THE IMPORTANCE OF BUSINESS OWNERS IN ASSESSING THE SIZE OF PRECAUTIONARY SAVINGS

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Abstract—Not properly accounting for differences between business owners and nonbusiness owners in studies of household wealth can lead to erroneous conclusions about the significance of different saving motives. Using data from the Panel Study of Income Dynamics from the 1980s and 1990s, we show that within samples of both business owners and non–business owners, the amount of precautionary savings with respect to labor income risk is modest and accounts for less than 10% of total household wealth. Previous large estimates of the size of precautionary balances resulted from pooling these two groups together. Such pooling is inappropriate given that business owners face higher labor risk and accumulate more wealth than non–business owners for reasons unrelated to precautionary motives.

I.   Introduction

PRECAUTIONARY saving is considered one of the most important motives to save, particularly for the young. Although a variety of empirical estimates exist, several studies show that precautionary savings may contribute to as much as 50% of aggregate wealth for individuals under the age of fifty.[1] The general approach taken in these studies is to relate measures of labor income risk that households face to the amount of wealth households accumulate. As a result of these large empirical estimates, most models in macroeconomics now incorporate a precautionary saving motive. Moreover, the importance of precautionary saving in explaining aggregate wealth holdings has implications for public policy: the effects of welfare and taxation policies very much rely on the strength of this motive.

In this paper, we show that the large, positive estimates of precautionary savings documented so far in the literature are in fact an artifact of pooling together two different subgroups in the population: business owners and other households. Such mixing has the potential to confound the analysis of precautionary savings. Business owners face, on

average, higher expected income risk and accumulate larger amounts of wealth than do other households but for reasons unrelated to precautionary savings.[2] The fact that business owners hold higher-than-average wealth while facing higher income risk than other households leads to a correlation between wealth and labor income risk regardless of whether a precautionary motive is important.

To test this hypothesis, we separately analyze precautionary saving motives of non–business owners and business owners using data from the Panel Study of Income Dynamics (PSID). Within each group, our modal estimates suggest that precautionary savings explain less than 10% of total household wealth. Yet when we pool these samples together, we find that as much as 50% of total wealth is explained by precautionary savings. Thus, estimates of precautionary savings are confounded in a sample that mixes different groups of households.

The work in this paper is the first to bridge the gap between the work of Carroll and Samwick (1997, 1998) and Kazarosian (1997), which show sizable effects of precautionary savings, and the literature that finds small effects (Skinner, 1988; Guiso, Jappelli, & Terlizzese, 1992; Engen & Gruber, 2001; Lusardi, 1998). In the final portion of the paper, we discuss how the studies that find small estimates of precautionary savings have implicitly controlled for differences between non–business owners and business owners by excluding either business owners from their samples or business wealth from their measure of household savings.

II.   Estimating the Size of Precautionary Balances

Intertemporal models of consumption and saving behavior under uncertainty predict that agents accumulate wealth to insure themselves against risk (Deaton, 1991; Carroll, 1992, 1997). For the most part, the precautionary saving literature has focused its attention on the relationship between labor income risk and wealth accumulation.[3] All else being equal, households that face more labor income risk should accumulate more wealth to insure themselves against unexpected income realizations.

Using calibrated theoretical models, several researchers have calculated that precautionary savings can explain as

[1] For a review of early work on precautionary savings, see Deaton (1992) and Browning and Lusardi (1996). For more recent results, see Carroll and Samwick (1997, 1998), and Carroll, Dynan, and Krane (2003).

[2] See Hurst and Lusardi (2008) for a discussion of some of the reasons business owners hold more wealth than non–business owners with a similar lifetime trajectory of labor income. We discuss some of these reasons in detail in this paper.

[3] Labor income risk is only one of the risks that households face. Other risks include health and longevity. As with the bulk of the empirical work on precautionary savings, the focus in this paper is on examining the relationship between noncapital income risk and household wealth accumulation. Given that our attention will be on heads of households aged 26 to 50 and labor accounts for most noncapital income, labor income risk is likely to be the most important risk these households face.

much as 50% of total wealth in the U.S. economy (Skinner, 1988; Caballero, 1990, 1991; Carroll, 1992; Gourinchas & Parker, 2002). Existing empirical estimates using microdata have yielded mixed results, but studies like Carroll and Samwick's (1997, 1998) have shown that precautionary saving is the leading motive to accumulate wealth and can explain roughly half of the total wealth of U.S. households.

