables for testing whether other asset income is too large is missing, liquid assets are set to missing. Liquid assets are also set to missing if any of the income variables just discussed have undergone major imputations, of if others' asset income is positive or missing. (For years before 1975, they are missing if others' asset income is positive or missing in 1975.)

Net wealth (including housing equity). The outstanding mortgage principal is not reported in years 1973-5 and 1982. The values in 1973-5 are interpolated from the values in 1972 and 1976 when available, and only if the family did not move and did not hold a second mortgage between April 1972 and April 1976 and if the reported principal is not larger in 1976 than in 1972. Else the values are extrapolated from the values in 1976 and 1977 if available, and if the family did not move nor hold a second mortgage between April 1977 and April of the year at hand, and if the reported principal is not larger in 1977 than in 1976. Else the values are similarly extrapolated from the values in 1971 and 1972, if possible. If the reported principal is zero in both 1972 and 1976, it is set to zero for 1973-5; and if the estimated principal is negative, it is set to zero. The principal in 1982 is estimated similarly. Net housing equity in PSID year t reflects the contemporaneous value of equity, i.e. in calendar year t. Therefore it is lagged before being added to liquid assets, which are blown-up from asset income in the previous calendar year, $t-1$. The real values of liquid assets and net wealth are the nominal values just described, deflated by the annual average of the NIPA personal consumption expenditures (PCE) deflators for the previous calendar year ($t-1$).

1984 Stocks of Wealth. To gauge the quality of the blowing up procedure, we compare the value of assets resulting from inflating asset income in 1985 (referring to calendar year 1984) to the actual stock of liquid assets in 1984. Ideally the stock should correspond to the flows that went into the procedure, namely dividends, interest, rent, etc., but such individual stocks are not separately available. The available relevant stocks are: first, "cash on hand", the value together of checking and savings accounts, money market funds, CD's, government savings bonds, and Treasury bills, including values in IRA's; second, of stocks, mutual funds, and investment trusts, including in IRA's; third, of bonds, trusts/estates, life insurance, collectibles, etc.. Putting aside rental income, the ideal stock corresponding to the flows should be bounded below by cash on hand, our narrow measure of liquid assets, and above by our wide measure, the sum of all three categories.

The narrow and wide measures of net wealth add housing equity (net of the outstanding mortgage principal, as above) to the narrow and wide measures of liquid assets. The real values of these stocks are the nominal values just described deflated by the average of the monthly PCE deflators for the first quarter of 1984.

Variables used in the First Stage Estimates of Being Constrained. We will describe only the variables that are not self-explanatory. Generally, the variables are constructed to match the variables used in estimating the probability of being constrained in the SCF. All characteristics refer to the household head. In couples, the head is defined as the male.

Married/Divorced. The head of the family is "married" if formally married or permanently cohabitating with someone, and this partner is present in the family. The head is "divorced" if formally divorced or separated, and the partner is not present in the family.

Region. Unlike the SCF, the PSID has some families living outside the continental United States. Families in Alaska and Hawaii are classified as living in the West, those abroad have region set to missing.

Employed. The head is employed if he or she is working part time or full time at the time of the interview or if he is temporarily laid off.

6.2.2. Sample Selection.

We generally followed the procedures of Zeldes, extended to 1987 (wave 20). Therefore we limit discussion to just a few salient notes. Even if a family is non respondent in 1987, previous observations of it are included provided they meet all other requirements. A family-observation in year t is included in the sample if valid data for both year t and year $t+3$ are available, and if observations on the household during the intervening years were available (although individual variables could be missing for those years). A family-observation in year t is excluded if there was a change in head or spouse in any PSID year between t and $t+3$; or if either in PSID year t or $t+3$ anyone other than the "wife" and their children lives with the head. Unlike Zeldes, we include the poverty subsample.

6.2.3. Splitting the Sample.

Splits based on blown-up wealth. The three Zeldes splits based on blown-up wealth are constructed following Zeldes's appendix. Again discussion here is limited to a few salient notes. The various wealth to (average) disposable-income ratios used in splits 1-3 are set to missing if either the numerator or denominator is negative, or if the denominator is zero. For splits 1 and 2 (based on liquid assets), the direct questions about whether the household has any savings and whether they amount to two month's income are available in 1971-2, 1975, and 1979-80. In these years, an observation is not assigned to either the constrained or unconstrained groups if the blown-up wealth-to-income ratio is missing, whatever the answers to the direct questions.

