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Precautionary Wealth and Portfolio Allocation: Evidence from Canadian Microdata

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Precautionary Wealth and Portfolio Allocation: Evidence from Canadian Microdata[1]

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Abstract

This paper estimates the effect of labour income uncertainty on financial wealth and portfolio allocation using two data sources. Wealth and portfolio choice information is obtained from the master files of the new Canadian Survey of Financial Security 1999 (SFS). Labour income risk proxies are constucted for each specified industry group (consistent with the SFS classification) using the Canadian Survey of Labour and Income Dynamics (SLID) between 1996 and 2001. The empirical results suggest the presence of a strong precautionary saving motive among Canadian households. Furthermore, the level of precautionary funds seems to decline when households have relatively unrestricted access to credit markets. The demand for risky and liquid assets does not appear to be affected by labour income uncertainty even after accounting for accessibility to credit markets. However the data suggest a significant hedging motive among the self employed.

1 Introduction

One of the basic motives for saving is to ensure a certain amount of wealth to buffer consumption against transitory and permanent shocks such as job loss or career underachievement. Theoretically, uninsurable earnings risk motivates buffer-stock saving behaviour and households that face such a risk accumulate additional funds to insure their consumption[1]. Given decreasing absolute risk aversion, the effect of labour income uncertainty on the level of wealth accumulation is unambiguously positive. However, the effect on the allocation of these additional funds is less straightforward and needs to be explored empirically. As empirical research on precautionary saving has produced mixed results and the number of studies that focus on precautionary allocation is quite limited (mostly due to data availability), new evidence from new data sources is surely needed.

This paper explores the ways in which uninsurable labour income risk affects the level and the allocation of household financial wealth. The paper offers new evidence on the link between labour income uncertainty and financial wealth accumulation using a high quality income panel survey and a newly available wealth survey, the Canadian Survey of Financial Security 1999 (SFS). The empirical approach involves constructing labour income risk proxies (ex-post labour income variance) for specified industry categories using the Canadian Survey of Labour and Income Dynamics (SLID) and modelling non-pension financial wealth and demand for risky assets as functions of labour income variance. The paper contributes to the existing literature in terms of the quality of the income data, econometric methodology and accounting for credit market accessibility.

The results suggest a strong and significant precautionary saving motive among Canadian

[1] See Deaton (1991). These funds are accumulated in addition to retirement (life cycle) savings.

households somewhat inconsistent with the recent research based on U.S. data[2]. According to the findings, for a 1 percent increase in total labour income variance, Canadian households increase their financial wealth to permanent income ratio by 0.28 (3.4 months of income). Moreover, the effect of income risk on financial wealth accumulation is found to be milder for the households that have relatively unrestricted access to credit markets.

On the allocation side, demand for risky liquid assets does not seem to be significantly affected by income uncertainty for the general population even after controlling for liquidity constraints. The evidence further suggests that the decision of participation in the stock market should be handled separately from the demand for risky assets, pointing to some sort of information cost associated with entry into risky asset markets.

A striking finding comes from the self employed sample. The data strongly suggest a negative impact of labour income uncertainty on risky financial asset holding among this group. This finding points to a significant hedging motive among this group and it is consistent with the evidence on a positive correlation between asset returns and self employed income found in the literature.

In the first part of the empirical investigation, I explore the strength of precautionary saving behaviour by regressing non-pension financial wealth normalized by permanent income on income variance and permanent income controlling for relevant household characteristics[3]. Unobserved taste variables such as tolerance for risk are likely to be correlated with financial risk taking and in turn wealth accumulation. Moreover, these unobservables may be correlated with

[2] The most recent research based on U.S. data is by Carroll et al. (2003). Their findings suggest a weaker precautionary saving motive when they use net worth as a wealth measure. They found no evidence of precautionary motive when they use financial wealth.

[3] I choose to use non-pension financial wealth instead of a broader definition of wealth. This is mainly because of the argument that saving for precautionary reasons is more likely to be channeled into more liquid, easy to convert financial assets than illiquid, risky real assets like housing. See Carroll et al. (2003) for estimations using broader definitions of wealth.

income risk via occupational or educational choices. More specifically, households with higher risk tolerance may choose to have riskier jobs and engage in riskier investments (with ex-ante higher returns) which in turn may lead to a higher wealth accumulation. In such a case, we may observe a spuriously strong positive impact of income variance on financial wealth accumulation. Given these problems and lack of panel data (to control for unobserved individual effects), I use a generalized instrumental variables estimation method in which mean labour income variance is estimated for each industry group and dummies for 21 industries are excluded from the second stage regressions.

The second part of the empirical investigation involves estimating the effect of income uncertainty on the allocation of financial wealth. For this, the portfolio share of risky assets is regressed on labour income variance, permanent income, financial wealth and relevant household characteristics. The econometric problems faced here are the same as the ones (discussed above) surrounding the estimation of the determinants of precautionary wealth levels. However, in addition to the problems of correlated income variance and unobserved taste variables we also face the problem of limited participation in the risky asset market. Almost 90% of Canadian households do not hold equities directly. The presence of fixed and variable costs associated with stock market participation leads to the separation of the participation and stock holding decisions[4]. In order to address the self selection and limited participation problems I employ an econometric technique proposed for female labour supply estimation by Blundell, Duncan and Meghir (1998).

The reminder of the paper is organized as follows: The next section provides background

[4]Limited stock market participation has been the focus of recent portfolio choice research. See Vissing-Jorgensen (2002) and Alan (2003). An emerging consensus seems to be that there may be some cost (mostly informational) associated with participating in the stock market. If this is the case, we expect a structural dependence in the participation decision leading to the separation of the participation and stock holding decisions.

information and a literature review on precautionary wealth accumulation and allocation. Section 3 discusses the allocation of financial wealth of Canadians. Section 4 presents the empirical results and Section 5 concludes.

2 Precautionary Saving and Portfolio Allocation

2.1 Level of Precautionary Wealth

Several empirical regularities regarding household consumption and saving behaviour have given rise to extensive debates on the presence and the economic importance of the precautionary motive for saving. One of the most debated empirical puzzles is that consumption appears to track current income very closely in any given household data. The precautionary saving motive has been offered as a potential explanation for this empirical phenomenon[5]. The main idea is that early in the life cycle, households save mostly to buffer consumption since they do not have sufficiently large accumulated wealth and they face substantial earnings and career risks. They accumulate precautionary saving to smooth their consumption as markets do not offer full insurance against the background risk they face. Combined with borrowing constraints, the precautionary motive for saving offers much promise to explain consumption and asset accumulation behaviour, especially of young and less affluent households.

A simple life cycle model with no labour income (or a certain income stream) implies that individuals save only for life cycle reasons i.e., for retirement[6]. In such a case, consumption growth is responsive only to interest rates and the degree of its sensitivity depends on the curvature of the individual's utility function. For example, an individual with a constant relative

[5]See Caballero (1990) and Normandin (1994). It has also been argued that adjusting for changes in family composition would solve the problem (see Attanasio et al. (1999) and Attanasio and Browning (1995).

[6]Browning and Lusardi (1996) have an excellent survey on different motives for household saving.

risk aversion (CRRA) utility function and with no background risk will have only life cycle saving and the degree of sensitivity of his saving to interest rates will be determined by the reciprocal of the relative risk aversion coefficient (the elasticity of intertemporal substitution). The higher the elasticity of intertemporal substitution (the lower the coefficient of relative risk aversion) the lower the total life cycle savings will be. Empirical studies based on Euler equation estimation where, typically, consumption growth is regressed on real interest rates show that the implied elasticity of intertemporal substitution is around 0.5 and often statistically not different from zero. The general conclusion of these studies is that the variation in consumption growth is too high to be explained by the variation in real interest rates alone[7].

