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Precautionary Savings and Entrepreneurship[1]

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Abstract

In this paper, we show the pivotal role entrepreneurs plays in estimating the importance of the precautionary saving motive. Since entrepreneurs hold larger amounts of wealth than other households and also face highly volatile income, they induce a correlation between wealth and income risk regardless of whether or not a precautionary saving motive exists. Using data from the Panel Study of Income Dynamics in the 1980s and the 1990s, we show that the large wealth entrepreneurs hold is not due to the desire to insure themselves against shocks to income. In fact, both within the group of entrepreneurs and among non-entrepreneurs, the size of precautionary savings is modest and accounts for less than ten percent of total household wealth. However, pooling entrepreneurs and non-entrepreneurs together and using conventional measures of wealth and income risk leads to artificially high values of precautionary savings. Data from the Survey of Consumer Finances (SCF) further confirms that precautionary savings accounts for only four percent of the wealth held by entrepreneurs and a higher but still modest share of wealth among other households. Thus, while a precautionary saving motive exists and affects all households, it does not give rise to high amounts of wealth in the economy, particularly among those households that face the most volatile stream of income.

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1. Introduction

The seminal work of Deaton (1991) and Carroll (1997) illustrated theoretically the importance of precautionary savings in explaining total household wealth accumulation. Many researchers have tried to test the relevance of these theoretical predictions using micro data sources. The general approach taken in such empirical studies is to relate measures of labor income risk faced by the household to the amount of wealth that the household accumulates, controlling for other saving motives (primarily lifecycle savings). While a variety of estimates exist, several studies show that precautionary savings may contribute to as much as fifty percent to aggregate wealth.[2]

One of the critical problems of the empirical work on precautionary saving is that researchers pool together two distinct sub-groups within the population: entrepreneurs and all other households.[3] Such mixing has the potential to confound analysis of precautionary savings. Entrepreneurs may face higher average expected risks and accumulate larger amounts of wealth for reasons *unrelated to precautionary savings*. For example, pension coverage rates are much lower for entrepreneurs than for non entrepreneurs. Entrepreneurs also display a stronger bequest motive than other households. The fact that entrepreneurs hold higher than average wealth for non precautionary reasons while facing much larger measured income risks than other households may lead to a correlation between wealth and labor income risk regardless of whether or not precautionary motives are important. In this paper, we explicitly show

[2] For a review of the work on precautionary saving, see Browing and Lusardi (1996).
[3] As in Hurst and Lusardi (2004), Gentry and Hubbard (2004), Cagetti and DeNardi (2003) and Quadrini (1999), we define entrepreneurs as households owning a business and we use the terms business owner and entrepreneur interchangeably. In our robustness specifications, we also define entrepreneurs as households who report being self employed.

that the large positive estimates of precautionary savings documented in the literature are, in fact, an artifact of pooling together entrepreneurs and non-entrepreneurs.

To test this hypothesis, we separately analyze precautionary saving motives within a group of non-entrepreneurs and within a group of entrepreneurs using data from the Panel Study of Income Dynamics (PSID). Within each group separately, we find that precautionary savings explains only up to ten percent of total household wealth. Yet, when we pool these samples together, we find results consistent with other empirical estimates on the importance of precautionary savings. Specifically, in the pooled sample, we find that as much as fifty percent of total wealth is explained by precautionary savings.

The novelty of our work is not only to show the pivotal role entrepreneurs play in estimating the importance of precautionary savings but also to show that the high amount of wealth held by entrepreneurs is not the result of their precautionary motive to save against income risk. In fact, the relationship between wealth and risk may simply reflect the risk-return tradeoff of the projects undertaken by entrepreneurs rather than their desire to shield themselves against shocks to income.

In the final part of the paper, we use a more direct approach to estimating the importance of precautionary savings. Starting in 1995, the Survey of Consumer Finances (SCF) asked respondents about the amount of their desired savings earmarked for unplanned emergencies. This question was designed by one of the authors of this paper and was rigorously pre-tested.[4] After showing that responses to this question vary with measures of economic risk faced by the household, we show that in the aggregate, reported precautionary savings comprises less than eight percent of total wealth. The

[4] See Kennickell and Lusardi (2004) for detail.

sample of entrepreneurs reports having less than four percent of their total wealth as precautionary savings while non-entrepreneurs report having around ten percent of their wealth as precautionary savings. In summary, our two methods for estimating the importance of precautionary savings yield strikingly similar results. Whether using regression analysis or examining direct reports of precautionary savings from survey questions, we find that precautionary savings explain less than ten percent of total wealth holdings.

The work in this paper bridges the gap between the work of Carroll and Samwick (1997, 1998) and Kazarosian (1997) that show sizeable effects of precautionary savings, and a literature that finds very small precautionary motives (Dynan (1993), Guiso, Jappelli, and Terlizzese (1992), Skinner (1988), and Lusardi (1998)). We conclude that when analyzing the importance of precautionary saving using micro data sets, researchers have to properly account for differences in saving motives between entrepreneurs and non-entrepreneurs. When differences cannot be accounted for, researchers should exclude entrepreneurs from their sample.

The paper is organized as follows. In section 2, we review the standard approach to estimating the economic importance of precautionary savings. In section 3, we use data from the PSID to demonstrate the seeming importance of precautionary saving on a pooled sample of entrepreneurs and non-entrepreneurs. In section 4, we show that the results in section 3 are an artifact of pooling together different groups of households. Within both groups taken separately, we find at best small evidence of precautionary savings. Moreover, once we properly account for differences between entrepreneurs and non-entrepreneurs, we no longer find precautionary motives to be a sizeable component

of aggregate wealth accumulation in the pooled sample. In section 5, we introduce the SCF data and review the evidence provided by the survey question designed to directly measure precautionary savings. In the final section we conclude.

2. Estimating the Importance of Precautionary Savings

Intertemporal models of consumption/saving behavior under uncertainty predict that agents accumulate wealth to insure themselves against risk (Deaton (1991), Carroll (1992, 1997)). For the most part, thr precautionary savings literature has focused its attention on the relationship between labor income risk and wealth accumulation.[5] All else equal, households who face more labor income risk should accumulate more wealth to insure themselves against unexpected low income realizations.

Using calibrated theoretical models, several authors have calculated that precautionary savings can explain as much as 50 percent of total wealth in the US economy (Skinner (1988), Caballero (1990, 1991), Carroll (1992), and Gourinchas and Parker (2002)). Existing empirical estimates using micro data have yielded mixed results, but studies such as Carroll and Samwick (1997, 1998) and Kazarosian (1997) have confirmed that precautionary saving is the leading motive to accumulate wealth and can explain roughly half of the total wealth of US households.

The empirical strategy to estimate the importance of precautionary savings using micro data is based on the following specification:[6]

$$\ln(W_{it}) = \alpha_0 + \alpha_1 \sigma_{it}^{permy} + \alpha_2 \sigma_{it}^{transy} + \alpha_3 \ln(y_{it}) + Z_{it}\beta + u_{it} \qquad (1)$$

[5] Labor income risk is only one of many different risks faced by households. Other risks include, for example, health and longevity risks. As with the bulk of empirical work on precautionary savings, the focus in this paper is on examining the relationship between labor income risk and household wealth accumulation.

[6] This specification is identical to the specification estimated by Carroll and Samwick (1997, 1998) and is similar to specifications used by Carroll, Dynan, and Krane (2003), Kazarosian (1997) and Lusardi (1998).

where $\ln(W_{it})$ is the log of a measure of household i's wealth in period t, $\ln(y_{it})$ is the log of a measure of household i's permanent income in period t, σ_{it}^{permy} and σ_{it}^{transy} are, respectively, measures of the variance of permanent shocks to household i's income and the variance of transitory shocks to household i's income. The Z vector includes demographic characteristics of household i in period t including age, age squared, gender, race and marital status. The controls are included to capture potential differences in preferences across households and the hump-shaped profile of wealth over the life cycle.