A. Empirical Specification

The empirical strategy of estimating the size of precautionary balances using microdata is based on the following specification:[4]

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\begin{aligned}
\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},
\end{aligned} \tag{1}
$$

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 i's permanent income in t, and σ_{it}^{permy} and σ_{it}^{transy} are, respectively, measures of the variance of permanent shocks and transitory shocks to i's income. The Z vector includes additional controls designed to capture potential household differences in preferences and the hump-shaped profile of wealth over the life cycle.

According to the precautionary saving model, wealth is a function not only of permanent income, but also of uninsurable income risk faced by the household. Almost all empirical studies designed to estimate the size of precautionary balances using microdata proxy uninsurable risk with either the variance of income (Carroll & Samwick, 1997, 1998) or the variance of consumption (Dynan, 1993), or they exploit actual job loss or expectations of future job loss (Lusardi, 1998; Carroll, Dynan, & 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.

B. Data

To estimate (1), we use data from the PSID. We examine accumulated household wealth in either 1984 or 1994. This broadens the analysis performed in Carroll and Samwick (1997, 1998), which analyzed only household wealth accumulation within the PSID using 1984 wealth data. The measure of wealth used is total net worth, which is defined as the sum of checking and savings accounts, bonds, stocks and mutual funds (including IRAs), home equity, other real estate, business equity, cars and other vehicles, and other assets, minus the value of all debts. Since we use logs, we exclude households that have negative or zero net worth in

our sample, which amount to a little more than 5% of our sample.[5] All dollar amounts in the paper are in 1997 dollars.

Following equation (1), we regress the log of household wealth in year t (either 1984 or 1994) on both permanent income and measures of the variance of income. We construct permanent income for each household by taking the seven-year average of noncapital income around the period for which we are measuring their wealth. Specifically, when explaining 1984 (1994) wealth holdings, we define permanent income as the average of noncapital income between 1981 and 1987 (1991 and 1997).[6] We use panel data from the PSID to compute the variances of permanent and transitory shocks to income. We follow the same procedure put forth by Carroll and Samwick (1997, 1998).[7]

Since both permanent income and the variances of permanent and transitory income are measured with error, we instrument for these variables using a large instrument set. As Carroll and Samwick (1997, 1998) suggested, we use occupation dummies, and these dummies interacted with age and age squared, as well as 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.[8] (See Lusardi, 1997, 1998, and Engen & Gruber, 2001, for the justification of using this latter set of variables as instruments for the variance of income.[9])

Table A2 (in the appendix) shows our estimates of the variances of permanent and transitory income by one-digit

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[5] While the distribution of wealth is very skewed to the right and we need to worry about the influence of very rich households, using the log transformation has some shortcomings. First, 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. Second, 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 may simply limit the amount of borrowing that a household would otherwise undertake. Since we eliminate the households in debt, we may end up incorrectly calculating the amount of precautionary savings undertaken in the economy. To potentially overcome that problem, we have used the ratio of wealth over permanent income as our dependent variable and retain the observations with 0 or negative net worth in the sample. Our main results are unchanged. See Hurst et al. (2005), table 2.

[6] See the data appendix for details on how noncapital income is defined.

[7] See the data appendix for a detailed summary of how we computed the income variances.

[8] These instruments have been criticized by Lusardi (1997) and Fuchs-Schündeln and Schündeln (2005). We discuss estimates using a different set of instruments later in the text.

[9] The predictive power of the instruments is not very high. The F-statistic in the first-stage regression for the variances of income was just above 2. We choose this instrument set to maintain comparability with the instrument set that Carroll and Samwick used. However, in a robustness appendix (posted on the Web page of Erik Hurst and Annamaria Lusardi: http://faculty.chicagobooth.edu/erik.hurst/research/restat_robustness_appendix_final.pdf) we use a different instrument set that has significantly higher predictive power. The conclusions of this paper are unchanged with that instrument set. The pooled sample of business owners and non–business owners leads to high estimates of the impact of precautionary savings on household wealth accumulation. However, after controlling for business owners, the empirical importance of precautionary savings falls precipitously.