There is a typographical error in Zeldes's description of split 2, the stringent split. In years in which the direct questions are reported, an observation is placed in the unconstrained group only if they have at least two month's savings (not just any savings, as printed in the appendix). In years in which the blown-up ratio is also generally computed, i.e. since 1971, that ratio must exist and be greater than 1/2.)

Splits based on Actual Asset Stocks. As above, the wealth to (average) disposable-income ratios are set to missing if either the numerator or denominator is negative, or if the denominator is zero. The reported splits use the narrow measure of liquid assets in the numerator (cash on hand, plus net housing equity, for split 3), which most closely corresponds to the asset income variables. For comparability with the Zeldes splits using blown-up wealth, the stocks in the numerators here are lagged, since unlike asset income the stock values in PSID year

t refer to calendar year t. However, unlike the Zeldes splits the direct questions on savings are not used. Accordingly, under split 1 an observation is unconstrained simply if the ratio of (the lag of) narrow liquid assets to average disposable income is greater than (or equal to) 2/12; and constrained if this ratio is less than 2/12. Similarly, under the extreme split 2 an observation is unconstrained if this ratio is greater than 1/2 and constrained if the ratio is zero. Split 3 is like split 1, but with (the lag of) narrow net wealth in the numerator.

6.3. Data: SCF

6.3.1. Constructed Variables.

The variables in the SCF generally are constructed to match the corresponding variables in the PSID, discussed above.

Disposable Income and Blown-up Wealth. Disposable income is total household income (variable b3202) minus nontaxable-interest income (b3207), minus income from the sale of stock, bonds or real estate (b3210), and minus household federal income and social security taxes. We subtract b3202 and b3207 because these seem unlikely to be well accounted for in the components of income that comprise taxable income in the PSID. Unlike the PSID, the SCF does not report property taxes. We recomputed the corresponding PSID variables without property taxes (and without averaging disposable income and its lag, which is not possible in the cross-sectional SCF), which yielded very similar results. These are not reported.

Taxes. Taxable income is adjusted gross income (b3219) minus 1000 times an estimate of the number of exemptions. Taxes are estimated using the 1982 tax tables, similarly to the estimation of the marginal tax in the PSID. The household's family composition determines which schedule is used. A married couple is assumed to file jointly. Anyone not currently married (including widows) is taken to be single. For singles the single's tax schedule is used; unless there is someone under 18 in the household (other than the head or spouse), assumed to be a dependent, in which case the head of household schedule is used. The number of exemptions is assumed to be the number of related people in the household, plus one for each of the head or spouse's being over 65. The earned income tax credit is subtracted from taxes for eligible households. Eligible households need have positive earned income (the sum of wages and business incomes, b3205 and b3206), adjusted gross income less than $10,000, and tax status as head of household or be married with a dependent child. For these households, the 1982 rules for calculating the tax credit are applied to their earned income. Social Security taxes are computed as for the PSID, using b4546 and b4646 for the head's and spouse's incomes. Even though here we know whether the spouse is self-employed, to maintain comparability with the PSID only the non-self-employed tax rate is used for the spouse.

Blown-up wealth. To match the variables on dividends, interest, rent, trust funds, royalties, and alimony in the PSID, the asset income used here is the sum of dividend income (b3208), taxable interest income (b3209), and income from rent, trusts, and royalties (b3211). Nontaxable interest income, like income from IRA's, was not included, since it seemed unlikely to have been included by many families in answering the PSID question at issue. Alimony was not included because it is not reported separately in the SCF from inheritance, gifts, and child and other financial support. If positive, this asset income is blown-up as above, using the 1982 passbook and Treasury bill rates, to yield liquid assets. As before, blown-up liquid assets are set to missing if the absolute value of home business income is greater than 100. Here home business income is the sum of business income (b3206), income from asset sales (b3210), and other income (b3216). Net housing equity is the value of a home minus any outstanding principal on a first mortgage (b3709). If there is not a second mortgage (b4024=0), this value is added to the estimated liquid assets to produce blown-up net wealth. Unlike the SCF, it is not possible to lag housing equity before adding. The real values of disposable income and liquid wealth and net wealth are obtained by dividing the nominal values by the average of the 1982 PCE deflators.