Past research on consumption insurance shows that individuals do indeed face substantial background risk that cannot be completely pooled[8]. Background risk, whether it is related to labour income, health or mortality, has serious theoretical and empirical implications for wealth accumulation. In an incomplete insurance market, risks that individuals face motivate self insurance mechanisms and in addition to life cycle savings, individuals accumulate buffer stock savings against some possible bad shocks such as unexpected loss of labour income. Along with limited borrowing opportunities, uninsurable risk generates additional saving that tends to occur early in the life cycle[9]. Even when a consumer is allowed to borrow, precautionary wealth is accumulated in the presence of income risk only to a lesser extent. It is important to note that, theoretically, precautionary savings can arise only if the marginal utility of consumption is strictly convex.

In early consumption studies, despite its undesirable features, a quadratic utility function was widely used mainly because it offered analytical results. Such a function has a constant

[7]See Alan and Browning (2003) for details of Euler equation based empirical studies.
[8]See Cochrane(1991) and Mace (1991).
[9]See Carroll and Samwick (1997) and Gourinchas and Parker (2002).

second derivative (linear marginal utility of consumption) which rules out a precautionary saving motive. More recent studies based on Euler equation estimation took account of this additional saving motive by assuming strictly convex marginal utility and modelled consumption growth as a function of the interest rate and consumption growth variance. While the coefficient on the interest rate still captures the life cycle motive for saving, the coefficient on the new term, consumption growth variance, captures the degree of prudence, hence the empirical importance of precautionary saving[10].

Although the implications of the standard life cycle model under an uncertain income stream are now well understood, the empirical evidence on the strength of the precautionary motive is at best mixed. While Kuehlwein (1991), Dynan (1993), Guiso et al. (1992) and Starr-McCluer (1996) find little or no evidence, Merrigan and Normandin (1996), Carroll and Samwick (1997), Engen and Gruber (1997), Kazarosian (1997), Lusardi (1997) and Carroll et al. (2003) find evidence of a significant precautionary motive. Some of these authors use subjective income risk measures, some use variability in household expenditure while others use ex-post income variance as a proxy for income uncertainty. It is important to note that the direction of the findings is independent of the proxy used for income risk.

2.2 Allocation of Precautionary Wealth

The effect of uninsurable risk is not limited to the level of household wealth. It also has theoretical implications for the allocation of savings[11]. Theoretical models on portfolio allocation in the presence of background risk are mostly in the form of simple life cycle models extended

[10] In the case of a constant relative risk aversion specification both intertemporal substitution and prudence are governed by the same parameter (the coefficient of relative risk aversion).

[11] See Bertaut and Haliassos (1997), Duffie et al. (1997) and Koo (1998). All these studies show (theoretically or via simulation) the impact of labour income risk on portfolio allocation.

to portfolio choice. Typically, they involve a choice between a risky asset (representing stocks) and a riskless asset (representing risk-free bonds and bank accounts). In these settings, if the only source of risk is the return risk, labour income acts as a risk-free bond, hence the well-diversifying rational individual is expected to invest all his savings in the stock market if he has a sufficiently long horizon.

What happens if labour income is risky? If this additional risk is positively correlated with asset returns it creates hedging demand for the riskless asset and we see a clear diversification away from stocks; the higher the correlation, the lower the demand for stocks. If income risk is not correlated with the returns, the effect on the demand for stocks is not as serious since the labour income still largely acts as a risk-free bond. Similarly, if the household can form a portfolio of risky assets which is negatively correlated with labour income we would observe an increasing demand for risky assets with labour income risk.

However, in general, any additional source of risk induced by income uncertainty should cause aversion to stock holding[12]. Kimball (1990) lays out theoretical foundations of "temperance", aversion to total exposure to risk, which results from decreasing absolute prudence (negative fourth derivative of the utility function). He shows that under typical frictionless conditions, demand for risky assets decreases with income uncertainty. Elmendorf and Kimball (2000) use a standard two-period life cycle model to establish the effect of labour income risk on the demand for risky assets. They show that in an incomplete market setting where income is risky and individuals have unlimited borrowing and shortselling opportunities, income risk can reduce overall savings due to its negative effect on risky asset demand.

[12] Most related studies look at the correlation between labour income shocks and market portfolio return (proxied by some composite stock index) assuming the equilibrium condition that the households hold the market portfolio. Overall evidence suggests small positive or no correlation between labour income shocks and composite indices. Since a typical household has a largely undiversified portfolio, the empirically relevant correlation coefficient can be quite different. Unfortunately, individual stocks are not reported in a typical wealth survey.

The effect of income risk on portfolio allocation is not governed entirely by the utility function parameters. Accessibility of borrowing opportunities can have a considerable impact on the ways in which household wealth is allocated[13]. The degree of risk aversion determines the degree of avoidance of risky, in favor of risk-free assets when there is an additional risk source; the higher the risk aversion, the lower the demand for the risky asset. However, an uninsurable risk such as labour income risk combined with borrowing constraints can reverse the temperance effect i.e., increase demand for stocks. In the presence of borrowing constraints prudence can easily dominate risk aversion and extra funds generated to buffer consumption can be channeled into the risky asset to take advantage of the equity risk premium[14]. This tends to occur early in the life cycle when consumers have a sufficiently long horizon to realize the returns. For further exposition of the theory of precautionary wealth allocation, the interested reader is referred to the detailed appendix provided at the end of the paper. The appendix presents a dynamic finite life portfolio choice model and its solution under labour income uncertainty. The model is solved and simulated under different income variance levels with and without liquidity constraints.

Similar to the literature on the level of precautionary saving, the empirical evidence on precautionary allocation is mixed. Bertaut and Haliassos (1997), Guiso at al. (1996), and Chakraborty and Kazarosian (1999) find that households try to reduce total exposure to risk by channeling their investments to safer assets when facing labour income risk. While Hochguertel (2003) finds some support for the temperance motive using Dutch panel data, his results are not unanimous. Most recently, Vissing-Jorgensen (2002) has found using the American Panel Studies of Income Dynamics that labour income volatility has a negative impact on both stock market participation and on the wealth invested in stocks conditional on participation.

[13] This is also true for the level of precautionary funds. A greater accesibility to credit markets is expected to reduce the overall level of precautionary saving.

[14] See Haliassos and Michaelides (2003).

Again recently, Letendre and Smith (2001) find that background income risk has little effect on portfolio allocation and this effect may be difficult to detect empirically. It is important to note that none of these empirical studies investigates the effect of income risk on risky asset demand under liquidity constraints (or credit market accessibility).

To sum up, although the implications of portfolio choice theory under background risk are solid but ambiguous, the related empirical evidence is somewhat weak. The reasons for this are twofold. First, a good quality panel wealth data set that includes detailed labour income information is seldom available. Second, it has proven to be extremely difficult to construct uncontroversial measures for ex-ante labour income risk and expected liquidity constraints. Establishing the relationship between labour income risk and the demand for risky liquid assets has turned out to be especially challenging due to the difficulty in identifying hedging behaviour of households. Given most households hold fairly undiversified portfolios (not the market portfolio), knowing the correlation between household portfolio return and labour income is extremely important to assess households' total exposure to risk. Unfortunately, it is not possible to estimate such a correlation with the currently available data[15]. As new evidence on precautionary saving and allocation is needed, new data sets are surely appreciated. Undoubtedly, the new Canadian Survey of Financial Security is an excellent opportunity to enrich our understanding of these issues. The empirical analysis presented in the next two sections is structured in light of the theoretical results surveyed above.