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

occupational categories. There are sizable differences in income variances across occupations. For example, self-employed managers are more likely than managers employed in firms to experience a shock to both their permanent and transitory components of income. Farmers and farm laborers are also more likely to face a higher variance of transitory income. The estimates reported in table A2 closely match the estimates reported by Carroll and Samwick (1997).

When estimating (1), we also include controls (Z) to capture additional reasons that household wealth may differ across households. The Z vector includes the following demographics: age, age squared, race, gender, marital status, and educational attainment. In addition, we exploit the panel dimension of the PSID to control for past income and wealth shocks that households experience. Specifically, we include year dummies, along with two dummies for whether the household head was unemployed during the year when the wealth data were collected and whether he or she was unemployed any time during the prior four years (1980–1983 or 1990–1993). Households that 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.

Finally, similar to Carroll and Samwick, we restrict our sample to households whose head is between the ages of 26 and 50 in the year in which the wealth is measured. A detailed description of other restrictions we used in constructing our final sample is reported in the data appendix. Our final sample contained 2,144 households. Table A1 provides descriptive statistics of the main variables we use in our empirical work.

C. Rationale for Splitting Sample by Business Ownership Status

One of the problems in estimating the regression described on a sample of the general population is that the general population pools together two distinct subgroups. Mixing together households that own a business with other households can be problematic to the extent that business owners as a group face higher risks and also accumulate larger amounts of wealth for reasons unrelated to precautionary saving. The large, positive estimates of precautionary savings documented in the literature may simply be an artifact of pooling together business owners and non–business owners.

Despite the addition of the Z vector of controls in (1), there are at least three reasons to believe that business owners may accumulate higher amounts of wealth than their non–business owner counterparts conditional on measured permanent income controls.[10] First, and potentially most important, business owners and non–business owners differ in their propensity to have a pension. Using data from the Health and Retirement Survey (HRS) we find that only 30% of older nonretired business owners have a pension. The comparable number for non–business owners was nearly twice as high, at just under 60%. This difference in pension participation is important when discussing differences in nonpension wealth holdings between business and non–business owners. Holding permanent income constant, business owners may accumulate more nonpension wealth than non–business owners given that they have to accumulate additional wealth to fund their consumption during retirement. Given that over this time period, the PSID does not measure pension participation or pension wealth, we cannot include pension wealth in our estimation of (1).

A second concern in estimating wealth regressions on a sample that pools together business owners and non–business owners (without controlling for business ownership) is that business owners and non–business owners may display different preferences—for example, different bequest motives, different degrees of risk aversion, and different rate-of-time preferences.[11] To the extent that business owners are more patient than non–business owners, household wealth at any time prior to retirement will be higher for business owners than non–business owners, all else equal. Ideally, we would like to control for such differences in our Z vector. However, the PSID does not include variables that measure well household differences in preferences.

The last reason that (1) may be misspecified when regressed on a pooled sample of business owners and non–business owners is that permanent income is mismeasured for business owners relative to non–business owners. Our measure of permanent income is a simple time average of noncapital income. While noncapital income is likely to be a sufficient measure of compensation for non–business owners, it has been shown to be a poor measure for business owners. Three main reasons can explain this fact. First, tax evasion may drive some business owners to underreport their labor income. Second, tax avoidance drives some business owners to retain part of their compensation within the business.[12] Third, tax evasion and tax avoidance aside, it is hard to specify and measure the actual labor return from business ownership; the part of business income attributed to capital and to labor is inevitably arbitrary in many cases. This is even more problematic given that the PSID imputes a large fraction of labor income for households that own a business. This type of mismeasurement is problematic for

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[10] See also Hurst and Lusardi (2008).

[11] See, among others, Barsky et al. (1997). Hurst and Lusardi (2008) discuss the many differences between business owners and non–business owners.

[12] Ample evidence suggests that business owners are much more likely to underreport their income relative to non–business owners (e.g., see Engstrom & Holmund, 2006). The use of food expenditure to test for underreporting of income by business owners is also common in this literature. Again, see Engstrom and Holmund (2006). Pissarides and Weber (1989) also show that food consumption can be used to gauge underreporting of income with more general populations.

