Robustness Appendix for
Precautionary Savings and the Importance of Business Owners

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February 2008

I.   Introduction

The goal of this appendix is to perform a series of robustness tests of the main specifications shown in our paper "Precautionary Savings and the Importance of Business Owners." All data and code to generate the results in the main paper and our robustness appendix are available upon request. Below, we provide the details for a variety of robustness tests.

In summary, as seen from the results described below and the additional results in the NBER working paper version of our paper (see Hurst, Lusardi, Kennickell and Torralba (2005)), the conclusions from our paper are very robust to alternate empirical specifications. In every specification we have examined, the estimated impact of precautionary savings in response to labor income risk in explaining aggregate wealth accumulation is always substantially overstated when pooling together business and non business owners. The reason for this finding is that business owners have other non-precautionary reasons to accumulate wealth while also facing substantially more labor income risk than non business owners. As we state in our paper, when analyzing the impact of precautionary savings in explaining aggregate wealth accumulation, researchers need to account for differences between business owners and non business owners or drop business owners from their sample.

II.   Self-employment vs. Business Ownership

In Table R1, we report the results of estimating equation (1) on a sample of households who report not being self-employed and a sample of households who report being self-employed. In the main paper, we only focused on business owners and non business owners. However, only around eighty percent of business owners report themselves as self-employed and only two-thirds of the self-employed report owning a business. Owning a business and being self-employed seems to be non-overlapping classifications among PSID respondents.

The results shown in the paper are robust to this alternate classification of business owners. Specifically, for households who are not self-employed, precautionary motives with respect to labor income risk only explain less than 1% of wealth holdings. For those who report being self-employed, precautionary motives explain only 6% of total wealth. Aside from that change, the regressions estimated in R1 are analogous to the regressions reported in columns 1–3 of Table 1 of the main paper. The results in Table R1 reinforce our general conclusions from the paper. Pooling together the self-employed and the non-self-employed leads to large estimates of the percentage of wealth explained by precautionary savings. However, when the samples are split by self-employment status, there is little evidence of a sizeable precautionary motive within either sub-sample.

III.   The Non-linear Relationship between Income Levels and Variance and Wealth

One of the referees suggested to further explore the role of non-linearities in the relationship between income variances, permanent income, and wealth by including polynomials of the independent variables in the regression. Doing so, we find evidence supportive of non-linear effects. These results are shown in Table R2.

Specifically, when we account for non-linear effects of the variances and permanent income, we find that the non-linear terms are significant up to the third power. For simplicity, we only show the results in Table R2 of including third-order polynomials in the level and variances of income. However, we did experiment with including up to fourth-order polynomials, and the results were unchanged relative to the inclusion of the third-order polynomials. Simply including the non-linear terms reduces the amount of wealth explained by precautionary saving from 47.5 percent (Table 1, column 1 of the main paper) to 26.7 percent (shown in Table R2). This shows that mean estimates of the variances of income are not doing a good job (probably due to the business owners). These results show again that the simple framework used by Carroll and Samwick (1997, 1998) does not capture well the empirical size of precautionary savings.

Moreover, as shown in Hurst and Lusardi (2004), the relationship between wealth and business ownership is highly non-linear. So, including non-linear terms may actually be partially controlling for business ownership. But, consistent with the results we have found in all specifications we have examined, when we interact the permanent and transitory variances (in the non-linear specification) with dummies for being a business owner and add a business owner dummy, the only variables that are significant are the interaction terms (Table 2, main paper). Moreover, once we include these business ownership controls, the estimate of the percentage of wealth explained by precautionary motives falls to 13.3%. Again, even in the non-linear specification, controlling for business ownership causes the estimated impact of precautionary savings in explaining wealth holdings to fall substantially.

IV.   A Variety of Additional Robustness Specifications

In this subsection, we show that the paper's results are robust to a variety of other more general alternate specifications. In essence, we want to show that what is driving the result is the pooling of non business owners and business owners rather than the choice of samples, measures of income variances, or instrument sets. The results from this section are shown in Table R3. The way the table is constructed is as follows: The table reports the fraction of wealth explained by precautionary savings within each specification. Each row of the table shows a different robustness specification. The columns each show a different sample. Column 1 reports results for the pooled sample without including controls for business ownership, column II reports results for non business owners only, and column III reports results for the sample that includes business owners only, while column IV reports results for the pooled sample including a business owner dummy and a business owner dummy interacted with the two variance measures in the regression. The regression specification shown in column IV is analogous to the regression specification shown in Table 2, column 1 of the main text.