Stocks of Wealth. To try to bound the ideal stock that corresponds to the asset income flow just described, we again compute both narrow and wide stocks. Our narrow measure of liquid assets is what the SCF calls "liquid assets" (b3301, the sum of checking, savings, and money market accounts, plus IRA's, Keoghs, CD's and savings bonds) minus the value of IRA and Keogh accounts (b3446). Our wide measure adds to this the value of bonds (b3458) and of stocks and mutual funds (b3462). Net wealth adds net housing equity, described above, to these measures of liquid assets. The real values of these stocks are the nominal values divided by the average of the 1983 PCE deflators.

Variables used in the First Stage Estimates of Being Constrained. These generally are constructed to match those from the PSID. The head is taken as employed if working full- or part-time of if temporarily laid off (b4511= 1, 2, or 3).

6.3.2. Sample Selection.

We used the version of the 1983 SCF data released with the 1986 data, which adopted a different definition of the head than in the original release of the 1983 data. (Basically, if a household was reinterviewed in 1986, the 1983 variables about the "head" are about the 1986 respondent, rather than the 1983 head of household.) We used the variable c1004 to restore the original concept of head (i.e. the male in a couple), and adjusted the variables for head and spouse accordingly. We dropped the 41 repeated 1983 observations (b3075 = 4) arising from the 41 1983-couples who split and were both reinterviewed in 1986. The 159 "uncleaned" observations (b3001 = 3) whose values are largely missing, as well as the high-income sample (b3001 = 1), were also dropped. Furthermore, we only kept households who were present in the 1986 reinterview sample with no marital status change between 1983 and 1986 (c1202 = 1 or 4). Unfortunately we cannot exactly match the sample exclusions of the PSID. For example, we don't know anything about food consumption. (We did not exclude households with unrelated people in them, since the motivation for this exclusion was to improve the measure of food consumption.)

6.3.3. Splitting the Sample.

Splits based on blown-up wealth. Under split 1 a household is unconstrained if the ratio of blown-up liquid assets to disposable income is greater than 2/12, and constrained if the ratio is less than this. Under the extreme split 2, it is constrained if the ratio if greater than 1/2, unconstrained if zero. Split 3 is similar to split 1, but uses blown-up net wealth instead. (As before, for all three splits, if either the numerator of the corresponding ratio is negative, or the denominator non-positive, the household does not go into either category.)

Splits based on the Direct Measures of Liquidity Constraints. According to our first measure a household is constrained if either a) it has been turned down for a loan, or failed to get as much credit as it desired (b5522 = 1 or 3); and if it reapplied for a loan, it did not then receive as much credit as desired (b5525 ~= 1); or b) it has been dissuaded from applying for credit, because it expected to be turned down (b5526= 1). Our second measure is the same as the first, but reclassifies constrained households as unconstrained if they report that they either have a credit card (b4103 = 1) or that they have a line of credit (b4104 = 1). The third measure simply classifies households as constrained if they have neither a credit card nor a line of credit.