TABLE 1.—INSTRUMENTAL VARIABLES ESTIMATES OF THE EFFECT OF LABOR INCOME RISK ON LOG OF NET WORTH: POOLED SAMPLE

	Sample				
Variables	Pooled	Non–Business Owners	Business Owners	Business Owners	Business Owners
Variance of permanent income shocks (α_1)	15.91	−0.63	6.79	3.38	2.85
	(2.98)	(3.65)	(3.05)	(2.82)	(2.62)
Variance of transitory income shocks (α_2)	7.52	−0.70	2.82	1.00	0.07
	(1.48)	(1.58)	(1.75)	(1.64)	(1.53)
Percentage of net worth explained by precautionary savings	47.5%	−4.1%	23.2%	10.9%	6.4%
Dependent variable (log)	Total net worth	Total net worth	Total net worth	Nonbusiness net worth	Nonbusiness net worth
Permanent income measure (averaged)	Noncapital income	Noncapital income	Noncapital income	Noncapital income	Food expenditure
Sample size	2,144	1,729	415	407	392

Notes: This table reports instrumental variables (IV) estimation of a regression of the log of net worth on the variance of permanent income shocks, the variance of 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 households between the ages of 26 and 50. Permanent income is measured as average household noncapital 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 business owners and non–business owners. We compute the percentage of net worth explained by precautionary savings by predicting net worth using the regression equation for each household. We then predict the household's net worth using the regression equation for each household but this time setting permanent and transitory variances to 0. We compute the percentage of net worth explained by precautionary saving by comparing these two predicted values. See text for full details. Robust standard errors are reported in parentheses.

the analysis above, particularly given that the return on investment of business owners (i.e., their total compensation) is likely correlated with the underlying risk of the project.

In this respect, the PSID contains information to address this problem. As a potentially better proxy for household permanent income, in some of our specification we use average household consumption in lieu of average household noncapital income in the estimation of (1).[13] According to standard specifications of the permanent income hypothesis, consumption in year t is a sufficient statistic for the household's period t expectation of lifetime resources. The PSID provides information on food consumption at home (including food stamps) and 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 nondurable 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 to test the sensitivity of the model to our original definition of permanent income. We instrument for the variances of income and average food consumption using the same set of variables as before.

With these concerns in mind, we estimate a variety of different specifications to address the potential problems of pooling together non–business owners and business owners when estimating (1). In particular, in some of our specifications, we use the average of food expenditure as our measure of noncapital income. As described above, this will allow us to assess the importance of the mismeasurement of permanent income of business owners. Also, to explore the

robustness of our results, in some of our estimations, we change the dependent variable in (1) to be the log of total net worth less business equity. The reason is that it is likely that business wealth is correlated with the underlying riskiness of the business. If equity in private businesses is illiquid, the returns on risky business ownership may show up in higher business wealth. Moreover, it seems implausible that business owners would hold their precautionary wealth in their businesses; income streams from the business and the value of the business are clearly positively correlated. For savings to provide insurance, we expect business owners to hold at least a portion of their precautionary reserves outside their businesses.

III. Data and Pooled Estimates

Empirical estimates of our baseline specification of equation (1) for the pooled sample 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 higher wealth holdings. Most relevant for our work is that 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 move households 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 0.0199 and an estimated variance of transitory shocks of 0.059). The movement across those occupational categories increases household wealth by 34% (all else equal). If we move a manager who is employed by a firm (estimated permanent and transitory variances equaling 0.017 and 0.030, respectively) to being a self-employed

[13] See, among others, Meyer and Sullivan (2003), who also use food consumption as a proxy for permanent income. Likewise, Aguiar and Hurst (2005) show that food expenditures are good predictors of a household's permanent income.

manager (estimated permanent and transitory variances equaling 0.027 and 0.0866), we predict that household's wealth would increase by 53%.

As a second way to gauge the magnitudes of the coefficients in table 1, we compute the total amount of aggregate wealth explained by precautionary savings by eliminating all income risk, that is, setting both variances to 0. 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.[14] As reported in table 1, we find that more than 47% of household wealth can be explained by precautionary motives.[15] Ninety-five percent bootstrapped confidence bands around our estimate suggest that the share of total wealth explained by precautionary savings ranges from about 41% to 60%. Thus, our estimates are consistent with the existing literature (Carroll & Samwick, 1997, 1998).

Our hypothesis is that the large empirical estimates of the importance of precautionary savings documented in the first column of table 1 (and from much of the existing literature on precautionary savings) result from pooling together business owners and non–business owners. In column 2 of table 1, we show the results of our estimation of (1) on a sample that includes only households that do not own a business. Otherwise the sample and specification are exactly the same as the one used for the estimates presented in column 1 of table 1.