According to the precautionary savings model, wealth is a function not only of permanent income but also of uninsurable risk faced by the household. Almost all empirical studies designed to estimate the importance of precautionary savings using micro data proxy uninsurable risk with either the variance of income (Carroll and Samwick (1997, 1998)), the variance of consumption (Dynan (1993)), or they exploit actual job loss or expectations of future job loss (Lusardi (1998) and Carroll, Dynan and Krane (2003)). In this paper, we follow Carroll and Samwick (1997, 1998) by using panel data to distinguish between the variance of permanent and transitory shocks to income.[7] Since both permanent income and the variance of income are measured with considerable amount of errors in micro data, we instrument these variables using controls such as, but not limited to, occupation and industry dummies. The testable implication then becomes whether households in those occupations facing more volatile income streams accumulate more wealth to shield themselves against uninsurable shocks to

[7] We discuss in detail in the Data Appendix how we estimate the variance of permanent and transitory income shocks. See also Carroll and Samwick (1997, 1998).

income.[8] Precautionary savings is calculated as the difference in the amount of wealth that households accumulates given that they face risky income stream and the amount of wealth they would accumulate if they were to face no labor income risk.

The empirical work using this specification faces several challenges. First, it is not clear which measure of wealth to use in the regressions since wealth components differ in term of their liquidity and substitutability. For example, wealth accumulated for retirement or bequest motives can also serve to buffer shocks to income. Second, there are many differences in preferences and individual characteristics that should be accounted for when measuring either household wealth or the income risk faced by the households. Third and most importantly, researchers need to find some observable and exogenous sources of income risk that vary enough among the population to be able to estimate the effect of risk on wealth (Browning and Lusardi (1996)).

In the following section, we make use of the specification described in (1) to show that, while the empirical estimates for precautionary savings seem very high, in fact these estimates may tell us little about the strength of the precautionary saving motive among US households.

3. Data and Empirical Work

We perform the empirical work using data from the PSID. As in Carroll and Samwick (1997, 1998), we use wealth data from the 1984 PSID wave, while we use income data from 1981 through 1987 to construct a measure of the permanent and

[8] We realize that there has been a growing literature that suggests occupation may not be a valid instrument given that risk averse household may accumulate more wealth and choose occupations with safe income streams. We address this issue in section 3.1.

transitory variance of income.[9] To broaden our analysis, we also use data from the 1994 PSID wealth supplement. In doing so, we construct the corresponding permanent income and variances of income using income data from 1991-97. The use of more than one cross-section of wealth data allows us to control for macroeconomic conditions in different time periods as well as to check the robustness of results across time. To partially overcome the problem that wealth accumulated for other reasons (i.e., retirement or bequests) can serve to insure against shocks to income, we restrict our sample to households whose head is 50-years old or younger.[10] According to the precautionary saving model of Carroll (1992, 1997), Carroll and Samwick (1997, 1998) and Gourichas and Parker (2002), the precautionary saving motive (with respect to labor income risk) is the dominant motive to save up to until age 45-50. After the age of 50, the predominant reason households save is to fund consumption during retirement. A description of other restrictions to construct our final sample is reported in the data appendix, which also includes descriptive statistics for the main variables we use in our empirical work and the details of the construction of the variance of permanent and transitory income. Our final sample includes 2,144 households.

The controls we use in our empirical work include the following demographics: age, age squared, race, gender, marital status, and education attainment.[11] In addition, we exploit the panel dimension of the PSID to control for past income and wealth shocks experienced by the household. Specifically, we include a year dummy and dummies for

[9] For detail, see the Data Appendix.

[10] As a robustness test, we redid our whole analysis including non-retired households aged 25-57. Results did not change substantially. We use the more restrictive age range for our analysis in order to: 1) give precautionary savings the best shot to explain household wealth accumulation and 2) be consistent with the existing literature.

[11] As a robustness check, we also included controls for the growth of household income during the seven-year period (either 1981 – 1987 or 1991 – 1997). In some specifications, we also instrumented for income growth. Regardless of the specification, the growth in income was always a strong predictor of household wealth. Those with steeper income profiles held lower wealth, conditional on their level of permanent income. However, in no instance, did the inclusion of our income growth measures affect our estimates of the importance of precautionary savings.

whether the head of the household was unemployed during the year when the wealth data were collected (1984 or 1994) or any time during the prior four years (1980-1984, 1990-94). Households who are more likely to face high income risk are also more likely to have been hit by past negative income shocks, and this may weaken the estimated relationship between wealth and risk. We also include dummies for past positive shocks, such as having received inheritances or other lump sum payments.

We construct permanent income by taking the average of non-capital income over the relevant sample period (1981 through 1987 or 1991 through 1997). Non-capital income is defined as the sum of the head's labor income, the spouse's labor income, the labor income of all other household members, and all transfers received by the household (excluding any capital income components). Since both permanent income and the variance of permanent and transitory income are measured with error, we instrument for these variables using a large set of variables. As suggested by Carroll and Samwick (1997, 1998), we use occupation dummies and these dummies interacted with age and age squared and industry dummies. In addition, we use the unemployment rate in the county of residence during the prior year, the variance in the county unemployment rate over the sample period, and a dummy for whether the head belongs to a union. Other studies have used the variation in unemployment across regions to instrument for the variance of income (Engen and Gruber (2001) and Lusardi (1997)). Furthermore, Gottschalk and Moffitt (1994) show that the increased earnings instability after the 1980s is correlated with changes in unionization.

The measure of wealth we use initially is total net worth, which is defined as the sum of checking and saving accounts, bonds, stocks and mutual funds (including IRAs),

home equity, other real estates, business equity, cars and other vehicles, and other assets, minus the value of all debts. Since we use logs, we exclude a little more than 5 percent of households who have negative or zero net worth in our sample. In the following subsections, we relax this assumption by using as our dependent variable wealth to income ratios (as opposed to log wealth). In this case, we do not exclude any additional households from our analysis. As we will show below, the key results are unchanged.

Empirical estimates of equation (1) are reported in Table 1. For brevity, only the coefficient estimates of the variances are reported. Both estimates of the income variances are statistically significant and show that, as predicted by the theory, higher income risk leads to the accumulation of more wealth. According to these estimates, the precautionary saving motive is very important. We perform two experiments to provide context to the magnitude of the coefficient estimates. First, we suppose that households move from an occupation with low income risk (professionals, with an estimated variance of permanent income shocks of 0.013 and an estimated variance of transitory shocks of 0.040) to an occupation with high income risk (operatives and laborers, with an estimated variance of permanent shocks of 0.019 and an estimated variance of transitory shocks of 0.059). The movement across those occupational categories increases household wealth by thirty-four percent (all else equal).

Second, we can compute the total amount of aggregate wealth explained by precautionary savings by eliminating all income risk, i.e., setting both variances to zero. After doing so, we can calculate how much wealth households would accumulate when facing no income risk and compare that amount to the estimates when income risk exists. As reported in Table 1, we find that almost half of total net worth is accounted for by

precautionary savings. This approach is very similar to the procedure used by Carroll and Samwick (1997, 1998), who found that about half of wealth is explained by precautionary motives. Ninety-five percent confidence bands around our estimate suggest that the total wealth explained by precautionary savings ranges from about forty-one to sixty percent.[12] Thus, our estimates are consistent with the existing literature.

3.1 Sensitivity Analysis

Before showing that the above results disappear when we control for differences between entrepreneurs and non-entrepreneurs, we show that these results are generally robust to a variety of alternate specifications. In essence, we want to show that what is driving the result is the pooling of non-entrepreneurs and entrepreneurs rather than the choice of samples, measures of wealth and income variances, or instrument sets.

First, as already suggested by several researchers (Lusardi (1997) and Fuchs-Schundeln and Schundeln (2003)), workers can self-select into jobs according to their coefficient of risk aversion. This invalidates the use of occupation and industry dummies as instruments for the variance of income. We have tried a different set of instruments, which excludes occupation and industry dummies. Specifically, our instrument set includes only the county unemployment rate, the variance of the county unemployment rate, and dummies for whether the head belongs to a union, whether the spouse works, whether there are other earners in the household, and whether the worker is hourly paid.