[15] Sweden has a unique data set that contains most disaggregated wealth information. It is indeed possible to identify the hedging motive with this data set. See Massa and Simonov (2003).

3 Wealth Allocation of Canadian Households

This section presents some useful summary statistics of the wealth allocation of Canadian households. For this, I use the family master files of the Survey of Financial Security 1999[16]. The survey information was obtained by personal interviews in May and June of 1999. It is supplemented by $2,000$ households selected from geographical areas with a larger concentration of high income households. Sample weights provided by the survey are used to make the data representative of the Canadian population as a whole. The information used in the estimation section of the paper comes from two major files. The information on wealth is obtained from the family files and the general demographic information on all members of the family as well as the detailed employment and education information come from the person files. For the estimations I use the demographic information of the major income earner in the family. The total number of households after merging the two master files is $15,933$.

3.1 Descriptive Statistics

Table 1 presents the allocation of non-pension financial wealth in Canada in 1999[17]. In the table and thereafter stocks refer to all non-RRSP Canadian and foreign stocks plus the shares held in private companies. Bonds refer to all Canadian and foreign bonds and debentures exclusive of RRSP investments. The category cash is defined broadly and includes chequing and savings accounts, term deposits and treasury bill funds. Unfortunately the survey has no information on the composition of mutual funds (amount of stocks, bonds or money market funds they contain) so I take them as a distinct asset category. Furthermore, the survey contains information on

[16] Statistics Canada has released a public use version of the SFS 1999. However, the crucial information used in this paper such as occupation, industry and detailed portfolio allocation is available only in the master files.

[17] For more detailed allocation statistics including housing, pension wealth etc. see Milligan (2003).

home ownership savings plans, registered educational savings, mortgage backed securities and funds loaned to others. Since the focus of the paper is mainly on stock holdings and non-pension financial wealth as a whole I combined these assets under the category of "other". Total financial wealth is the total market value of these 5 aggregated assets. Table 1 has 3 main panels. The first row presents the statistics for all households, the second row is for households with positive financial wealth. The last row presents the summary statistics of conditional asset holdings. Conditional holding here refers to asset holding conditional on positive holding of such assets.

It appears to be that Canada has one of the lowest stock market participation rates among the industrialized countries after Italy (around 7% in 1998) The percentage of Canadians holding stocks was 11.2% in 1999. This figure was 19.2% in the U.S and 21.6% in the U.K. in 1998[18]. The participation rates for the bond and the mutual fund market are slightly higher than that of the stock market (14.5% and 14.2% respectively). Similar to other countries Canadian households tend to keep their financial wealth in safe forms: bank accounts and money market funds. When we look at the mean portfolio shares we see that portfolio weights of stocks, bonds and mutual funds are very small compared to the weight of cash (75%). As it is the case in all other industrialized countries a typical Canadian household's financial portfolio is undiversified and quite safe.

The picture is not different when we concentrate only on the households with positive financial wealth (90% of the entire sample). Although the participation numbers for stocks, bonds and mutual funds are now higher, the median holdings of those assets are still zero. Interestingly, even though the percentage of households with positive financial wealth holding stocks

[18] The United Kingdom has the highest direct stock market participation rate among all industralized countries. However Sweden has the highest indirect stockholding (around 54%) followed by the U.S (around 49%). Indirect stock holding refers to all stocks including those in mutual funds and pension accounts. Unfortunately, we cannot calculate this important number with Canadian data since the survey does not have details of mutual fund and pension wealth allocation.

is less than that holding bonds (12.4% vs 16%) mean conditional holding of stocks is much higher than holding of all other assets (almost $100,000). It appears that after overcoming the participation hurdle, households tend to invest quite a large amount of money in the stock market, which again, parallels with the evidence for the other industrialized countries.

4 Estimation Results

This section first discusses the income risk estimation methodology. Then, the empirical results for the level of precautionary wealth and its allocation are presented.

4.1 Estimation of Income Variance

As a proxy to income risk I use ex-post labour income variance[19]. The estimates in the next subsections necessitate constructing income risk proxies outside the SFS sample since the SFS is a single cross section and one needs reasonably long panel data on labour income to estimate ex-post income variance for each household. The strategy is to combine income and wealth information from two separate surveys and use a generalized instrumental variable estimator to estimate regression models of level of precautionary saving and its allocation. Income process parameters, permanent and transitory income variances and predictable income growth, are estimated for each industry (total 21 industries). Unfortunately, the panel length is not long enough to make it worthwhile to use permanent and transitory variances separately. Therefore I use total estimated variance in the subsequent regressions. This is in fact a plausible choice since both permanent and transitory income variances work in the same direction and total variance estimates are less noisy. After estimating after-tax labour income variance using the

[19]Some studies including Lusardi (1997) and Guiso et al. (1992) used subjective self reported income risk. Such a variable or a similar one does not exist in the SFS.

characteristics of the major income earner of the household, an average variance for each industry category is calculated and merged with the SFS master files.

To estimate the income parameters for each industry group (the first stage estimation), I follow Carroll and Samwick (1997). The data source for this stage is the Canadian Survey of Labour and Income Dynamics (SLID). The SLID is a rotating longitudinal data set with 6 year windows[20]. The first panel covers the years between 1993 and 1998. The second panel started in 1996 and ended in 2001. Since the wealth data are available for 1999 I choose to estimate income process parameters for the sample period covering 1996 and 2001 (6 years). Income data in the SLID refer to the previous year's income.

I define non-financial family income broadly enough to account for possible insurance schemes available to households such as unemployment insurance and social assistance. Simply, total household nonfinancial income is total labour income plus unemployment insurance, workers compensation, social security, supplemental social security, child support, and some other transfers of all family members. To calculate after tax income I first calculate the average tax rate using the information on taxable income and total taxes paid[21]. Then I apply this rate to gross labour income and obtain after-tax labour income. Real income data are calculated using the consumer price index with base year 1992.

The sample for the income risk estimation is selected so that the resulting panel is balanced. Families that split up during the sample period are excluded. Since there is no clear definition of "head" of a household in the survey, I define a person to be head if he or she is the major income earner of the family for at least four years out of six. Households that do not have such a person are excluded. I use characteristics such as occupation, age, education, marital status and sex

[20] The public use version of the data supresses the panel aspect. The longitudinal data set is confidential.

[21] A progressive tax structure reduces the variance of income. Therefore one should construct income variances based on after-tax income.

of the head for the entire analysis. It is sensible to think that income variance parameters vary over time due to for example moving from a safer job to self employment or taking retirement or changing occupation and education status. In order to deal with this issue I restrict the sample to households whose industry affiliation, occupation and education did not change during the sample period. Finally, since the focus is labour income risk, households whose heads are younger than 21 (mostly students) and older than 60 (mostly retirees) are excluded. The final sample size used for estimating income variances is $5,067$ households ($30,402$ observations).

Following Carroll and Samwick (1997) I assume an income process that can be decomposed into permanent and transitory components. The logarithm of permanent income p_t^i for each household follows a random walk with drift:

$$p_t^i = g_t^i + p_{t-1}^i + z_t^i \tag{1}$$

where p_t^i is the logarithm of permanent income of ith household in period t, g_t^i is income growth (likely to be a function of individual characteristics and demographics) and z_t^i is mean zero iid shocks with variance σ_z^2.