Below, we discuss each robustness specification in turn. First, as already argued by several researchers (Lusardi (1997) and Fuchs-Schündeln and Schündeln (2005)), workers may 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 tried a different set of instruments that 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 paid hourly.

While these alternative instruments have some predictive power for the variance of income, it has lower power than when occupation and industry dummies are included. The estimated amount of wealth explained by precautionary saving from this specification is 24 percent (shown in Table R3, row 1, column I). As seen in columns II–IV, once we control for business ownership, the share of wealth explained by precautionary savings falls sharply.

To further evaluate the robustness of results, we have investigated a different measure of the variance of income. These results are shown in rows 2 and 3 of R3. Rather than calculating the variance of 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 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) for each household. 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). The results of these specifications are shown in rows 2 and 3 of Table R3, respectively. Both instrument sets have much higher power in predicting this new variance measure. The results are similar to every other specification. The share of wealth explained by precautionary savings falls

sharply after controlling for business ownership (comparing column I to column IV in both rows 2 and 3 of Table R3).

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 the income variance, and using different measures of the income variance with a different set of instruments all yield results similar to those documented in the main paper.

V.   The First-stage Power of Our Instrument Set

The last robustness exercise we perform is to explore the power of our instrument set. As discussed in the main paper, the F-statistic of our instrument set in the first-stage regressions is rather low. As discussed in Bound, Jaeger, and Baker (1995), Staiger and Stock (1997), and Stocks and Yogo (2004), there are problems in performing instrumental variables estimation when the instruments are weak. We chose our instrument set to be consistent with the instrument set used by Carroll and Samwick (1997, 1998). However, as shown in this subsection, even if we use a different instrument set that has a much higher first-stage predictive power, the results documented in our main paper are unchanged.

To increase the predictive power, our instrument set includes industry dummies, 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, the number of earners, and whether the worker is paid hourly. Also, to further increase the predictive power, we focus on the total variance of income only (as opposed to trying to separately predict the variances of the transitory and permanent shocks to income). The previous subsection defines how we compute the household's total variance of income.

The first two columns of Table R4 show the first-stage predictive power of the old instrument set (column 1) and the new instrument set (column 2) in explaining the total variance of income. The first-stage F-statistics for the two specifications are 3.3 and 7.1, respectively.

Notice that the specification in column 1 is exactly the same specification that is shown in row 2 of Table R3. The rest of the results in columns 1 and 2 show the estimated coefficients on the total variance in the second-stage regression as specified in (1) in the text. Using this alternate instrument set decreases the amount of wealth explained by precautionary savings from nearly 50 percent to 26 percent.

In column III, we show that when using this alternate instrument set with higher first stage predictive power, the conclusions of our paper remain unchanged. In column III, we specifically control for whether the household is a business owner by including a business ownership dummy and the business ownership dummy interacted with the variance of income. In that specification, the total amount of wealth explained by precautionary savings resulting from labor income risk is very small (less than 2%). Moreover, when we use non-business net worth as a measure of wealth and food expenditure as a measure of permanent income, we again find that the share of precautionary wealth is essentially zero.

To summarize: When using an alternate instrument set that increases the first-stage regression predictive power, the results of our paper do not change. Not accounting for differences between business owners and non business owners severely overstates the estimated importance of precautionary savings in explaining aggregate wealth holdings.

VI. Conclusion

This appendix shows that the results presented in our main paper are remarkably robust to a variety of different empirical specifications. Our key finding is that when we pool together business owners and non business owners and attempt to estimate the effect of precautionary savings in explaining aggregate wealth, we obtain rather large estimates. However, whenever we explicitly control for factors determining business ownership, the impact of precautionary savings on business wealth falls sharply. Across our more-preferred specifications, precautionary savings

in response to labor income risk explains no more than 10–12 percent of total household wealth

accumulation for young and middle-age households.