While these alternative instruments have some predictive power for the variance of income, it is lower than the power when occupation and industry dummies are included. The results of this specification are shown in Table 2 column I. The key fact is

[12] 95 percent confidence bands were bootstrapped using 1,000 repetitions.

that using our new instrument set, the importance of precautionary savings in explaining aggregate wealth holdings is diminished. Instead of explaining almost one-half of total wealth accumulation, the estimates with the modified instrument set suggest that only one-quarter of total wealth accumulation is explained by precautionary motives. Note, however, that even when excluding industry and occupation dummies from the instrument set, precautionary savings still explain a sizeable portion of aggregate wealth holdings.

To further evaluate the robustness of results, we have investigated a different measure of the variance of income. Rather than calculating the variance of the permanent and transitory shocks to income--a procedure that involves making rather restrictive assumptions- we have worked with a measure of the total income variance faced by the household. To compute this measure, we regress the log of non-capital income on some exogenous characteristics such as age, age squared, race and gender. We calculate the variance of the residual from that regression over the sample period (1981-87 or 1991-97). We then use this measure to replace both the permanent and transitory income variances in our estimation of (1). We re-estimate (1) using both the original instrument set and the second instrument set discussed above (excluding the occupation and industry dummies). Both instrument sets have strong statistical power in predicting this new variance measure. Estimates using this variance measure and the original set of instruments are reported in Table 2, Column II, and estimates using the new variance measure and the alternate instrument set are reported in Column III. As in Table 1, those facing higher income risk accumulate higher amounts of wealth. Thus, the results hold

true in this specification as well and are not sensitive to the assumptions we have made when calculating the permanent and transitory variances of income.

Another potential problem is represented by the use of the log of wealth. While the distribution of wealth is very skewed and we need to worry about the influence of very rich households, using the log transformation leads us to exclude from the sample a sizable number of households with negative or zero wealth. This exclusion is hardly exogenous. In fact, high risk households may get hit by shocks that deplete their resources and push them into negative wealth. In this case, the selection of the sample can bias our estimates. There is another consideration when working with positive net worth only. It could be that the precautionary saving motive prevents households from going heavily into debt, but they still would not hold positive wealth. In other words, the precautionary saving motive simply limits the amount of borrowing that household would otherwise undertake. Since we eliminate the household in debt, we may end up incorrectly calculating the amount of precautionary savings undertaken in the economy.[13]

To potentially overcome that problem, we have used the ratio of wealth over permanent income as our dependent variable and retain the observations with zero or negative net worth in the sample. To limit the effects of outliers, we have trimmed the distribution and excluded the observations at the top and bottom two percent of the distribution of the wealth to permanent income ratio. As reported in column IV of Table 2, this specification implies that fifty-seven percent of aggregate wealth is explained by the precautionary savings motive.

[13] Many theoretical models of precautionary savings impose liquidity constraints and prevent households from going into debt (see Deaton (1991, 1992). The inability to borrow makes the precautionary saving motive stronger; if households cannot borrow when hit by shocks, there is stronger need to accumulate a stock of precautionary wealth.

In summary, the estimation of (1) is robust to many potential criticisms. Specifically, changing the instrument set to exclude occupation and industry dummies, using different measures of income variance, and using the wealth-to-income ratio as opposed to the log of wealth as our dependent variable all yield results that suggest that precautionary savings explain at least one-quarter and as much as sixty percent of total wealth accumulation.

4. The Importance of Entrepreneurs

One of the problems in estimating the types of regressions described above is that they pool together distinct sub-groups within the population. For example, mixing together households that own a business (or are self-employed) with other households can be problematic to the extent that entrepreneurs as a group face higher risks and accumulate larger amounts of wealth for reasons unrelated to precautionary saving.[14] It is possible that the large positive estimates of precautionary saving documented in the previous section are, in fact, an artifact of pooling together entrepreneurs and non-entrepreneurs.

Figure 1 reports a simple plot of net worth and permanent income (both in logs) and shows that entrepreneurs hold larger amounts of wealth than other households with the same level of permanent income. To explore this relationship more formally, we regress the log of household wealth on a cubic in the log of household permanent labor income and an entrepreneurship dummy for households in our PSID sample. All

[14] Moskowitz and Vissing-Jorgensen (2002) document that the return to private equity (entrepreneurship) is about the same as the return to public equity (stocks), yet the risk born by entrepreneurs is much higher than the risk born by stock owners. They conclude that there are large non-pecuniary benefits to owning a business. Hamilton (2000) draws similar conclusions about the importance of non-pecuniary benefits of entrepreneurship.

variables are defined as above.[15] The coefficient on the entrepreneurship dummy is 1.24 (p-value < 0.01). This implies that, conditional on measured permanent income, entrepreneurs on average accumulate 124 percent more wealth than their non-business owning counterparts.

There are many reasons why entrepreneurs hold more wealth than non entrepreneurs aside from the fact that they face higher income variances. For example, entrepreneurs are much less likely to have private pensions (Gustman and Steinmeier, 1999). As a result, they have to accumulate much more non-pension wealth to sustain consumption through their retirement years. This fact alone could explain a large fraction of the difference in wealth levels conditional on permanent income. Upon retirement, the ratio of pension wealth (excluding social security) to non-pension wealth is about twenty-five percent for the average household (Gustman, Mitchell, Samwick and Steinmeier (1999)).

Additionally, entrepreneurs are more likely to report that they would like to leave a bequest to future heirs (Hurst and Lusardi (2004)). This is not surprising given that entrepreneurs often want to pass their business directly to their heirs. Thus, conditional on permanent income, entrepreneurs will be observed holding higher wealth than non-entrepreneurs. Entrepreneurs may also need to maintain large amounts of working capital both to deal with necessities of their business and to maintain effective control over the business. Most importantly, if households are compensated for taking greater "risks" with higher "returns," it is again not surprising that entrepreneurs have higher wealth than non business owning households for given levels of permanent income. If researchers do

[15] As discussed above, our measure of wealth does not include public or private pensions. Up through 2001, the PSID did not collect significant information on private pensions.

not properly control for all of these differences between entrepreneurs and non-entrepreneurs, one would expect to find a strong positive association between income risk and wealth even in an environment where there were no precautionary motives.

Lastly, as mentioned above, *conditional on measured permanent income*, entrepreneurs have higher wealth than non-entrepreneurs. However, it is possible that the way permanent income is usually measured is an appropriate measure of actual permanent income for non-entrepreneurs, but it may be an inappropriate measure of actual permanent income for entrepreneurs. If average non-capital income is an underestimate of actual permanent income for entrepreneurs, that could explain the results presented in Figure 1. Given tax avoidance incentives, tax evasion incentives, and the difficulty in separating between labor and capital returns for entrepreneurs, there is reason to believe that measured permanent income is understated for entrepreneurs. We explore this hypothesis in depth in sub-section 4.2.

4.1 Estimating Precautionary Savings Among Non-Entrepreneurs

Our hypothesis is that the empirical estimates of precautionary savings from Section 3 (and from much of the existing literature on precautionary savings) are large because they pool together entrepreneurs and non-entrepreneurs. To test this hypothesis, we begin by estimating (1) on a sample which only includes households which did not report owning a business in year t (sample size = 1,729). Otherwise, the sample is exactly the same as the one we used to obtain the results presented in Table 1. Our dependent variable remains the log of total net worth. The permanent and transitory variances are computed as above and the vector Z of controls is unchanged. Lastly, we instrument the variance of permanent income shocks, the variance of transitory income

shocks, and the level of permanent income with the main instrument set described in section 3.