Then, the logarithm of current income y_t^i evolves as:

$$y_t^i = p_t^i + \varepsilon_t^i \tag{2}$$

$$y_t^i = g_t^i + p_{t-1}^i + z_t^i + \varepsilon_t^i \tag{3}$$

where ε_t^i is mean zero iid transitory shock with variance σ_ε^2. Assume that the errors z and ε are uncorrelated with each other at all lags. Now define a $d-$year income difference as

$$r_d^i = y_{t+d}^i - y_t^i = p_{t+d}^i + \varepsilon_{t+d}^i - p_t^i - \varepsilon_t^i \quad (4)$$

Continuous substitution yields

$$r_d^i = (z_{t+1}^i + z_{t+2}^i + ... + z_{t+d}^i) + \varepsilon_{t+d}^i - \varepsilon_t^i \quad (5)$$

Then the $d-$year income variance is

$$Var(r_d^i) = d\sigma_z^2 + 2\sigma_\varepsilon^2 \quad (6)$$

To estimate income variance I regress the logarithm of real after-tax labour income on age dummies, marital status, family size, education, sex, occupation and age-occupation and age-education interactions. The R-square from this regression is around 46%. Residuals from this regression are used to calculate the income variance for each industry group. For efficiency I combine 4 and 3 year differences. Constructed $Var(r_d^i)$ is regressed on d and a constant. The results are presented in Table 2. Not surprisingly, agriculture exhibits the highest earnings variability. Mining has the smallest overall variance, even lower than public administration.

4.2 Precautionary Wealth

In order to estimate the strength of the precautionary saving motive two master files of the SFS and the estimated income variances from the SLID are merged. Wealth information in the SFS is recorded at the family level. Personal information such as occupation, age, sex , marital status and education is needed for a complete econometric evaluation and it is recorded in person files. Characteristics of the major income earner whose age is between 21 and 60 are used for the estimations. Heads (major income earners) who did not report one of these characteristics or industry affiliation are excluded from the sample. The final sample size is 9,691 households.

The econometric modelling involves simply regressing the non-pension financial wealth to permanent income ratio on the labour income variance and permanent income. Note that the income variance varies only across industries so industry dummies are excluded from the analysis. The main assumption is that industry choice is correlated with income risk but uncorrelated with the unobserved taste variables such as degree of risk aversion. Alternatively, occupation or education could be used to instrument income risk but it seems less plausible that occupational or educational choice would be uncorrelated with risk tolerance. The basic econometric model is

$$\frac{FW}{PI} = \beta_0 + \beta_1 \ln Var(Y) + \beta_2 \ln PI + Z\gamma + \varepsilon \tag{7}$$

where FW is financial wealth, $Var(Y)$ is the variance of after tax labour income, PI is permanent income and Z is a matrix of control variables; age, education, marital status, sex, home ownership and occupation. The specification also includes the debt to permanent income ratio interacted with the income variance. The purpose of this variable is to investigate whether risk has different effects depending on access to credit markets (that is, depending on whether the household faces liquidity constraints.) A high debt to permanent income ratio is expected to reflect easier access to credit markets. Finally, in order to establish whether the effect of income risk varies with income level, permanent income deciles interacted with the income variance are also included in the empirical model. Permanent income is proxied by predicted values obtained from the regression of the logarithm of household labour income (recorded in the SFS family files) on age dummies, marital status, family size, education, sex, occupation and age-occupation, age-education interactions. The R-square from this regression is around 36%.

The results for the precautionary wealth estimations using two sample IV (industry dummies excluded) and boostrapped standard errors are presented in Table 3[22]. It may be plausible to think that the self employed have different portfolios due to different attitudes towards risk. Therefore the results are presented for the whole sample (9, 691), the self-employed-excluded sample (8117) and for the self-employed only (1574).

The effect of income risk on the level of financial wealth is clearly positive and significant suggesting a strong precautionary saving motive for the general population and the self-employed-excluded sample. More specifically, a 1 percent increase in the total after-tax income variance leads to an increase in the financial wealth to permanent income ratio of 0.28 (approximately 3.4 months of income). This effect is much stronger than the effect estimated by Carroll et al. (2003) using unemployment probability as a risk measure and total net worth as a wealth measure (0.7 months of income). The effect seems somewhat weaker at low permanent income levels but this finding is significant only at the 10 percent level for the whole sample. The weak precautionary response at low permanent income levels may be because most of these households use a "rule of thumb" in making consumption decisions instead of rational optimization. They may simply be consuming their current income and hence not reacting to income uncertainty in the expected way.

The reason for the self employed group not to exhibit any significant precautionary saving

[22] Two Sample IV can be thought of as an IV estimator using two sets of sample moments. The first set is the cross product of the instruments and the dependent variable. The second set is the cross product of instruments and regressors. If both samples are drawn from the same population one can consistently estimate the model parameters using one set of moments from one sample and the other set of moments from the other. See Angrist and Krueger (1992).

motive may simply be a strong hedging motive observed in this group. As presented in the following section, this group seems to avoid risky liquid assets in the face of income uncertainty. This fact alone can be enough to weaken or even reverse the precautionary effect on saving as observed in the regression for the self employed; the coefficient of income variance is now negative although it is statistically insignificant. Moreover, as opposed to the general population, the response to income risk does vary with permanent income level for this group.

Note that the coefficient of the debt to income ratio (interacted with income variance) is negative and significant for the whole and self employed excluded sample. This is expected since easier access to credit markets may reduce the need for accumulating extra funds in the face of income risk. The fact that the accessibility of credit markets has no effect on the behaviour of the self employed provides further support for the strong hedging motive among this group. Surprisingly, permanent income does not seem to have any significant effect on financial wealth accumulation. This finding is robust across all sample restrictions and in parallel with the most recent evidence by Carroll et al. (2003).

It appears that home owners tend to accumulate more financial wealth than non-home owners. This could be because liquid financial wealth can be used easily in the case of a mortgage payment crisis or simply because of the life cycle effect; households tend to own homes and have more accumulated financial wealth later in the life cycle. The life cycle effect also appears in the positive and significant age coefficient. Male headed and married households accumulate less financial wealth but the results are not statistically significant. Family size appears to have a negative impact on financial wealth holding. This can be explained by the argument that households with live-in children tend to be more impatient since they are more likely to use their income for immediate consumption needs.

Given a single cross section and the lack of some important behavioural questions there is no way of controlling for the effect of unobserved heterogeneity in the regressions. Although income risk is instrumented by industry, in principle, the results can still be reflecting a possible correlation between unobserved taste variables (determining wealth accumulation) and some of the other right hand side variables such as occupation and education. Unfortunately one needs panel data or detailed risk attitude questions in a cross section survey to address this problem further.

4.3 Precautionary Allocation

Among the households with positive financial wealth only 12.4 percent hold stocks directly. Theoretically, households hold stocks only if their optimal portfolio share exceeds the zero threshold level. This is when the econometrician observes the wealth invested in stocks. Therefore, zero stock shares reflect the likelihood of being under such threshold. This simply calls for a censored regression model and the Tobit method could be used to estimate the demand for stocks. However, the determinants of participation in the stock market might be different than for the demand for stocks. This is particularly true if we think that there may be some sort of cost (mostly informational) associated with entry into the stock market. The presence of a fixed entry cost would create a structural dependence in stock market participation i.e., households that participated before would become more likely to participate later. There is now some evidence that households do indeed face some entry cost. Vissing-Jorgensen (2002) presents evidence of a significant state dependence in stock market participation even after controlling for unobserved heterogeneity[23]. Using the U.S. Panel Survey of Income Dynamics

[23] Unobserved heterogeneity can also manifest itself as structural dependence. To infer the "true" structural dependence, one should control for it.