The first thing to note is that among non–business owners, the estimates on both income variance measures fall dramatically in magnitude and are no longer statistically different from 0. To gauge the overall size of precautionary balances within this sample, we repeat the experiments above. First, we suppose that households move from an occupation with low income risk (professionals) to an occupation with high income risk (operatives and laborers). Under this experiment, household wealth would barely change at all. Second, we assume that households face 0 or very low risk and examine how much of the total wealth

held by non–business owners is explained by precautionary savings (as in the procedure described previously). The estimation implies that precautionary savings explain −4.1 percent of total wealth holdings when setting the variances to 0 and −1.4 percent when setting the variances to the lowest mean value. Note that these estimates are not statistically different from 0. The bootstrapped 95% confidence bands for the first estimate (0 variances) are −40% to 12% and for the second estimate (lowest mean value) are −9% to 7%. In other words, the confidence bands from these estimates imply that at most, 12% of total wealth held by households under the age of fifty is explained by precautionary savings. The result of this specification is striking. It says that among non–business owners (about 85% of the population), there is at best only a small, systematic relationship between labor income risk and household wealth holdings.[16]

Another set of variations serves to emphasize just how critically the estimated size of the precautionary saving motive hinges on the inclusion of business owners in the sample used for the estimation. One might argue that because business owners are, on average, wealthier than other households, the estimates may simply capture different behavior among the wealthy. To assess whether we are simply measuring wealthy or successful households when considering business owners, we cut the data in two additional ways. First, we remove from our sample households in the top 20% of the income distribution (leaving us with 1,716 observations). Second, we exclude from the sample households that own stocks (for a sample of 1,238 observations). In both cases, precautionary savings continue to explain a large (and statistically significant) portion of total household wealth. Specifically, for the sample of households in the bottom 80% of the income distribution, 40% of wealth appears to be explained by precautionary motives. In the sample of non–stock owners, 35% of wealth appears to be explained by precautionary motives. 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; 18% of households in the bottom 80% of the income distribution and 17% of non–stock owners report owning a business.

The results in column 2 of table 1 do not imply that precautionary savings are not important in explaining aggregate wealth within the United States. It may be that business owners respond strongly to labor income risk. Their response to such risk in turn may give rise to large amounts of wealth in the economy, a point previously noted by Carroll and Samwick (1997, 1998).[17] In fact, a key

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[14] To do this, we use the estimates from (1) to predict log wealth for each household. We then predict log wealth for each household, setting the variances of permanent and transitory incomes to 0. To get the estimated percentage of wealth explained by precautionary savings, we take the difference between the predicted log wealth with and without the variances set to 0 for each household and then average over all households. We also repeat this procedure setting the value of the variances to the minimum mean value across occupations rather than setting the value to 0.

[15] As long as the thought experiment entails moving a household from an occupation with high income risk to one of low income risk, general equilibrium effects can safely be ignored. However, computing the size of precautionary savings by setting everyone's income variance to 0 will likely have general equilibrium consequences. Interest rates will likely increase in an economy with no labor income risk. Higher interest rates will induce higher saving (if the substitution effect dominates the income effect), potentially mitigating the drop in wealth accumulation. We chose to focus on the partial equilibrium magnitudes to be consistent with the thought experiments found in the earlier literature (e.g., Carroll & Samwick, 1997, 1998). A general equilibrium analysis, however, is likely only to reinforce one of our main conclusions that the estimated importance of precautionary savings found in earlier papers is artificially high.

[16] We obtain very similar results when we use the self-employed rather than the business owners. See the robustness appendix posted on Erik Hurst and Annamaria Lusardi's Web site (see n. 9). See also the discussion in Hurst et al. (2005).