Table 3 shows that, compared to the results in Table 1, the coefficients on both income variance measures fall dramatically in magnitude and are no longer statistically different from zero. To gauge the overall importance of precautionary saving under these estimates, we repeat the experiments in Section 3. First, we suppose that households move from an occupation with low income risk (professionals) to an occupation with a high income risk (operatives and laborers). Under this experiment, household wealth would barely change at all. Recall that the comparable thought experiment using the coefficients estimated using the pooled estimation (Table 1) was an increase of 34 percent.

Second, we can ask how much of total wealth held by non-entrepreneurs is explained by precautionary savings. Using the same procedure described in Section 3, the estimation implies that precautionary savings explains -4.1 percent of total wealth holdings. However, this estimate is not statistically different from zero. The bootstrapped 95 percent confidence bands on this estimation are minus forty percent to twelve percent.

The result of this specification is striking. It says that among non-entrepreneurs (between eighty percent and ninety percent of the population), there is, at best, only a small systematic relationship between labor income risk and household wealth accumulation. Moreover, compared to values reported in the empirical and theoretical papers mentioned above, our estimates are much smaller. Even the upper bounds of the

95 percent confidence intervals for our estimate imply a much smaller importance of precautionary savings than is implied by the previous literature.

The result persists even when we divide the sample by self-employment status as opposed to business ownership. Sixty-three percent of entrepreneurs report that they are self employed when asked about their primary job.[16] Segmenting households by whether they report being self-employed as opposed to whether they report owning a business leaves us with a sample of 1,798 households. For this sample, precautionary saving motives explain less than 2 percent of total household wealth accumulation.

These estimates are very robust. Whether we use the modified instrument set, the broader measure of income variance, or the ratio of wealth to permanent income as our dependent variable, we find that precautionary savings account for no more than 5 percent of aggregate wealth holdings.

Another set of variations serves to emphasize just how critically the importance of the precautionary saving motive hinges on the inclusion of entrepreneurs in the sample used for the estimation. One might argue that because the entrepreneurs are, on average, wealthier than other households, the results might turn simply on different behavior among the wealthy. To assess whether we are measuring simply wealthy or successful households when considering entrepreneurs, we cut the data in two additional ways. First, we remove from our sample the top twenty percent of the income distribution (leaving us with 1,716 observations). Second, we exclude from the sample households who own stocks (for a sample of 1,238 observations). In both cases, we find that precautionary saving motives continue to explain a large (and statistically significant

[16] Some entrepreneurs earn their primary labor income from a source other than the business. For these households, the business provides either a supplement to their primary labor income or a return on capital only.

portion) of total household wealth. Specifically, for the sample of households in the bottom eighty percent of the income distribution, forty percent of wealth appears to be explained by precaution. In the sample of non-stock owners, thirty-five percent of wealth appears to be explained by precaution. Thus, in both cases substantial fractions of wealth can be explained by the precautionary motive, arguably because each sample includes a substantial fraction of business owners; eighteen percent of the lower income households and seventeen percent of non-stock owners report owning a business.

In conclusion, there is no evidence of precautionary saving driving large amounts of wealth accumulation in the sample of non-entrepreneurs. Moreover, the estimates are likely much closer to zero than they are to fifty percent.

4.2 The Importance of Precautionary Savings among Entrepreneurs

In the above subsection, we documented that the estimated importance of precautionary savings is severely mitigated if we exclude the entrepreneurs from our sample. However, this does not imply that precautionary savings is not important. It may be that entrepreneurs respond strongly to labor income risk. Their response to such risk may give rise to large amounts of wealth in the economy, a point previously noted in the work by Carroll and Samwick (1997, 1998).

To probe the precautionary motives of business owners, we re-estimate (1) for this group alone. The results of this estimation are shown in column I of Table 4. Indeed, the coefficients on both variance measures are positive and statistically different from zero. Using the same procedure as above, we find that thirty-three percent of wealth among entrepreneurs can be explained by precautionary motives.

On the surface, this number appears large. But, as with the pooling of different types of households in the full sample, the numbers reported in column I of Table 4 could result from other reasons than the desire to insure against risk. Specifically, among entrepreneurs, households who take more risks should on average be compensated with higher returns. The relationship between wealth and income risk could simply capture the risk-return trade-off rather than the strength of the precautionary saving motive among entrepreneurs.[17]

To address this issue, we first assess how robust the findings in column I are to alternate specifications. One simple change to the estimation is to exclude business wealth from our measure of total net worth. If equity in private businesses is illiquid, the returns to entrepreneurship may show up in higher business wealth.[18] Moreover, it seems implausible that entrepreneurs would hold their precautionary wealth in their businesses. If anything, we would expect them to hold their precautionary reserves outside of their business.

In column II of Table 4, we report the estimates of (1) for our entrepreneurship sample where the dependent variable is the log of non-business wealth. Under this specification, the estimated impact of the precautionary saving motive falls by more than half (from thirty-three percent to fifteen percent). The degree to which non-business wealth responds to risk is now fairly small among entrepreneurs.

[17] Note that since we consider those households who are entrepreneurs in the years when the wealth data was collected (1984 or 1994), we are implicitly considering only those entrepreneurs who started in that year or that started earlier and survived. The survival bias further strengthens the relationship between wealth and labor income risk in the sub-sample of entrepreneurs.

[18] We are aware that entrepreneurs could effectively liquidate the returns to their business by holding lower non-business wealth. The exclusion of business wealth from our measure of net worth is meant to explore the robustness of the precautionary savings results to plausible alternate specifications.

Another important point concerns the estimation of permanent income. As mentioned before, permanent income is measured by averaging non-capital income for a given household over the sample period. While non-capital income is likely a sufficient measure of compensation for non entrepreneurs, the situation is not so straightforward for entrepreneurs. There are three important factors in this difference. First, tax evasion may drive some entrepreneurs to under-report their labor income (by large, the most important component of non-capital income, which also includes transfers). Second, legal tax avoidance drives some entrepreneurs to retain part of their compensation within the business.[19] Lastly, tax evasion and tax avoidance aside, it is hard to specify and measure the actual labor return from entrepreneurship; the part of business income attributed to the business and to wages is inevitably arbitrary in many cases.[20] This mis-measurement is problematic for this sort of analysis given that the return to the investment of business owners (i.e., their total compensation) is likely correlated with the underlying risk of the project.

According to standard consumption theory, household consumption is a valid measure of a household's permanent income. While labor income may be underreported for entrepreneurs, there is no reason to believe that consumption for entrepreneurs will be seriously mis-measured relative to the consumption of non-entrepreneurs. As a potentially better proxy for the lifetime resources of households, we use consumption in lieu of non-capital income in the estimation of (1).[21]

[19] See also Holtz-Eakin et al (1994) who also emphasize there are many tax incentives in entrepreneurship.
[20] Note that a large portion of labor earnings for business owners are simply imputed within large micro surveys such as the PSID or the Current Population Survey.
[21] See, among others, Meyer and Sullivan (2003) who also use consumption as a proxy for permanent income.

The PSID provides information on food consumption at home (including food stamps) and food outside the home. Although the sum of these two measures is only a limited proxy for total nondurable consumption, many studies have used food consumption to test the predictions of the theory and have found that food consumption often displays characteristics similar to non-durable consumption (Lusardi (1996), Hurst (2004)). We take the average of the sum of food at home, food away from home, and food stamps over the sample period as a proxy for permanent income and use it as a proxy for y_{it} in (1) to test the sensitivity of the model to our original definition of permanent income. [22] We instrument for the variances of income and average food consumption using the same instruments as before.

The results of this regression are reported in Table 4 (Column III). The coefficient on the variance measures are no longer statistically different from zero and are much smaller in magnitude, compared to those found in Table 1. Using the same procedure as outlined in Section 3, we find that precautionary motives explain a little more than eight percent of total wealth within the sample of entrepreneurs. Again, our results are robust to a variety of changes. Whether we use different instrument sets, different measures of the variance of income, or the self-employed rather than entrepreneurs, our key results do not change.