(PSID) Alan (2003) estimates stock market entry cost within a structural framework and finds that households face an entry cost of approximately 2.2% of their permanent income.

Given the evidence on stock market entry cost, participation and demand for stocks should be modelled separately, while allowing for unobservables to be correlated. For this, I use the method suggested for female labour supply estimation by Blundell, Duncan and Meghir (1998). The method involves first, estimating a participation equation using maximum likelihood probit and including generalized residuals obtained from this estimation in the risky asset demand equation to correct for self selection. Both equations have income variance as a regressor and again industry dummies are excluded from both equations. The participation equation also includes the variable "urban" to control for participation cost[24]. The size of the area of residence is thought to be an indicator of how well information regarding stock markets is circulated. The idea is, the larger the area of residence the thicker the information markets and the lower the informational cost of participation.

For the analysis, I use two separate definitions of a risky liquid asset. First, I define it to be the sum of stocks, mutual funds, long term government bonds and debentures. Then I use a narrower definition by removing bonds and debentures. The estimation results for participation are shown in Table 4. The most pronounced result for both asset definitions and all groups is that participation in the risky asset market is strongly determined by the level of financial wealth. Permanent income is also a significant determinant of participation except for the self employed group.

Income variance does not seem to affect the participation decision significantly although we observe negative coefficients for the self employed group for both asset definitions. When faced

[24] This instrument is not ideal. Nevertheless this type of "location" instrument hase been used by the researchers (see, for example, Guiso, 1996). Unfortunately, we do not have a better measure for this unobservable variable and this problem is not unique to the Canadian data.

with income uncertainty this group appears to avoid investing in risky asset markets. Surprisingly, higher education is positively associated with the participation decision only for the self employed. For the general population such a relationship does not exist. The likely explanation for this result may be that although higher education increases efficiency in acquiring information, time devoted to information gathering is more valuable for the educated households due to their higher wages. Since these two forces work against each other, insignificant coefficient estimates may be a natural result. Given permanent income is not a significant determinant of participation for the self employed, the positive impact of high education on participation may not be a surprising finding for this group.

After estimating participation equations, the next step is to specify the demand for risky assets. The basic empirical model for risky asset holding is

$$\frac{Risky\ asset}{FW} = \beta_0 + \beta_1 \ln Var(Y) + \beta_2 \ln PI + \beta_3 \ln FW + \beta_4 GR + Z\gamma + \varepsilon \tag{8}$$

where the dependent variable is the share of financial wealth invested in risky assets, GR is generalized residuals obtained from the participation estimation and Z is a matrix of control variables. The model also includes debt to permanent income ratio interacted with income variance and financial wealth deciles interacted with income variance. Table 5 presents the results for the broad definition of risky financial assets. The first thing to notice in the table across all groups is that the sign of income variance is negative; however it is significant only for the self employed group. There seems to be avoidance of extra risk taking in the face of income risk especially at the lower end of the wealth distribution. Although this result is not statistically significant for the whole sample, it is quite strong for the self employed.

These findings deserve particular attention. First of all, the evidence on risky asset avoidance at low wealth levels can be thought of as evidence against the constant relative risk aversion assumption frequently used by macroeconomists[25]. Although the results for the general population are statistically weak, they point strongly to decreasing relative risk aversion for the self employed group. Secondly, the negative and significant coefficient for the income variance supports the findings of Heaton and Lucas (2000) that there is a positive and significant correlation between self employed income and asset returns. The self employed group appears to have a stronger hedging motive relative to the general population. Finally, as opposed to the case of precautionary wealth, the accessibility of credit markets does not seem to lessen the impact of income risk on the demand for risky assets for any group.

As further evidence against the constant relative risk aversion assumption, financial wealth is a significant determinant of the share of risky assets in financial portfolio. The coefficient is positive and significant for the whole and self-employed-excluded sample. However this result should be interpreted carefully as it can be due to unobserved heterogeneity. A positive coefficient is also the case for permanent income. Although it seems to be a significant determinant of the demand for risky assets for the general population, for the self employed group it is not statistically significant. Note that the sign of the results regarding risky asset demand and permanent income are the same as those in precautionary wealth regressions.

Another interesting result is that the coefficient on the probit residuals is positive and significant except for the self employed group. This finding confirms that the determinants of participation and demand for risky asset are not the same and this should be taken into account when estimating the demand for risky assets. This does not seem to be true for the self employed group. The insignificant coefficient indicates that the self employed stock holders

[25] Browning and Crossley (2000) show formally that the constant relative risk aversion specification is unlikely to explain the consumption and saving behaviour of households.

are in fact a random group within the self employed. The other household head characteristics such as marital status, age and sex do not seem to be significant determinants of risky asset demand. The exception is family size. It appears that larger families tend to have less risky financial assets than smaller families except for the self employed group. This could be due to highly leveraged portfolios of young households with live-in children.

For the narrow definition of risky assets Table 6 presents the results. All the findings are similar to those obtained using the broader definition except that the evidence of risky asset avoidance at the low end of the wealth distribution is stronger for the self employed group when we consider only stocks and mutual funds as risky assets. The coefficient on income variance is still negative and significant, further supporting the strong hedging motive for this group.

5 Conclusion

This paper estimates the impact of labour income risk on financial wealth accumulation and allocation in Canada. Labour income risk is proxied by ex-post after tax labour income variance and estimated using a 6-year balanced panel. The study intends to uncover the link between labour income risk and the level of buffer stock saving as well as the allocation of saving among different investment options. According to the empirical results Canadian households accumulate financial wealth partly for precautionary reasons. Moreover, they tend to channel their precautionary funds into risk-free investment tools rather than risky assets with higher expected returns. The latter evidence is particularly strong for self employed Canadians. Furthermore, the precautionary saving motive is not as strong among households that seem to have better access to credit markets.

Two important caveats apply here. First, it is extremely difficult to control for unobserved taste variables that are potentially important determinants of wealth accumulation with a single cross section. Even though the income risk proxy used in the regressions is instrumented to avoid its likely correlation with unobserved taste variables, other right hand side variables may also be suffering from such a correlation. Without panel data on wealth, this particular issue cannot be addressed properly. Second, although the quality of income data used in the paper is very high, one can still question the quality of ex-post income variance as a proxy for expected income uncertainty. The same doubts arise when researchers use some subjective measure to proxy this variable. Unfortunately, the available theories provide no analytical measure of income uncertainty. In principle, optimal behaviour depends not only on the first and second moments but also on the entire income distribution. Similarly, it is quite hard to find acceptable measures of current and expected liquidity constraints. This is particularly important for the estimation of precautionary allocation since liquidity constraints can easily reverse temperance and conceal the hedging motive.

Innovations in the financial sector and the presence of unemployment insurance reduce the extent to which financial markets are incomplete. However there is substantial evidence that individuals still face considerable earnings and career risk. Naturally, understanding the ways in which households handle this risk is crucial for policies that target financial and insurance markets. If precautionary savings comprise a significant portion of overall household savings, public insurance schemes may have some crowd out effect on aggregate wealth accumulation. Moreover, progressive tax policies that tend to reduce earnings variance may lower household saving and alter its allocation. The results presented in this paper can provide a first step towards policies that are better designed and implemented.