[17] Carroll and Samwick (1998) note that when they exclude farmers and the self-employed from their sample, their estimates suggest that precautionary motives explain essentially 0 percent of aggregate wealth hold-

TABLE 2.—INSTRUMENTAL VARIABLES ESTIMATES OF THE EFFECT OF LABOR INCOME RISK ON LOG OF NET WORTH: POOLED SAMPLE

	Pooled Sample				
	1	2	3	4	5
Variance of permanent income shocks (α_1)	−1.57	−0.68	−4.90	10.88	3.96
	(4.35)	(4.30)	(4.85)	(2.57)	(2.53)
Variance of transitory income shocks (α_2)	−0.27	0.03	−3.50	4.48	0.63
	(1.87)	(1.82)	(2.02)	(1.26)	(1.23)
Variance of permanent income shock × business owner	16.53	12.45	12.41		
	(6.75)	(7.21)	(7.89)		
Variance of transitory income shock × business owner	6.32	3.43	6.15		
	(3.79)	(3.65)	(4.32)		
Business owner	0.14	−0.13	−0.26		
	(0.39)	(0.42)	(0.44)		
Percentage of net worth explained by precautionary savings	13.3%	10.2%	−10.7%	16.8%	4.7%
Dependent variable (log)	Total net worth	Nonbusiness net worth	Nonbusiness net worth	Nonbusiness net worth	Nonbusiness net worth
Permanent income measure (averaged)	Noncapital income	Noncapital income	Food expenditure	Noncapital income	Food expenditure
Sample size	2,144	2,136	2,077	2,136	2,077

Notes: This table reports instrumental variables (IV) estimation of a regression of the log of net worth on the variance of permanent income shocks, the variance of transitory income shocks, permanent income, and a set of demographic variables (see notes to table 1). In columns 1–3, the variances are interacted with a dummy for being a business owner, and a business owner dummy is added to the regression. Columns 4 and 5 report estimates using a different measure of net worth (nonbusiness net worth) and permanent income (food expenditure). Robust standard errors reported in parentheses.

contribution of this paper is to show that even among the subsample of business owners, the relationship between wealth and income risk proxies for something other than precautionary motives.

To probe the precautionary motives of business owners further, we reestimate (1) for this group alone. The results of this estimation are shown in column 3 of table 1. The coefficients on both variance measures are positive, and the coefficient on the variance of the permanent income shock is statistically different from 0. Using the same procedure as above and setting the variances to 0, we find that only 23% of wealth among business owners can be explained by precautionary motives. These effects are also statistically different from the non–business owner sample. Notice that even within the business owner sample, the estimated importance of precautionary savings in explaining aggregate wealth holdings is much lower than the Carroll and Samwick estimates. Within the samples of both business owners and non–business owners, the importance of precautionary savings in explaining aggregate wealth accumulation is much smaller than what the pooled estimates imply. At a minimum, the pooled estimates overstate the size of the precautionary motive, reflecting the fact that business owners face more labor income risk and are more likely to accumulate wealth for nonprecautionary reasons.

In columns 4 and 5 of table 1, we make two modifications to the specification presented in column 3. In column 4, we replace the dependent variable with the log of total net worth less business equity. While wealth is fungible and

business owners may face tax and other incentives to keep as much as possible in the business, it is unlikely that they hold their precautionary wealth exclusively in business equity, particularly in light of the fact that business equity is highly correlated with negative shocks to business income. Under this specification, the estimated impact of the precautionary saving motive falls by more than half (from 23% to close to 11% when setting the variances to 0). When business equity is excluded from our measure of total wealth, nonbusiness wealth response to risk is now fairly small among business owners.

Using the log of nonbusiness wealth as our dependent variable and replacing average food consumption as our proxy for permanent income (an important modification for the sample of business owners), we now find that precautionary motives explain only a little more than 6% of total wealth within the sample of business owners. The 95% confidence bands on these estimates range from roughly −3% to 12%.

Given how different business owners are, we return to the pooled sample and reestimate (1), directly controlling for a business ownership dummy and the business ownership dummy interacted with the two variance measures. These results are shown in columns 1 to 3 of table 2. Column 1 is our baseline specification where the dependent variable is the log of total net worth and the control for permanent income is average noncapital income. In column 2, the dependent variable is the log of net worth less business equity and the control for permanent income is average of noncapital income. In column 3, the dependent variable is the log of net worth less business equity, and the control for permanent income is average food expenditure. These results show that once we account for a business ownership dummy (and business ownership interacted with the variance measures), the percentage of wealth explained by

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ings. They state, "Our preferred interpretation of these findings is of course that the farmers and the self-employed provide exactly the same kind of variation in the independent variable that is very valuable to identify the coefficient on uncertainty, and hence, these groups should remain in the sample" (p. 415). In fact, our paper shows that business owners have high wealth (compared to non–business owners) for reasons other than precautionary motives.

precautionary savings for labor income risk is very small, even in the pooled sample. The estimated percentage of wealth explained by precautionary motives in these specifications ranges from −10% to 13%. The confidence bands strongly reject the estimates from the pooled sample in table 1, column 1, which did not control directly for business ownership.