When we return to the full sample and estimate (1) using the log of total net worth less business equity as the dependent variable and using food consumption as the measure of permanent income, we find results dramatically different from those reported in Table 1 (Table 5). Notably, the implied share of precautionary wealth explained by

[22] A description of our exact measurement of average food consumption is found in the Data Appendix.

precautionary motives decreases from forty-seven percent to less than 10 percent.[23] These results are striking. When pooling together non-entrepreneurs and entrepreneurs, we find that precautionary savings explains nearly half of all total wealth accumulation within the U.S. However, this is simply an artifact of pooling together different groups of households without accounting for their differences. When we control for the presence and importance of entrepreneurs, we find estimates of the impact of precautionary savings in explaining aggregate wealth holdings to be lower than much of the existing literature.

Does our estimation imply that one cannot run precautionary savings estimation on pooled samples that include both non-entrepreneurs and entrepreneurs? According to our work, if researchers do run pooled regressions (as done in the majority of the empirical work on precautionary saving), they need to account for differences between these two groups. At a minimum, researchers should account for more appropriate measures of permanent income and should also exclude business wealth from their measure of potential precautionary savings. They should further model the other reasons why entrepreneurs may accumulate wealth since that may lead to an artificial correlation between wealth and income risk. In surveys where such data is not provided, we suggest to drop the entrepreneurs (or the self-employed) from the sample.

In summary, we show that the standard estimates of the importance of precautionary savings in explaining total wealth accumulation are fragile. Within both the sample of entrepreneurs and non-entrepreneurs, our estimates of the magnitude of precautionary savings are less than ten percent. While this amount is still sizable, it is

[23] The bootstrapped 95 percent confidence band for the proportion of wealth explained by precautionary saving documented in Table 5 is from -7.5% to 25.7%.

much smaller than the estimates reported by other authors using the same estimation procedure. In the next section, we explore a potentially more robust method to measure the amount of precautionary savings within the total population.

5. An Alternative Approach to Estimating Precautionary Savings

As the previous sections show, it is hard to disentangle the amount of precautionary savings using the modeling techniques applied above. We propose an alternative approach to evaluate the importance of precautionary savings, which relies on a direct question about desired precautionary wealth from the Survey of Consumer Finances (SCF). Starting from 1995, the following question has been asked to all SCF respondents:

"*How much do you think you and your family need to have in savings for unanticipated emergencies and other unexpected things that may come up?"*

This question was specifically designed to get respondents to elicit the amount of desired precautionary savings.[24] In other words, the question was intended to measure what is the equilibrium level of desired precautionary savings due to the fact that future income streams and consumption needs are uncertain. Prior to being added to the SCF, the question was thoroughly pre-tested, using also focus groups.[25]

The question has been extensively analyzed by Kennickell and Lusardi (2004). These authors show that responses to this question tend to mimic the pattern of wealth

[24] As a result, the wording reflects the responses households give when asked open-ended questions about motives to save. Other data sets, such as the Dutch CentERdata and the German Save, have questions about precautionary savings that have the same wording. See Borsch-Supan and Essing (2003).
[25] A similar question has now been added to the 2003 Italian Survey of Household Income and Wealth.

over the life-cycle and across demographic groups. For example, young households, who have low wealth, tend to report low amounts of precautionary savings and, for this group, precautionary savings is almost always less than total reported gross wealth. More importantly, Kennickell and Lusardi show that responses to this question are correlated with various measures of risk. Since the question is asked to all respondents with no age restrictions and does not specify a specific source of risk, the responses refer to all types of risk, not just labor income risk. In particular, Kennickell and Lusardi show that desired precautionary wealth is correlated with a variety of risk measures including income risk, longevity risk and health risk.

Another important feature of this variable is its behavior during the stock market boom. While total net worth increased sharply from 1995 to 1998 due to the increase in the prices of stock, the distribution of desired precautionary savings remained roughly the same in 1995 and 1998, as we would expect from the fact that neither risk nor permanent income increased dramatically during that short time period (Kennickell and Lusardi (2004)). The contrasting behavior of these two variables may explain why it is hard to find much evidence of precautionary savings when using wealth data which include periods of increases in stock market prices, such as the 1990s (Carroll, Dynan and Krane (2003)).

To further assess the accuracy of the SCF self-reported measure of precautionary wealth, we construct a sample in the SCF using the same criteria to construct the sample as in the PSID. Our goal is to see how our new measures of precautionary savings respond to measures of permanent and transitory income variances. To do this, we estimate an equation similar to equation (1) described above, but where we replace the

log of net worth with the log of reported precautionary saving. This specification allows us to examine directly whether households with higher income variances household report higher amounts of precautionary wealth.

The one draw-back to this procedure is that the SCF is not a panel data set. This makes it impossible to measure income variance directly from SCF data. To overcome this problem, we use a two-sample instrumental variables procedure. We estimate the first stage of the IV procedure using income data from the PSID (from 1991 to 1997). We then use the estimated coefficients from the PSID to construct a measure of the variance of both permanent and transitory income shocks for the SCF. This procedure is possible because one can define the demographic variables and the occupation and industry dummies used as instruments comparably in the PSID and the SCF. We measure permanent income in the SCF by using the measure of "normal" household income provided by SCF respondents (Kennickell and Lusardi (2004)).

Estimates from this two-sample procedure are reported in Table 6. Column I reports the results from the full sample, while columns II and III, respectively, report the results when the sample is restricted to including non-entrepreneurs only and then including entrepreneurs only. As expected, desired precautionary savings is correlated with the variance of permanent income in the total sample. Thus, higher income risk leads households to hold higher amounts of precautionary wealth. What is different from the previous estimates is that income risk remains statistically significant when entrepreneurs are excluded. As we show later, the fact that we can use a measure of desired precautionary savings directly as a left-hand-side variable overcomes the problem of defining a "correct" measure of wealth in estimating precautionary savings. Estimates

of the impact of labor income risk can therefore be more precise. Among the entrepreneurs only, higher labor income risk also leads to higher amounts of precautionary wealth. Thus, we find that a precautionary saving motive exists among our full sample of households as well as in both the sample of entrepreneurs and the sample of other households.

If we use total net worth rather than desired precautionary savings, our results with the SCF are very similar to those we obtain using the PSID (Table 7). The variance of income is statistically significant in the full sample, but its significance and magnitude disappears when the entrepreneurs are excluded. But, as we stressed above, it is hard to interpret such regressions given flaws in the measure of permanent income and the difficulty in properly accounting for the risk/return trade-off. This table well illustrates the difficulty in estimating precautionary savings by using the measure of wealth and proxies for risk, which have been common in this literature. Furthermore, the coefficient estimates from these regressions on net worth in the SCF suffer from some of the other problems discussed before. For example, if people self-select into occupations according to their coefficient of risk aversion, then the estimates of the coefficients of the variance of income are biased downward (Fucks-Schundeln and Schundeln (2003)).

The great advantage of the SCF data on desired precautionary savings is that we can simply look at the amounts reported by households. These values represent an upper bound to the value of precautionary savings against income risk since the question refers to all types of risk that household finds relevant. However, since we concentrate on young families only, income risk is likely to be the most considerable source of risk faced by households.

In our most preferred analysis, we simply examine the amount of reported precautionary wealth as a fraction of total reported net worth for SCF households. As seen above, the reported precautionary wealth measure seems to be informative in the sense that it does vary with measures of income risk. If the SCF question is truly measuring desired precautionary savings, we can measure the overall importance of precautionary savings by directly examining the relative magnitudes reported by SCF households. Panel A of Table 8 reports mean and median values of desired precautionary saving in the total sample, the sub-sample of non entrepreneurs and the sub-sample of entrepreneurs only. These values highlight again the importance of entrepreneurs when assessing the importance of precautionary saving. Entrepreneurs desire a higher amount of precautionary saving than non entrepreneurs and these values are often quite high.