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Figure 1

Regression Function of Liquidity Constraint on Financial Net Wealth

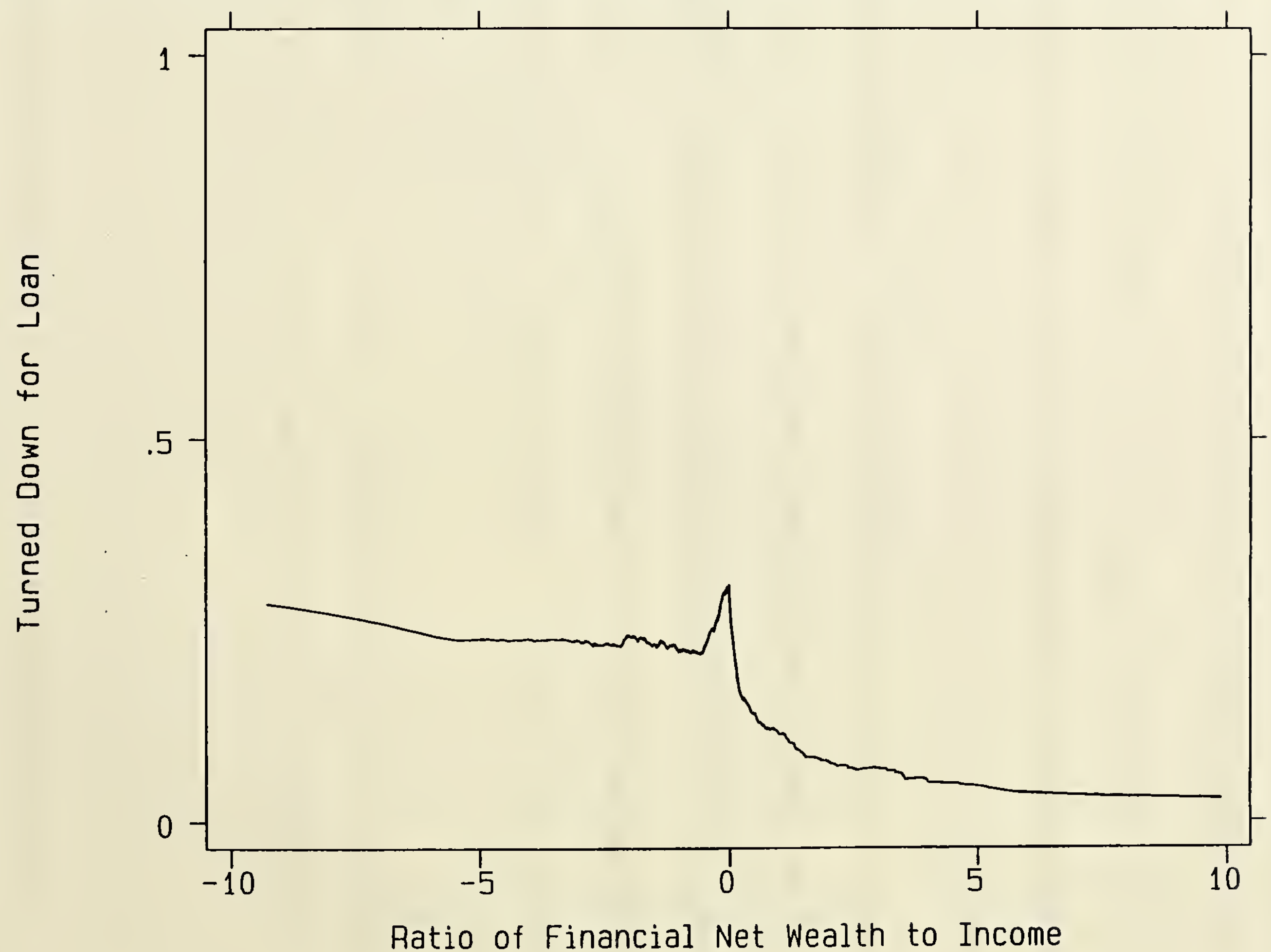

Figure 2

Histogram of Imputed Probability of Constraint

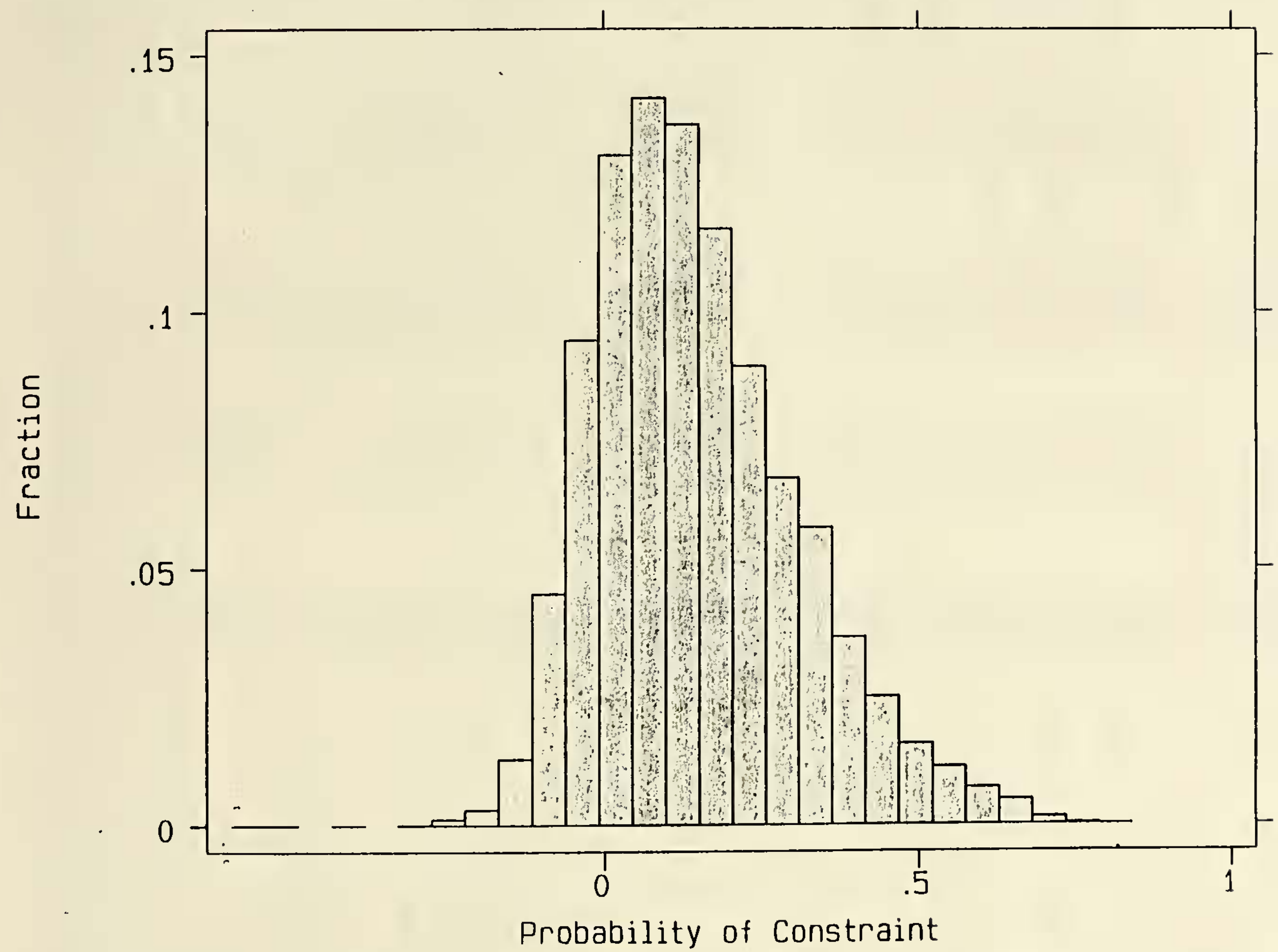

Table 1
Sample means

	PSID (1971 -1984)	PSID (1984)	SCF (full sample)	SCF (constr.)	SCF (unconst.)
	(1)	(2)	(3)	(4)	(5)
Demographics					
Age of head	47.9	48.6	47.2	37.8	49.1
Married	0.679	0.648	0.649	0.523	0.675
Divorced	0.101	0.128	0.137	0.228	0.118
Black	0.097	0.120	0.125	0.281	0.093
Male head	0.744	0.720	0.739	0.669	0.753
One adult	0.265	0.297	0.267	0.370	0.245
Two adults	0.595	0.575	0.554	0.473	0.571
Three or more adults	0.140	0.129	0.179	0.157	0.183
No kid	0.537	0.581	0.563	0.434	0.589
One kid	0.170	0.161	0.172	0.206	0.165
Two kids	0.165	0.162	0.178	0.249	0.164
Three or more kids	0.127	0.096	0.087	0.110	0.082
Region					
North east	0.241	0.227	0.212	0.249	0.204
North central	0.294	0.275	0.295	0.224	0.309
South	0.293	0.320	0.341	0.349	0.339
West	0.171	0.178	0.153	0.178	0.148
Schooling					
No high school	0.153	0.120	0.156	0.117	0.163
Some high school	0.157	0.159	0.142	0.171	0.136
High school graduate	0.349	0.356	0.328	0.292	0.335
Some college	0.146	0.166	0.191	0.256	0.178
College graduate	0.122	0.132	0.095	0.071	0.100
Post graduate	0.061	0.057	0.088	0.093	0.087
Income and employment					
Disposable income	26,505	26,994	24,057	18,858	25,115
Head employed	0.720	0.680	0.710	0.733	0.705
Homeowner	0.720	0.708	0.715	0.441	0.771
Number of observations	35,280	3,202	1,662	281	1,381

Notes: PSID samples include the poverty subsample; means are weighted by family weights. SCF means are unweighted. Constrained households in the SCF are defined as those who are reported being denied loans or discouraged from borrowing.