In columns 4 and 5 of table 2, we show that even if we do not directly control for business owners but instead omit business wealth from our measure of wealth and use average food expenditure for our measure of permanent income, the implied share of aggregate wealth explained by precautionary motives decreases from 47% to no greater than 17%.[18]

IV.   Conclusion

Some of the papers in the literature on precautionary savings report that precautionary motives explain about half of total wealth, while other papers suggest a much smaller fraction. The results of this paper show that the high estimates of the size of precautionary balances are driven by mixing two very different groups of households: business owners and non–business owners. Relative to the latter group, the former holds large amounts of wealth for nonprecautionary reasons and also faces high income risk. Although pooling these two groups leads to very large estimates of the share of precautionary wealth out of total net worth, we show that within these two groups separately, the estimated amount of precautionary savings is low.

Our results can explain and reconcile the widely different estimates of precautionary savings that are found using different microdata sets. For example, Engen and Gruber (2001), Hrung (2000), Lusardi (1998), and Skinner (1988) all found rather modest estimates of the importance of precautionary savings. These findings are consistent with our results. For example, in their estimation of precaution-

ary savings, Engen and Gruber (2001) use data from the Survey of Income and Program Participation and consider a measure of gross financial assets that does not include business equity. Similarly, Hrung (2000) uses a measure of liquid financial wealth from the Continuous Work History Sample Panel of the U.S. Treasury that excludes business equity. Lusardi (1998) uses total net worth in her estimation, but her sample excludes the self-employed. All of these papers, which found low estimates of the importance of precautionary savings in explaining wealth holdings within the U.S. economy, have either explicitly or implicitly controlled for differences between business owners and non–business owners.

Finally, we stress that the results presented in this paper have implications for research well beyond precautionary savings. We show that when examining household consumption or saving behavior, it is important to account for the differences between business owners and non–business owners. This is likely to be equally important in studies assessing the importance of bequest motives, since business owners are more likely to leave bequests to their children. Similarly, business owners may play a critical role in assessing the offset of pension and private wealth; business owners are far less likely to have pensions than other households but may hold large amounts of wealth for reasons unrelated to pensions. We conclude that given the well-documented differences between business and non–business owners, microstudies of household consumption and saving decisions should attempt to account for these differences. Alternatively, researchers should exclude business owners from their samples.

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[18] In the appendix posted on Hurst and Lusardi's Web page (see n. 9), we have performed a variety of robustness checks on our specifications. Among the most important, we explore the robustness of our results to alternate instrument sets. The instrument set used by Carroll and Samwick is relatively weak (i.e., the first-stage F-statistics for the instrument set are around 2). In the results shown in tables 1 and 2, we used a similar set of instruments as Carroll and Samwick to make our results as comparable to theirs as possible. However, we are fully aware of the problems associated with weak instruments. So in the accompanying appendix, we used a slightly different specification (including only the total variance of income as opposed to the total variance decomposed into the permanent and transitory component) and a different instrument set. The first-stage predictive power of the instrument set in this specification increased substantially (to around standard acceptable levels of significance). The conclusions of the paper with this alternate instrument set are unchanged. The key results from the appendix are that our results are extremely robust to alternate specifications, including the more powerful instrument sets, nonlinear income controls, endogenous choice of occupation (as discussed in Lusardi, 1997, and Fuchs-Schündeln & Schündeln, 2005), and alternate definitions of business ownership. In all cases, pooling together business and non–business owners artificially increases the estimated impact of precautionary saving in explaining aggregate wealth accumulation.

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DATA APPENDIX

Panel Study of Income Dynamics

A   Sample Selection

We use data from the PSID for 1981 to 1987 and 1991 to 1997. To construct our final sample, we drop all households from the Survey of Economic Opportunity (SEO), which oversamples the poor, and we drop the Latino subsample. We also drop households with heads who were younger than 26 or older than 50 in 1981 (for the 1981–1987 panel) or 1991 (for the 1991–1997 panel). We drop households with invalid education, occupation, or industry responses (including the unemployed and those who are not participating in the labor market) in those same years, as well as households where the marital status of the head changes at any time during the period considered. We also drop households from the sample if the head or the spouse changes during the period considered. Finally, to avoid the estimation of the permanent and transitory variances being driven by a few households with extremely volatile incomes, we drop households whose income in any year falls below 20% of the average household income during the time period. We also exclude observations with missing county unemployment rates. When using log wealth over permanent income, we also exclude those observations with 0 or negative net worth. In total, the number of households dropped due to missing observations or excessively volatile income was small.