Panel B of Table 8 reports the more relevant statistic, the ratio of desired precautionary saving to total net worth. Precautionary savings accounts for approximately seven percent of wealth in the full sample of households under the age of fifty in the SCF. Among entrepreneurs, precautionary savings accounts for approximately four percent, while among non-entrepreneurs, precautionary savings account for ten percent of total net worth.

This analysis is consistent with the regression approach outlined above. These values show that a precautionary saving motive does exist among young families in the U.S. Thus, models of consumption-saving behavior should incorporate uncertainty into their theoretical framework. However, this motive does not give rise to large amounts of wealth. The precautionary saving motive can at best explain less than ten percent of total net worth.

Disentangling the importance of precautionary savings by using a measure of total net worth is very difficult both conceptually and empirically. The stock of wealth at a point in time is the result of precautionary accumulation, but it also includes (among other things) the return from taking risk, past and current portfolio choice, the shocks that have hit households. Estimates of precautionary savings from simple regressions of total wealth on proxies for risk are likely to be confounded by such factors.

5. Conclusion

Some of the papers in the literature on precautionary savings suggest that precautionary motives explain about half of total wealth, while other papers suggest a much smaller fraction. The results of this paper indicate that the high estimated importance of the precautionary saving motive is driven by mixing two very different groups of households: entrepreneurs and non-entrepreneurs. Relative to the latter group, the former holds large amounts of wealth and also faces high income risk. Moreover, business owners have many other motives for wealth accumulation. Although pooling these two groups leads to very large estimates of the share of precautionary saving in total net worth, we show that in these two groups separately, the estimated amount of precautionary savings is low. While Carroll and Samwick (1998) already noted that the precautionary saving motive would almost vanish when excluding farmers and the self-employed from the sample, we show that, even among these excluded groups, the precautionary saving motive is small. Thus, the high estimates in the total sample are simply an artifact of pooling together different groups of households and the correlation between wealth and income risk does not reflect the desire of households to insure against risk.

Because the conceptual and measurement issues related to entrepreneurs have such a powerful effect on estimates of precautionary savings, we recommend that other researchers control carefully for differences between entrepreneurs and other households. When this is not possible, entrepreneurs should be excluded from the sample.

Our work also show that many factors may make the presence of a precautionary motive hard to estimate using the wealth measures and risk proxies common to this type of literature. Using data from the PSID and a direct measure of precautionary saving from the SCF, we find that the precautionary saving motive accounts for less than ten percent of total net worth.

An additional implication of our paper is that one should be wary in making international comparisons of the importance of precautionary saving motives. Since entrepreneurs in other countries may accumulate rather different amounts of wealth than other households, estimates from foreign countries should be used with caution. For example, our results may explain why the estimates of precautionary saving in Italy and France (Guiso, Jappelli and Terlizzese (1992) and Arrondel (2002)) are much lower than what is found in US data.

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Table 1: Instrumental Variables Estimates of the Effect of Labor Income Risk on Log of Net Worth: Pooled Sample

Variable	Coefficient (Standard Error)
Variance of Permanent Income Shocks (α_1)	15.91 (2.98)
Variance of Transitory Income Shocks (α_2)	7.52 (1.48)
Percent of Net Worth Explained By Precautionary Savings	47.5%
Sample Size	2,144

Notes: This table reports IV estimation of a regression of the log of net worth on the variance of permanent income shocks, transitory income shocks, and permanent income. The regression also includes controls for household demographics and past shocks to wealth. See text for full detail of additional variables included. Estimation was performed using PSID wealth data from 1984 and 1994. Sample was restricted to household between the age of 25 and 50. Permanent income is measured as average household non-capital income. The two variance measures as well as permanent income were instrumented using occupation dummies, industry dummies, interactions between occupation dummies with age and age squared, union status of household head, the county unemployment rate, and the variance of county unemployment rate. Sample pools together entrepreneurs and non-entrepreneurs.

Table 2: Estimates of the Effect of Labor Income Risk on Log of Net Worth: Pooled Sample, Alternate Specifications

Variable	I	II	III	IV
Variance of Permanent Income Shocks (α_1)	16.78 (8.97)			25.26 (5.73)
Variance of Transitory Income Shocks (α_2)	0.05 (3.33)			13.01 (2.69)
Variance of Income		9.91 (1.46)	3.18 (1.89)	
Percent of Total Net Worth Explained by Precautionary Savings	24%	49%	19%	57%
Sample Size	2,144	2,144	2,144	2,198

Notes: Specification I is the same as the regression presented in Table 1 except the instrument set excludes occupation and industry dummies and add dummies for whether the wife works, whether there are other earners in the household and whether the worker is hourly paid. Specification II is the same as the regression presented in Table 1 except the variance of permanent income shocks and the variance of transitory income shocks are replaced by the variance of total income. Specification III is the same as specification II but the instrument set is the same as specification I. Specification IV is the same as regression presented in Table 1 except the dependent variable is the ratio of net worth to average household non-capital income. The top and bottom 2% of the net worth to income distribution was truncated. Sample pools together entrepreneurs and non-entrepreneurs.

Table 3: Instrument Variables Estimates of Labor Income Risk on Log of Net Worth: Non-Entrepreneurs Only Sample

Variable	Non-Entrepreneur Sample
Variance of Permanent Income Shocks (α_1)	-0.63 (3.65)
Variance of Transitory Income Shocks (α_2)	-0.70 (1.58)
Percent of Total Net Worth Explained By Precautionary Savings	-4.1%
Dependent Variable	Log of Total Net Worth
Measure of Permanent Income	Average Non-Capital Income
Sample Size	1,729

Notes: Estimations in this table is the same as the estimation reported in Table 1 except that the sample is restricted to non-entrepreneurs only. See notes to Table 1 for a full discussion.

Table 4: Instrument Variables Estimates of the Effect of Labor Income Risk on Log of Wealth: Entrepreneurs Only Samples

Variable	I.	II.	III.
Variance of Permanent Income Shocks (α_1)	6.79 (3.05)	3.38 (2.82)	2.85 (2.62)
Variance of Transitory Income Shocks (α_2)	2.82 (1.75)	1.00 (1.64)	0.07 (1.53)
Percent of Total Net Worth Explained By Precautionary Savings	33.2%	15.9%	8.7%
Dependent Variable	Log of Total Net Worth	Log of Net Worth Less Business Equity	Log of Net Worth Less Business Equity
Measure of Permanent Income	Average Non-Capital Income	Average Non-Capital Income	Average Food Expenditure
Sample Size	415	415	415

Notes: Estimations in column I of this table is exactly the same as the estimation reported in Table 1 except that the sample is restricted to entrepreneurs only. See notes to Table 1 for a full discussion. Column II differs from column I in that the dependent variable is the log of non-business wealth. Column III differs from column II in that our measure of permanent income is average food expenditure rather than average non-capital income.

Table 5: Estimates of the Effect of Labor Income Risk on Log of Non-Business Wealth: Pooled Sample, Accounting for Heterogeneity Between Entrepreneurs and Non-Entrepreneurs

Variable	Coefficient (Standard Error)
Variance of Permanent Income Shocks (α_1)	3.95 (2.53)
Variance of Transitory Income Shocks (α_2)	0.63 (1.23)
Percent of Net Worth Explained By Precautionary Savings	9.4%
Sample Size	2,144

Notes: Estimation and sample are the same as that used in Table 1. The difference between the results in this Table and the results in Table 1 occur because the dependent variable in this table is the log of non business wealth (as opposed to the log of total wealth) and the measure of permanent income is average household food consumption (as opposed to average non-capital household income).