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Table R1: Instrument Variables Estimates of the Effect of Labor Income Risk on Log of Net Worth: Self-employed and Non-self-employed Samples

Variables	I. *Non-self-employed Sample*	II. *Self-employed Sample*
Variance of Permanent Income Shocks (α_1)	1.48 (4.02)	1.47 (2.49)
Variance of Transitory Income Shocks (α_2)	-0.11 (1.62)	0.47 (1.25)
Percent of Total Net Worth Explained By Precautionary Savings	0.7%	6.0%
Sample Size	1,798	346

Notes: Estimations in this table are the same as the estimation reported in Table 1 except that the sample is restricted to non-self-employed only (column I) and self-employed only (column II). See notes to Table 1 of the text for a full description of the specification and how we compute the share of total net worth explained by precautionary savings. Robust standard errors reported in parentheses.

Table R2: Instrumental Variables Estimates of the Effect of Labor Income Risk on Log of Net Worth: Exploring Non-linearities (pooled sample)

Variables	*Coefficient*
Variance of Permanent Income Shocks	11.46 (6.03)
Variance of Permanent Income Shocks Squared	-48.94 (22.86)
Variance of Permanent Income Shocks to the Power of 3	6.64 (19.03)
Variance of Transitory Income Shocks	-1.83 (3.47)
Variance of Transitory Income Shocks Squared	25.79 (9.24)
Variance of Transitory Income Shocks to the Power of 3	-10.98 (3.99)
Percent of Net Worth Explained By Precautionary Savings	26.70%
Sample Size	2,144

Notes: This table reports IV estimation of a regression of the log of net worth on permanent income, the variance of permanent and transitory income shocks, and higher-order terms of the variance of permanent and transitory income shocks. The regression also includes controls for household demographics and past shocks to wealth. 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 non-capital income. The instrument set includes 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 zero. We compute the percentage of net worth explained by precautionary saving by comparing these two predicted values. Robust standard errors reported in parentheses.

Table R3: Percent of Wealth Explained By Precautionary Motives,
Alternate Specifications

Specification		Pooled Sample	Sample		Pooled Sample w/Business Ownership Controls
			Non Business Owners	Business Owners	
Limited Instrument Set	(I)	24%	17.0%	-2.4%	7.3%
Alternate Measure of Variance	(II)	49%	-3.4%	38.4%	24.1%
Limited Instrument Set and Alternate Measure of Variance	(III)	19.4%	3.3%	-3.9%	3.5%
Sample Size		1, 244	1,729	415	1,244

Notes: Specification I is the same as the regression presented in Table 1 except the instrument set excludes occupation and industry dummies and adds dummies for whether the wife works, whether there are other earners in the household, and whether the worker is paid hourly. 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.

Table R4: Instrumental Variables Estimates of the Effect of Labor Income Risk on Log of Net Worth: Pooled Sample

	I	II	III	IV
Variance of Income Shocks	9.92	4.42	-3.83	-1.81
	(1.46)	(1.58)	(3.00)	(1.28)
Variance of Income Shock * Business Owner			12.75	
			(7.35)	
Business Owner			-0.17	
			(0.70)	
Percent of Net Worth Explained By Precautionary Savings	49.0%	25.9%	1.8%	-12.9%
First-Stage F-statistic	3.27	7.12	7.12	8.18
Dependent Variable (Log)	Total Net Worth	Total Net Worth	Total Net Worth	Non-business Net Worth
Permanent Income Measure (Averaged)	Non-capital Income	Non-capital Income	Non-capital Income	Food Expenditure
Instrument Set	Original	New	New	New
Sample Size	2,144	2,144	2,144	2,077

Notes: This table reports IV estimation of a regression of the log of net worth on the variance of total income, permanent income, and a set of demographic variables. See the text for a description of how the variance of total income is calculated. Column I reports the estimates of precautionary wealth by using the set of instruments described in the main text of the paper, which includes 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. Columns II through IV report estimates using an alternative instrument set, which includes industry dummies, 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, the number of earners, and whether the worker is paid hourly. Column III reports estimates of precautionary wealth when the variance is interacted with a dummy for being a business owner and a business owner dummy is added to the regression. Column IV reports estimates using a different measure of net worth (non-business net worth) and permanent income (food expenditure). Robust standard errors reported in parentheses.