B   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.

Noncapital current income.   We calculate noncapital income 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) workers' compensation; (f) child support

TABLE A1.—SUMMARY STATISTICS OF PSID SAMPLE
FULL SAMPLE AND SUBSAMPLES

Variables	Total Sample	Business Owners	Non–Business Owners	Self-Employed	Non-Self-Employed
Age of head	36.57	37.47	36.35	37.49	36.39
Number of children	1.38	1.41	1.37	1.60	1.34
Percentage of married households	85.35	93.73	83.34	93.93	83.70
Percentage of white households	92.91	97.11	91.90	96.53	92.21
Percentage of female household heads	8.82	1.69	10.53	2.31	10.07
Average household noncapital income	45,164	50,535	43,875	49,258	44,376
Mean wealth	132,645	291,594	94,493	287,582	102,829
Median wealth	58,216	146,708	46,907	140,116	49,803
25th percentile of wealth distribution	22,995	71,285	18,041	57,622	19,408
75th percentile of wealth distribution	125,741	302,001	98,112	302,001	104,966
Number of observations	2,144	415	1,729	346	1,798

Note: Sample includes households in either the 1984 or the 1994 PSID between the ages of 26 and 50. See the data appendix text for additional sample restrictions. Average household noncapital income is the average of household noncapital income between 1981 and 1987 for households from the 1984 PSID and between 1991 and 1997 for households from the 1994 PSID. Noncapital income includes all income from wages and transfers received by the household. All dollar amounts are in 1997 dollars.

TABLE A2.—ESTIMATED VARIANCES OF PERMANENT AND TRANSITORY INCOME BY OCCUPATION GROUPS

Group	Permanent Variance	Transitory Variance	Percentage 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 (non-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 are in parentheses.

TABLE A3.—ESTIMATED VARIANCES OF PERMANENT AND TRANSITORY INCOME BY HOUSEHOLD GROUPS

Group	Permanent Variance	Transitory Variance	Percentage of Sample
Business owners	0.0277 (0.0066)	0.0763 (0.0116)	19.36
Non–business owners	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 are in parentheses.

transfers; (g) transfers from relatives and friends; and (h) 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 consider two alternative definitions of permanent income. The first is simply the time average of current income. For example, for a given household in the 1981–1987 panel, permanent income is 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) over the same period as a 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 owner* is the household whose head is self-employed. The exact wording of that question is, "Do you (head) work for someone else, yourself, or what?" The possible answers to this question are (a) someone else, (b) both someone else and self, and (c) self only. A household is considered self-employed if the answer is either b or c.

C Construction of the Variance of Permanent and Transitory Incomes

To calculate the variance of permanent and transitory income, we follow closely the method that Carroll and Samwick (1997) used. We assume that the natural logarithm of current noncapital income, y_t, can be decomposed into three components:

$$y_t = g_t + y_t^p + \varepsilon_t, \tag{A1}$$

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_ε^2, whereas the permanent component follows a random walk,

$$y_t^p = y_{t-1}^p + \eta_t, \tag{A2}$$

where η_t, another white noise with variance σ_η^2, 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:

$$r_d \equiv \hat{y}_{t+d} - \hat{y}_t. \tag{A3}$$

Combining (A3) with equations (A1) and (A2) and ignoring the trend g_t, since it has been previously removed,

$$r_d = \sum_{s=1}^{d} \eta_{t+s} + \varepsilon_{t+d} - \varepsilon_t. \tag{A4}$$

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 (A4) we find that

$$r_d^2 = \text{Var}(r_d) = d\sigma_\eta^2 + 2\sigma_\varepsilon^2. \tag{A5}$$

In principle, (A5) 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.[19] For example, for the period 1981–1987, we took 1984–1981, 1985–1982, 1986–1983, 1987–1984, 1985–1981, 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 nine observations. This is the same procedure Carroll and Samwick (1997) used.

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[19] 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.