Table 2
Percentiles of liquid assets and wealth in the 1984 PSID and 1983 SCF

Liquid assets

Liquid asset measure	Survey	Sample size	10%	25%	50%	75%	90%
Blown up	PSID	2,284	0	0	0	9,232	45,568
Narrow definition	PSID	2,284	0	113	1,469	7,913	28,259
Wide definition	PSID	2,284	0	226	2,261	11,869	36,172
Blown up	SCF	2,994	0	0	0	8,714	37,395
Narrow definition	SCF	2,994	0	174	1,277	7,080	26,556
Wide definition	SCF	2,994	0	194	1,454	8,075	32,673

Net wealth

Wealth measure	Survey	Sample size	10%	25%	50%	75%	90%
Blown up	PSID	2,198	0	0	17,859	59,067	113,622
Narrow definition	PSID	2,198	0	678	16,636	56,518	101,733
Wide definition	PSID	2,198	0	904	18,086	58,915	107,385
Blown up	SCF	2,890	0	0	21,491	61,762	117,330
Narrow definition	SCF	2,890	0	720	18,571	58,103	106,353
Wide definition	SCF	2,890	0	812	19,056	59,190	113,083

Notes: The blown up measure of liquid assets is obtained by dividing asset income by the interest rate. The other two measures are obtained directly from asset stocks. The narrow definition excludes bonds, stocks, and IRAs; the wide definition includes these assets. Net wealth is the sum of liquid asset and housing wealth net of outstanding mortgage principal. PSID samples include the poverty subsample. All results are unweighted.

Table 3
A comparison of asset based sample splits and the sample split based on the self reported indicator of liquidity constraints

PSID 1984:
Zeldes' split versus split based on asset stocks

Zeldes' splits	Sample size	Constr. accord. to both splits	Constr. in Zeldes' split only	Constr. in stock based split only	Unconstr. in both splits
	(1)	(2)	(3)	(4)	(5)
Split 1: constrained if liquid assets below 2 months income	2,594 (100%)	1,366 (53%)	282 (11%)	268 (10%)	678 (26%)
Split 2: constrained if liquid assets equal zero[a]	909 (100%)	427 (47%)	63 (7%)	26 (3%)	393 (43%)
Split 3: constrained if net wealth below 2 months income	2,490 (100%)	748 (30%)	98 (4%)	69 (3%)	1,673 (67%)

SCF 1983:
Zeldes' split versus split based on self-reported indicator of liquidity constraint

Zeldes' splits	Sample size	Constr. accord. to both splits	Constr. in Zeldes' split only	Constr. in self-reported split only	Unconstr. in both splits
	(1)	(2)	(3)	(4)	(5)
Split 1: constrained if liquid assets below 2 months income	2,992 (100%)	532 (18%)	1,471 (49%)	90 (3%)	899 (30%)
Split 2: constrained if liquid assets equal zero[a]	2,271 (100%)	454 (20%)	1,159 (51%)	55 (2%)	603 (27%)
Split 3: constrained if net wealth below 2 months income	2,888 (100%)	372 (13%)	617 (21%)	221 (8%)	1,678 (58%)

a. Unconstrained group for split 2 has assets greater than six months' income, middle group is omitted from this split.

Notes: Those constrained according to the self reported indicator are those who were denied loans or discouraged from borrowing. The samples used here differ from the samples used in the analysis below. The poverty subsample is eliminated from the PSID and all cross tabulations are unweighted.