References

Alan, S. (2003) "Portfolio Choice and Stock Market Participation Cost over the Life Cycle: Evidence form the PSID." Unpublished Manuscript.

Alan, S. and M. Browning (2003) "Estimating Intertemporal Allocation Parameters Using Simulated Residual Estimation". Unpublished Manuscript.

Angrist J. and A. Krueger (1992) "The Effect of Age at School Entry on Educational Attainment: An Application of Instrumental Variables with Moments from Two Samples" *Journal of the American Statistical Association*, 87, 328-336.

Attanasio, O.P., J. Banks, C. Meghir, G. Weber (1999), "Humps and Bumps in Lifetime Consumption", *Journal of Business and Economic Statistics*, 17(1), 22-35.

Attanasio, O.P., M. Browning (1995) "Consumption over the Life Cycle and over the Business Cycle", *American Economic Review*, 85(5), 1118-1136.

Bertaut, C. and M. Haliassos (1997) "Precautionary Portfolio Behavior from a Life Cycle Perspective", *Journal of Economic Dynamics and Control*, 21, 1511-1542.

Blundell, R ., A. Duncan and C. Meghir (1998) "Estimating labour Supply Responses Using Tax Reforms", *Econometrica*, vol:66, no:4, 827-861.

Browning , M. and T. Crossley (2000), "Luxuries are Easier to Postpone: A Proof", *Journal of Political Economy*. 108(5):1064-1068.

Browning , M. and A. Lusardi (1996), "Household Saving: Micro Theories and Micro Facts", *Journal of Economic Literature*, December, 1797-1855.

Caballero, R. J. (1990), " Consumption Puzzles and Precautionary Savings" *Journal of Monetary Economics*, 25, 113-136.

Carroll C. D., (1992) "The buffer-Stock Theory of Saving: Some Macroeconomic evidence"

Brookings Papers on Economic Activity 2, 61-156

Carroll, C. and A. Samwick (1997) " The Nature of Precautionary Wealth" *Journal of Monetary Economics*, 40,41-71.

Carroll, C., K. E. Dynan and S. S. Krane (2003) "Unemployment Risk and Precautionary Wealth: Evidence from Households' Balance Sheets" *Review of Economics and Statistics*, 85(3).

Chakraborty, A. and M. Kazarosian (1999) "Portfolio Allocation of Precautionary Assets: U.S. Panel Evidence" Northeastern University, mimeo.

Cochrane, J. H. (1991) "A Simple Test of Consumption Insurance", *Journal of Political Economy*, vol.99, no:5, 957-976.

Deaton, Angus (1991) "Saving and Liquidity Constraints", *Econometrica*, vol.59, no.5, 1221-1248.

Duffie, D., W. Fleming, H.M. Soner and T. Zariphopolou (1997) " Hedging in Incomplete Markets with HARA Utility", *Journal of Economic Dynamics and Control*, 21, 753-782.

Dynan, K. E. (1993), "How Prudent are Consumers?" J*ournal of Political Economy*, vol. 101, no:6, 1104-1113.

Elmendorf, D.W. and Kimball M. S. (2000) " Taxation of labour Income and the Demand for Risk Assets" *International Economic Review*, 3, 801-834.

Engen, M. E. and J. Gruber (1997) "Unemployment Insurance and Precautionary Saving" NBER Working Paper no: 5252.

Gakidis, H. E. (1998) "Stocks for the Old? Earnings Uncertainty and Life Cycle Portfolio Choice"

Gourinchas, P.O. and J. A. Parker, (2002) " Consumption over the Life Cycle" *Econometrica* 70, no:1, 47-89.

Guiso, L., T. Jappelli and D. Terlizzese, (1992) "Earnings Uncertainty and Precautionary Saving." *Journal of Monetary Economics*, 30(2), 307-338.

Guiso, L., T. Jappelli and D. Terlizzese, (1996) " Income Risk, Borrowing Constraints and Portfolio Choice" *American Economic Review*, 86(1) 158-172.

Haliassos, M. and A. Michaelides (2003), "Portfolio Choice and Liquidity Constraints" *International Economic Review*, vol.44, 143-177.

Heaton J. and D. Lucas (2000), "Portfolio Choice in the Presence of Background Risk" *The Economic Journal*, 110, 1-26.

Hochguertel, S. (2003) "Precautionary Motives and Portfolio Decisions" *Journal of Applied Econometrics*, 18, 61–77.

Kazarosian, M. (1997) "Precautionary Savings: A Panel Study" *The Review of Economics and Statistics*" 241-247.

Hubbard, R. G., J. Skinner and S. P. Zeldes (1995) "Precautionary Saving and Social Insurance" J*ournal of Political Economy*, vol. 103, 360-399.

Kimball, M. S. (1990) "Precautionary Saving in the Small and in the Large" *Econometrica*, 58, 53-73.

Koo, H. K. (1998) " Consumption and Portfolio Selection with labour Income: a Continuous Time Approach." *Mathematical Finance*, 8, 49-65.

Kuehlwein, M. (1991) "A Test for the Presence of Precautionary Saving" *Economics Letters*, 37, 471-75.

Letendre, M and G. Smith (2001) "Precautionary Saving and Portfolio Allocation: DP by GMM" *Journal of Monetary Economics* vol 48:1 197-215.

Lusardi, A., (1997) "Precautionary Saving and Subjective Earnings Variance." *Economic*

Letters 57, 319-26.

Mace, B. J., (1991) “Full Insurance in the Presence of Aggregate Uncertainty”, *Journal of Political Economy*, vol.99, no:5, 928-956.

Massa, M. and A. Simonov (2003) "Hedging, Stock Market Participation and Portfolio Choice" Unpublished manuscript.

Merrigan, P. and M. Normandin (1996) "Precautionary Saving Motives: An Assessment from UK Time Series of Cross-Sections" *The Economic Journal*, 106, 1193-1208.

Milligan, K. (2003) "Life Cycle Asset Accumulation and Allocation in Canada" UBC.

Normandin M. (1994) "Precautionary Saving: An explanation for the Excess Sensitivity of Aggregate Consumption." *Journal of Business and Economic Statistics*, 12, 205-19.

Starr-McCluer, M. (1996) ”Health Insurance and Precautionary Saving” *American Economic Review,* 86, 285-95.Vissing-Jorgensen, A. (2002) “Towards an explanation of Household Portfolio Choice Heterogeneity: Nonfinancial Income and Participation Cost Structures.

All Households

Asset	**% of households holding**	**mean (median) holdings**	**mean (median) portfolio shares(%)**
Stocks	11.2	10,602 (0)	5.3 (0)
Bonds	14.5	2,109 (0)	5.2 (0)
Cash	87.9	13,383 (2,000)	75.2 (100)
Mutual Fund	14.2	6,554 (0)	8.1 (0)
Other	12.2	2,600 (0)	6.2 (0)
Total Fin. Wealth	90.2	35,249 (3,350)	
Households with Positive Financial Wealth			
Asset	**% of households holding**	**mean (median) holdings**	**mean (median) portfolio shares(%)**
Stocks	12.4	11,749 (0)	5.3 (0)
Bonds	16.0	2,337 (0)	5.2 (0)
Cash	97.4	14,831 (2,500)	75.2 (100)
Mutual Fund	15.7	7,263 (0)	8.1 (0)
Other	13.6	2,881 (0)	6.2 (0)
Total Fin. Wealth		39,061 (4,824)	
Conditional Holdings			
Stocks		94,892 (10,000)	42.8 (36.0)
Bonds		14,581 (2,590)	32.4 (23.0)
Cash		15,219 (2,679)	77.1 (100.0)
Mutual Funds		46,188 (13,000)	51.5 (51.0)
Other		21,234 (4,000)	46.0 (40.8)

Source: 1999 Canadian Survey of Financial Security. Mean and median values in Canadian dollars. Conditional holding refers to asset holding conditional on positive holding of such assets.