Table 6: Regression of Desired Precautionary Savings in the SCF on Labor Income Risk: Two-Sample IV Estimates

Variable	Full Sample	Non-Entrepreneur Sample	Entrepreneur Only Sample
Variance of Permanent Income Shocks (α_1)	6.67	3.82	9.14
	(1.62)	(1.89)	(2.83)
Variance of Transitory Income Shocks (α_2)	0.62	-1.20	2.88
	(0.89)	(0.98)	(1.79)
Sample Size	1,497	1,046	451

Note: This table reports two-sample IV regressions of log of desired precautionary savings in the 1995 SCF on the variance of permanent income shocks, the variance of transitory income shocks, and additional controls such as permanent income, age, age squared, marital status, race, gender, and number of children. The sample is restricted to all heads between the age of 25 and 50 and using the other restrictions in constructing the PSID sample. The variance measures were predicted using PSID data and fitting estimates back to the SCF using demographics, occupation and industry dummies and those dummies interacted with age and age squared.

Table 7: Regression of Log Net Worth in SCF on Labor Income Risk: Two-Sample IV Estimates

Variable	I. Full Sample	II. Non-Entrepreneurs	III. Entrepreneurs
Variance of Permanent Income Shocks (α_1)	10.49	2.40	15.99
	(2.13)	(2.36)	(3.10)
Variance of Transitory Income Shocks (α_2)	1.48	-3.61	7.11
	(1.18)	(1.23)	(1.97)
Dependent Variable	Log of Total Net Worth	Log of Total Net Worth	Log of Total Net Worth
Measure of Permanent Income	Normal Income	Normal Income	Normal Income
Sample Size	1,497	1,046	451

Notes: This table shows the effect of the variance of income on net worth accumulation among SCF households. The specification in this table is the same as that in Table 1 which was estimated for PSID households. Column I uses the full sample of SCF households. Column II restricts the sample to non-entrepreneurs only. Column III restricts the sample to only entrepreneurs. The variance measures were predicted using PSID data and fitting estimates back to the SCF using demographics, occupation and industry dummies and these dummies interacted with age and age squared.

Table 8: Level of Desired Precautionary Savings and Ratio of Desired Precautionary Savings to Total Wealth in the SCF

Panel A: Level of Precautionary Savings		
Sample	Mean	Median
Entrepreneurs	$18,300	$7,100
Non Entrepreneurs	$10.400	$5,000
Panel B: Ratio of Precautionary Savings to Total Wealth		
Entrepreneurs	4%	5%
Non-Entrepreneurs	10%	12%

Notes: Data from the 1995 Survey of Consumer Finances. Sample restricted to households with heads aged between 25 and 50. Sample size equals 1,497. Panel A reports the response to a survey question designed to measure how much savings a household desire to have due to uncertainty surrounding future income and consumption needs. See text for exact question specification. Panel B shows the ratio of desired precautionary savings to total net worth for the same sample of households.

DATA APPENDIX

A.1 Sample selection

We used data from the PSID in 1981-87 and 1991-97. To construct our final sample, we dropped all households from the Survey of Economic Opportunity (SEO), which over-samples the poor, and from the Latino sample. We also dropped households with heads who were younger than 26 or older than 57 in 1981 (for the 1981-1987 panel) or 1991 (for the 1991-1997 panel). We dropped households with invalid education, occupation or industry responses (including the unemployed and those who were not participating in the labor market, for whom the occupation and industry question was not asked) in those same years, as well as households where the head's marital status changed at any time during the period considered. Household were also dropped from the sample if the head or the wife changed during the period considered. Finally, we dropped a household if its income in any year fell below a 20% of the household's average income during the period, in order to avoid that the estimations of the permanent and transitory variances are driven by a few households with extremely volatile incomes. We also exclude those observations with missing data on their county unemployment rate and those with zero or negative wealth.

The following table shows the number of observations dropped due to each sample selection criterion, for each of the panels.

Table A.1 Sample selection

Variable	1981-1987		1991-1997	
	Dropped Households	Remaining Households	Dropped Households	Remaining Households
Original PSID sample	-	9,423	-	14,948
SEO / Latino samples	4,514	4,909	10,991	3,957
Age<26	510	4,399	301	3,656
Age>57	2,227	2,172	1,079	2,577
Age>50	213	1,959	127	2,450
Invalid education, occupation or industry	253	1,706	215	2,235
Change in marital status	564	1,142	780	1,455
New head or spouse	12	1,130	9	1,446
Income lower than 20 percent of average income over the period	37	1,093	263	1,183
Missing, zero or negative net wealth	43	1,050	78	1,105
Missing county unemployment rate	4	1,046	7	1,098

A.2. Definitions

Net worth

Net worth is defined as the sum of all assets owned by the household at the time of the interview. It includes money in checking or savings accounts and in IRAs; money market bonds; Treasury bills; bond funds; cash value in life insurance policies; valuable collections for investment purposes; rights in trusts or estates; shares of stock in publicly held corporations; mutual funds; investment trusts; stocks in IRAs; value of all vehicles, and value of all (partially or fully) owned farms and businesses. The value of all those assets is net of anything owed on them, such as the value of mortgages and due payments

of car loans. Other debts that have been subtracted include: mortgages on other owned real estate, credit card charges, student loans, medical or legal bills and loans from relatives.

Non-capital current income

Non-capital income was calculated as labor income plus transfers of the head, spouse, and all other members of the household. Labor income includes wages and salaries, overtime compensation, bonuses, commissions and tips, and income from the practice of a profession or trade, as well as the labor share of income from farm income and business income. Total transfers include: (a) ADC/AFDC, Supplemental Security Income and other welfare transfers; (b) Social Security transfers; (c) other retirement income, pensions and annuities; (d) unemployment compensation; (e) workman's compensation; (f) child support transfers; (g) transfers from relatives and friends; and (i) food stamps, which are not included in any of the transfers above.

All dollar values were deflated to 1997 dollars, using the CPI.

Permanent income

We considered two alternative definitions of permanent income. The first one is simply the time average of current income (so, for a given household, permanent income in 1981-1987 is the average income over that period.) We have also considered the time average of expenditures on food (the sum of food at home, food away from home and annual value of food stamps) as an alternative proxy for permanent income.

Business owner

A household is classified as business owner if answering 'yes' to the following question in the wealth supplement of the PSID: 'Do you (or anyone in your family living

there) own part or all of a farm or business?' Our alternative definition of business owners is households are are self-employed. The exact working of that question is 'Do you (head) work for someone else, yourself, or what?' The possible answers to this question are: (1) Someone else; (2) Both someone else and self; (3) Self only. We classify a household as being self-employed if the answer is either (2) or (3).

A.3 Construction of the variance of permanent and transitory incomes

The calculation of the variance of permanent and of transitory income is virtually identical to that found in Carroll and Samwick (1997). We assume that the natural logarithm of current non-capital income, y_t, can be decomposed into three components:

$$y_t = g_t + y_t^p + \varepsilon_t \tag{A.1}$$

where g_t represents a predictable trend due to demographic and human capital factors, y_t^p is the permanent component of income, and ε_t is the transitory component.

The transitory component is a white noise with variance σ^2_ε, whereas the permanent component follows a random walk

$$y_t^p = y_{t-1}^p + \eta_t \tag{A.2}$$

where η_t, another white noise with variance σ^2_η, is the shock to permanent income in period t; ε_t and η_t are assumed to be uncorrelated at all leads and lags.

The first step in the construction of the variances consists of removing the trend. To do that, we run a cross-sectional OLS regression of the natural logarithm of current income on age, age squared, a gender dummy, a marital status dummy, a white race dummy, education, occupation and industry dummies, and the interaction of the

education and occupation dummies with age and age squared. The residual from that regression is our detrended income, $\hat{y}_t$.

Next, we calculate the d-year difference of detrended income, r_d:

$$r_d \equiv \hat{y}_{t+d} - \hat{y}_t$$

(A.3)

Combining (A.3) with equations (A.1) and (A.2), and ignoring the trend g_t, since it has been previously removed,

$$r_d = \sum_{s=1}^{d} \eta_{t+s} + \varepsilon_{t+d} - \varepsilon_t$$

(A.4)

r_d^2 is the estimate of the variance of r_d, and it is related to the variance of the permanent and transitory components of income, since, using (A.4) we find that

$$r_d^2 = Var(r_d) = d\sigma_\eta^2 + 2\sigma_\varepsilon^2$$

(A.5)

In principle, (A.5) alone would be enough to calculate the variances. However, we exploit all the information contained in the data set by running an OLS regression, household by household, of r_d^2 on d and a constant. The coefficient on d is our estimate of the permanent variance of income, whereas the constant (divided by two) is our estimate of the transitory variance of income.