Table 4
Linear probability models for being constrained

	PSID Asset Split	SCF Asset Split	SCF Turned down for loan	SCF Turned down, no credit card	SCF no credit card or credit line
Demographics	(1)	(2)	(3)	(4)	(5)
Age	-0.005	0.007	-0.007	-0.001	-0.014
	(0.002)	(0.004)	(0.004)	(0.003)	(0.005)
Age squared/100	-0.005	-0.015	0.001	-0.001	0.013
	(0.002)	(0.004)	(0.003)	(0.003)	(0.005)
Male head	0.029	0.034	0.024	0.026	0.099
	(0.025)	(0.045)	(0.038)	(0.029)	(0.044)
Married	-0.058	0.025	-0.028	-0.044	-0.150
	(0.033)	(0.055)	(0.043)	(0.033)	(0.052)
Divorced	0.059	0.096	0.039	0.013	0.030
	(0.020)	(0.036)	(0.034)	(0.026)	(0.037)
One adult	-0.120	-0.091	0.014	-0.030	-0.065
	(0.023)	(0.041)	(0.037)	(0.029)	(0.041)
Three or more adults	0.147	0.078	0.051	0.029	0.055
	(0.016)	(0.033)	(0.027)	(0.018)	(0.027)
One kid	0.100	0.075	0.020	0.043	0.074
	(0.014)	(0.032)	(0.027)	(0.018)	(0.027)
Two kids	0.129	0.084	0.071	0.055	0.063
	(0.015)	(0.036)	(0.031)	(0.020)	(0.029)
Three or more kids	0.179	0.090	0.030	0.073	0.173
	(0.017)	(0.042)	(0.041)	(0.029)	(0.040)
Change in the number of adults	0.011	0.017	0.006	-0.013	-0.011
	(0.007)	(0.017)	(0.015)	(0.010)	(0.015)
Change in the number of kids	-0.000	-0.000	0.007	0.018	0.025
	(0.007)	(0.015)	(0.015)	(0.010)	(0.016)
Black	0.128	0.158	0.197	0.086	0.039
	(0.014)	(0.028)	(0.034)	(0.026)	(0.032)
Region					
North east	-0.012	-0.071	0.012	0.007	0.045
	(0.018)	(0.036)	(0.029)	(0.023)	(0.030)
North central	-0.012	-0.033	-0.056	-0.031	0.036
	(0.017)	(0.034)	(0.026)	(0.017)	(0.027)
South	0.037	-0.014	-0.048	-0.026	0.077
	(0.016)	(0.033)	(0.027)	(0.018)	(0.027)

Table 4 - continued

Table 4 - continued

	PSID Asset Split	SCF Asset Split	SCF Turned down for loan	SCF Turned down, no credit card	SCF no credit card or credit line
Schooling	(1)	(2)	(3)	(4)	(5)
Some high school	-0.136 (0.030)	-0.165 (0.053)	0.003 (0.041)	0.011 (0.036)	-0.108 (0.061)
High school graduate	-0.203 (0.027)	-0.233 (0.049)	0.045 (0.036)	0.032 (0.032)	-0.143 (0.054)
Some college	-0.279 (0.030)	-0.346 (0.061)	0.028 (0.048)	-0.002 (0.040)	-0.287 (0.060)
College graduate	-0.265 (0.037)	-0.351 (0.075)	0.105 (0.065)	-0.029 (0.034)	-0.357 (0.079)
Post graduate	-0.291 (0.036)	-0.212 (0.079)	0.137 (0.071)	0.011 (0.029)	-0.365 (0.063)
Income and Employment					
Log income	0.186 (0.124)	0.762 (0.261)	0.533 (0.145)	-0.014 (0.153)	-0.395 (0.330)
Log income squared	-0.020 (0.006)	-0.049 (0.014)	-0.030 (0.008)	-0.002 (0.008)	0.012 (0.017)
Employed	0.001 (0.027)	-0.049 (0.052)	-0.022 (0.046)	-0.021 (0.038)	-0.082 (0.063)
Employed * some high school	0.098 (0.035)	0.103 (0.072)	0.026 (0.062)	-0.017 (0.051)	-0.047 (0.083)
Employed * high school graduate	0.111 (0.032)	0.098 (0.064)	-0.106 (0.053)	-0.095 (0.044)	-0.066 (0.073)
Employed * some college	0.165 (0.036)	0.224 (0.075)	-0.028 (0.065)	-0.047 (0.052)	0.049 (0.079)
Employed * college graduate	0.050 (0.042)	0.154 (0.091)	-0.178 (0.078)	-0.050 (0.045)	0.072 (0.094)
Employed * post graduate	0.041 (0.044)	-0.129 (0.096)	-0.116 (0.086)	-0.074 (0.042)	0.061 (0.078)
Homeowner	-0.106 (0.012)	-0.067 (0.026)	-0.124 (0.026)	-0.073 (0.018)	-0.103 (0.025)
R^2	0.313	0.261	0.186	0.155	0.295
Percent constrained	61.9	62.0	16.9	6.3	24.1
No. of observations	35,280	1,662	1,662	1,662	1,662