Table 1: Summary Statistics of Non-Pension Financial Wealth Allocation

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Industry	**total var.**	**perm. inc. var**	**trans. inc. var.**	**income gr.**
Agriculture	.225 (.045)	.140 (.088)	.358 (.157)	.040 (.005)
Forestry	.047 (.009)	.037 (.018)	.089 (.032)	.042 (.013)
Fishing, hunting	.074 (.013)	.061 (.024)	.144 (.043)	.038 (.017)
Mining	.028 (.004)	.021 (.007)	.052 (.013)	.037 (.007)
Utilities	.031 (.008)	.017 (.015)	.045 (.027)	.034 (.007)
Construction	.073 (.010)	.058 (.018)	.139 (.032)	.033 (.005)
Durables	.027 (.002)	.017 (.003)	.044 (.007)	.028 (.003)
Non-durables	.038 (.007)	.029 (.014)	.071 (.025)	.025 (.005)
Wholesale trade	.053 (.011)	.038 (.020)	.093 (.037)	.033 (.006)
Retail trade	.048 (.006)	.031 (.012)	.079 (.021)	.035 (.004)
Transportation	.048 (.006)	.041 (.011)	.097 (.018)	.029 (.005)
Finance, insurance	.074 (.015)	.064 (.029)	.151 (.052)	.039 (.005)
Real estate	.174 (.072)	.257 (.141)	.538 (.251)	.037 (.013)
Professional service	.179 (.083)	.082 (.165)	.233 (.291)	.032 (.005)
Management	.070 (.019)	.056 (.037)	.132 (.065)	.024 (.011)
Educational service	.034 (.005)	.029 (.009)	.068 (.016)	.022 (.004)
Health care	.066 (.008)	.053 (.015)	.127 (.028)	.024 (.004)
Information, recreation	.046 (.015)	.042 (.030)	.098 (.054)	.026 (.005)
Accommodation, food	.130 (.035)	.064 (.069)	.178 (.123)	.040 (.007)
Other service	.108 (.041)	.060 (.081)	.159 (.144)	.023 (.006)
Public administration	.033 (.003)	.022 (.006)	.056 (.010)	.036 (.004)
Standard errors are in parentheses. Source: SLID 1996-2001				

Table 2: Parameter Estimates of After-tax Household Labour Income Process

Dependent variable: (FW/PI) financial wealth to permanent income ratio			
	whole sample	**self excluded**	**only self emp.**
Variable	estimate	estimate	estimate
ln(income variance)	.281 (.083)*	.248 (.089)*	.215 (.210)
ln(permanent income)	.142 (.132)	.190 (.223)	−.249 (.787)
age	.038 (.012)*	.033 (.013)*	.143 (.043)*
male	−.005 (.068)	−.037 (.073)	.199 (.194)
family size	−.018 (.031)	−.034 (.037)	.072 (.076)
married	−.101 (.136)	−.078 (.143)	−.519 (.510)
ownhome	.243 (.052)*	.214 (.063)*	.461 (.126)*
$(debt/PI) * \ln(var)$	. − 034 (.012)*	−.049 (.018)*	−.025 (.057)
$\frac{\partial FW}{\partial \ln(var)}$, PI percentile 10^{th}	−.200 (.089)**	−.185 (.098)	−.046 (.343)
20^{th}	−.190 (.073)**	−.183 (.075)	−.008 (.257)
30^{th}	−.190 (.072)**	−.150 (.071)	−.361 (.283)
40^{th}	−.144 (.070)	−.134 (.071)	−.086 (.217)
50^{th}	−.150 (.069)	−.126 (.063)	−.219 (.207)
60^{th}	−.139 (.065)	−.125 (.061)	−.167 (.190)
70^{th}	−.177 (.086)	−.167 (.087)	−.169 (.160)
80^{th}	−.129 (.069)	−.118 (.065)	−.151 (.149)
90^{th}	−.109 (.061)	−.079 (.053)	−.297 (.224)
elementary educ.	1.09 (.568)	1.19 (.652)	.964 (1.73)
secondary educ.	.802 (.420)	.899 (.457)	.739 (1.48)
high school	.931 (.394)	1.08 (.454)	.342 (1.45)
postsecondary (no cert.)	.751 (.414)	.899 (.459)	−.505 (1.79)
postsecondary (cert.)	.785 (.399)	.836 (.467)	1.05 (1.15)
R^2	.04	.03	.10
Boostrapped standard errors in parentheses. Other controls: education-age interactions, occupation dummies, occupation and age interactions.			
* and ** indicate significance at the 5 and 10 percent level respectively.			

Table 3: Precautionary Wealth

Dependent variable: whether to hold stocks+mutual funds+bonds			
	whole sample	**self excluded**	**only self emp.**
Variable	estimate	estimate	estimate
ln(income variance)	−.019 (.033)	.012 (.039)	−.027 (.081)
ln(permanent income)	.471 (.127)*	.516 (.147)*	.067 (.292)
ln(financial wealth)	.417 (.010)*	.417 (.011)*	.410 (.024)*
age	−.000 (.007)	−.006 (.007)	.068 (.031)
male	−.081 (.045)	−.073 (.049)	−.071 (.119)
family size	−.097 (.020)*	−.104 (.023)*	−.034 (.046)
married	−.054 (.061)	−.063 (.069)	.056 (.149)
$(debt/PI) * \ln(var)$	.001 (.016)	−.044 (.082)	.003 (.016)
urban	−.070 (.032)	−.061 (.035)	−.126 (.083)
elementary educ.	−.799 (.595)	−1.02 (.647)	−1.02 (1.98)
secondary educ.	.215 (.279)	.158 (.307)	1.05 (.838)
high school	.204 (.243)	.135 (.263)	1.37 (.754)
postsecondary (no cert.)	−.113 (.262)	−.288 (.287)	1.74 (.765)
postsecondary (cert.)	−.091 (.183)	−.282 (.199)	1.67 (.531)
Dependent variable: whether to hold stocks+mutual funds			
ln(income variance)	.013 (.035)	.030 (.042)	−.135 (.085)
ln(permanent income)	.364 (.137)*	.399 (.160)*	−.016 (.305)
ln(financial wealth)	.471 (.012)*	.478 (.013)*	.463 (.027)*
age	−.007 (.008)	−.014 (.008)	.038 (.029)
male	.029 (.048)	.046 (.053)	−.094 (.123)
family size	−.114 (.022)*	−.124 (.025)*	−.034 (.049)
married	−.008 (.066)	−.013 (.076)	.099 (.156)
$(debt/PI) ** \ln(var)$	.012 (.016)	.014 (.046)	.008 (.016)
urban	−.069 (.035)	−.037 (.038)	−.285 (.088)*
elementary educ.	−.945 (.722)	−1.41 (.794)	.595 (2.17)
secondary educ.	−.131 (.320)	−.178 (.355)	.546 (.895)
high school	.308 (.261)	.198 (.284)	1.23 (.794)
postsecondary (no cert.)	−.247 (.281)	−.559 (.309)	1.69 (.801)
postsecondary (cert.)	−.110 (.194)	−.371 (.213)	1.99 (.601)*
Boostrapped standard errors in parentheses. Other controls: education-age interactions, occupation dummies and occupation and age interactions.			
* indicates significance at the 5 percent level.			