For each of the two panels, 1981-1987 and 1991-1997, we considered all the possible differences between incomes at least three years apart[26]. For example, for the period 1981-1987, we took 1984-1981, 1985-1982, 1986-1983, 1987-1984, 1985-1981,

[26] Our procedure is thus not affected if the stochastic process for transitory income is a moving average of order 1 or 2. See Carroll and Samwick (1997) for more detail.

1986-1982, 1987-1983, 1986-1981 and 1987-1982. Therefore, a household's variance of permanent and transitory incomes is estimated with a regression on 9 observations.

A.4 Summary statistics

Table A.2: Summary statistics of demographic variables

	Mean		
Variable	Total sample	Entrepreneurs	Non-entrepreneurs
Average non-capital income (1)	45,164 (28,964)	50,535 (39,583)	43,875 (25,620)
Average food consumption (1)	13,160 (38,977)	13,873 (39,775)	12,988 (38,792)
Age of head	36.57 (6.77)	37.47 (6.53)	36.35 (6.81)
Number of children	1.38 (1.17)	1.41 (1.11)	1.37 (1.18)
Percentage of married households	85.35	93.73	83.34
Percentage of white households	92.91	97.11	91.90
Percentage of female household heads	8.82	1.69	10.53
Education (percentage):			
0-8 grades	2.89	0.97	3.35
9-12 grades	6.30	4.10	6.82
High-school diploma	19.12	17.83	19.43
Some college, no degree	40	38.31	40.43
College degree	22.20	24.82	21.57
Some advanced education	9.47	13.98	8.39
Number of observations	2,144	415	1,729

Note: Standard deviation in parentheses.
(1) Average over sample period.

Table A.3: Estimated variances of permanent and transitory income by occupation groups

Group	Permanent variance	Transitory variance	Percent of sample
Total sample	0.0162 (0.0023)	0.0513 (0.0040)	100
Professional and technical workers	0.0135 (0.0042)	0.0404 (0.0069)	23.74
Managers (not self-employed)	0.0171 (0.0048)	0.0305 (0.0083)	14.60
Managers (self-employed)	0.0272 (0.0163)	0.0866 (0.0270)	5.27
Clerical and sales workers	0.0192 (0.0075)	0.0541 (0.0128)	13.25
Craftsmen	0.0129 (0.0043)	0.0524 (0.0079)	20.10
Operatives and laborers	0.0199 (0.0055)	0.0592 (0.0094)	15.35
Farmers and farm laborers	0.0079 (0.0209)	0.1414 (0.05)	2.01
Service workers	0.0126 (0.0096)	0.0547 (0.0184)	5.69

Note: Standard errors in parentheses.

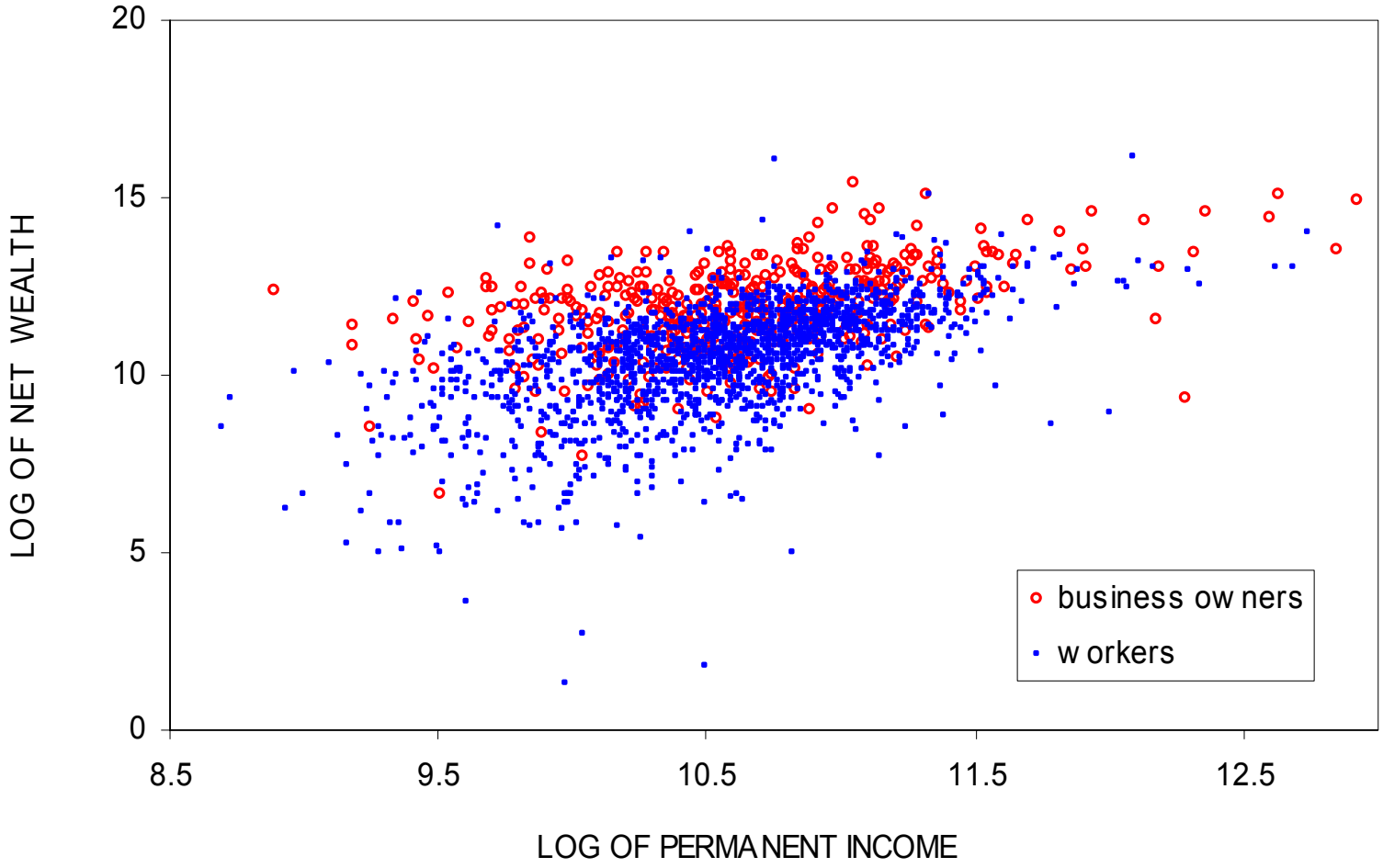
Table A.4: Estimated variances of permanent and transitory income by household groups

Group	Permanent variance	Transitory variance	Percent of sample
Entrepreneurs	0.0277 (0.0066)	0.0763 (0.0116)	19.36
Non-entrepreneurs	0.0134 (0.0023)	0.0453 (0.0041)	80.64
Self-employed	0.0301 (0.008)	0.0923 (0.0142)	16.14
Non self-employed	0.0135 (0.0022)	0.0435 (0.0039)	83.86

Note: Standard errors in parentheses.

Table A.5: Total net wealth by household groups

Group	Mean	Median	25th percentile	75th percentile
Total sample	132,645	58,216	22,995	125,741
Entrepreneurs	291,594	146,708	71,285	302,001
Non entrepreneurs	94,493	46,907	18,041	98,112
Self-employed	287,583	140,116	57,622	302,001
Non self-employed	102,829	49,803	19,408	104,966


20
15
10
5
0
LOG OF NET WEALTH
8.5
9.5
10.5
11.5
12.5
LOG OF PERMANENT INCOME
business owners
workers