Notes: The dependent variable equals 1 if a household is liquidity constrained, 0 otherwise. In columns 1 and 2 the household is constrained if liquid assets are below two months income. In column 3 a household is constrained if it reported being denied credit or discouraged from borrowing; in column 4 if it also does not have a credit card or credit line. In column 5 a household is constrained if it does not have a credit card or credit line. Excluded attributes are households with two adults, no kids, no high school, living in the west. Regressions also include a constant. Heteroskedasticity robust standard errors in parentheses. Standard errors for PSID sample are also robust to random individual effects.

Table 5
Euler equations estimates splitting the sample by wealth

	Pooled sample	High assets	Low assets
	(1)	(2)	(3)
Constant	0.256 (0.043)	0.290 (0.097)	0.285 (0.052)
Change in the number of adults	0.108 (0.005)	0.120 (0.010)	0.103 (0.005)
Change in the number of children	0.094 (0.004)	0.105 (0.010)	0.091 (0.005)
Age	-0.0061 (0.0011)	-0.0086 (0.0023)	-0.0050 (0.0014)
Age squared/100	0.0036 (0.0011)	0.0057 (0.0022)	0.0024 (0.0015)
Lagged disposable income	-0.007 (0.004)	-0.003 (0.008)	-0.012 (0.005)
Number of observations	35,280	9,138	26,142

Notes: Dependent variable is the three year change in log food consumption. Standard errors are adjusted for the resulting overlapping data structure. Households are classified as low assets if they have assets less than two months' income (split 1). All regressions include the poverty subsample of the PSID and use family weights. See text for details.

Table 6

Euler equation estimates of the two sample switching regression model

	Constraint indicator			
	Turned down for loan	Turned down, no credit card	No credit card or credit line	Asset split
	(1)	(2)	(3)	(4)
	Unconstrained regime			
Constant	0.418 (0.068)	0.393 (0.072)	0.421 (0.095)	0.494 (0.125)
Change in the number of adults	0.115 (0.006)	0.110 (0.006)	0.105 (0.006)	0.141 (0.013)
Change in the number of children	0.096 (0.007)	0.101 (0.006)	0.101 (0.007)	0.124 (0.015)
Age	-0.0094 (0.0018)	-0.0085 (0.0015)	-0.0109 (0.0021)	-0.0111 (0.0032)
Age squared/100	0.0060 (0.0016)	0.0054 (0.0014)	0.0081 (0.0021)	0.0071 (0.0028)
Lagged disposable income	-0.012 (0.005)	-0.013 (0.006)	-0.011 (0.008)	-0.012 (0.011)
	Constrained regime			
Constant	0.272 (0.213)	0.046 (0.405)	0.219 (0.116)	0.335 (0.085)
Change in the number of adults	0.058 (0.029)	0.054 (0.048)	0.118 (0.017)	0.087 (0.009)
Change in the number of children	0.083 (0.022)	0.024 (0.072)	0.058 (0.015)	0.078 (0.007)
Age	0.0029 (0.0064)	0.0194 (0.0128)	0.0023 (0.0036)	-0.0027 (0.0023)
Age squared/100	-0.0049 (0.0068)	-0.0210 (0.0131)	-0.0039 (0.0034)	-0.0001 (0.0024)
Lagged disposable income	-0.036 (0.022)	-0.057 (0.038)	-0.028 (0.011)	-0.024 (0.008)
Number of observations	35,280	35,280	35,280	35,280

Notes: Dependent variable is the three year change in log of food consumption. All regressions include the poverty subsample of the PSID and second stage regressions are weighted using the family weight. In column 1 a household is constrained if it reported being denied credit or discouraged from borrowing; in column 2 if it also does not have a credit card or credit line. In column 3 a household is constrained if it does not have a credit card or credit line. In column 4 the household is constrained if liquid assets are below two months income. Standard errors are adjusted for two sample estimation and for the overlapping data structure. See text for more details.