Table 4: Probit Results for Participation

Dependent variable: Share of stocks+mutual funds+bonds in financial wealth			
	whole sample	**self excluded**	**only self emp.**
Variable	estimate	estimate	estimate
ln(income variance)	−.014 (.013)	−.012 (.015)	−.072 (.020)*
ln(permanent income)	.093 (.031)*	.103 (.036)*	−.054 (.061)
ln(financial wealth)	.084 (.016)*	.086 (.018)*	.038 (.024)
age	−.001 (.001)	−.001 (.001)	.001 (.002)
male	−.014 (.012)	−.009 (.013)	−.0309 (032)
family size	−.034 (.006)*	−.034 (.007)*	−.015 (.013)
married	−.005 (.017)	−.015 (.019)	.079 (.041)
$(debt/PI) * \ln(var)$	.001 (.004)	.186 (.044)*	−.002 (.004)
generalized residuals	.297 (.064)*	.271 (.074)*	.046 (.076)
$\frac{\partial share}{\partial \ln(var)}$, $\ln(FW)$ percentile 10^{th}	−.037 (.033)	−.050 (.037)	−.200 (.104)
20^{th}	−.035 (.023)	−.046 (.027)	−.091 (.058)
30^{th}	−.010 (.019)	−.018 (.023)	−.082 (.055)
40^{th}	.019 (.017)	.012 (.020)	−.012 (.048)
50^{th}	.028 (.015)	.018 (.017)	.045 (.040)
60^{th}	.019 (.013)	.012 (.015)	.043 (.033)
70^{th}	.031 (.011)	.031 (.013)	−.012 (.027)
80^{th}	.018 (.010)	.016 (.011)	.004 (.023)
90^{th}	.011 (.008)	.011 (.009)	−.005 (.017)
elementary educ.	−.153 (.044)*	−.100 (.048)	−.301 (.110)
secondary educ.	−.004 (.025)	.029 (.027)	−.156 (.058)
high school	−.019 (.019)	−.012 (.020)	−.094 (.047)
postsecondary (no cert.)	.132 (.021)*	.133 (.023)*	.068 (.054)
postsecondary (cert.)	.007 (.014)	.013 (.015)	−.065 (.039)
Boostrapped standard errors in parentheses. Other controls: education-age interactions, occupation dummies, occupation and age interactions.			
* indicates significance at the 5 percent level			

Table 5: Precautionary Allocation: Stocks+Mutual Funds+Bonds

Dependent variable: Share of stocks+mutual funds in financial wealth			
	whole sample	**self excluded**	**only self emp.**
Variable	estimate	estimate	estimate
ln(income variance)	$-.006$ (.013)	$-.001$ (.016)	$-.064$ (.021)*
ln(permanent income)	.038 (.032)	.049 (.037)	$-.105$ (.065)
ln(financial wealth)	.085 (.017)*	.075 (.020)*	.003 (.002)
age	$-.001$ (.001)	$-.001$ (.001)	.003 (.002)
male	.017 (.014)	.021 (.016)	$-.022$ (.034)
family size	$-.035$ (.007)*	$-.033$ (.008)*	$-.009$ (.014)
married	.020 (.021)	.004 (.023)	.096 (.044)
$(debt/PI) * \ln(var)$	.001 (.004)	.191 (.048)	$-.003$ (.004)
generalized residuals	.254 (.061)	.191 (.071)	$-.017$ (.069)
$\frac{\partial share}{\partial \ln(var)}$, $\ln(FW)$ percentile 10^{th}	$-.027$ (.042)	$-.044$ (.046)	$-.374$ (.109)*
20^{th}	$-.015$ (.029)	$-.026$ (.035)	$-.159$ (.059)*
30^{th}	.030 (.023)	.022 (.028)	$-.156$ (.075)
40^{th}	.042 (.021)	.030 (.025)	$-.035$ (.056)
50^{th}	.025 (.017)	.017 (.020)	$-.107$ (.052)
60^{th}	.008 (.015)	.001 (.017)	$-.024$ (.037)
70^{th}	.017 (.013)	.017 (.015)	$-.053$ (.028)
80^{th}	.011 (.010)	.011 (.012)	$-.054$ (.026)
90^{th}	.010 (.008)	.007 (.009)	$-.003$ (.018)
elementary educ.	$-.291$ (.060)*	$-.26$ (.065)	$-.171$ (.134)
secondary educ.	$-.067$ (.030)	$-.027$ (.035)	$-.176$ (.068)
high school	$-.012$ (.022)	.003 (.025)	$-.061$ (.050)
postsecondary (no cert.)	.131 (.024)*	129 (.026)*	.035 (.059)
postsecondary (cert.)	$-.019$ (.017)	$-.021$ (.018)	$-.016$ (.041)
Boostrapped standard errors in parentheses. Other controls: education-age interactions, occupation dummies, occupation and age interactions.			
* indicates significance at the 5 percent level			

Table 6: Precautionary Allocation: Stocks+Mutual Funds

A Appendix: A Model

The absence of an analytical solution for a model that incorporates both a precautionary saving motive and labour income uncertainty necessitates the use of numerical solution and simulation techniques[26]. In order to generate testable implications, I solve a stochastic portfolio choice model under labour income uncertainty and simulate life cycle consumption and saving paths for a large number of ex-ante identical consumers. Due to its desirable properties such as decreasing absolute risk aversion, homogeneity and strictly positive consumption, the constant relative risk aversion (CRRA) utility function is used for all simulation experiments. In order to present the impact of labour income risk, the model is solved for different income variance values and life cycle paths are generated separately for each income variance level with and without borrowing constraints. I then establish the theoretical implications of labour income risk for wealth accumulation and stock holding behaviour. The empirical investigation is structured in the light of these theoretical findings.

Assume that the expected utility function is intertemporally additive over a finite lifetime and the sub-utilities are iso-elastic. The problem of the generic consumer is

$$\max E_t \left[\sum_{j=0}^{T-t} \frac{(C_{t+j})^{1-\gamma}}{1-\gamma} \frac{1}{(1+\delta)^j} \right] \tag{9}$$

where C is non-durable consumption (separable from durable consumption), γ is the coefficient of relative risk aversion, and δ is the rate of time preference. Assume that the end of life T is certain[27]. Following Deaton (1991), I define the endogenous state variable cash on hand

[26] Analytical solutions for the large scale precautionary saving models are available only in the case of a constant absolute risk aversion specification. However such specification rules out the effect of labour income risk on the optimal portfolio. See Caballero (1990) for details.

[27] It would be straightforward to incorporate a stochastic mortality into the model. This additional complexity though would not change the model implications.

X_t as the sum of financial assets and labour income and it evolves as follows:

$$X_{t+1} = (1 + r^e_{t+1})S_t + (1 + r)B_t + Y_{t+1} \tag{10}$$

where r^e_{t+1} is the stochastic return from the risky asset representing the stock market, r is the risk-free rate which can be thought of as bonds, T-bills and bank accounts, S_t is the amount of wealth invested in the risky asset, and B_t is the amount of wealth invested in the risk-free asset. Following Carroll (1992) Y_{t+1} denotes stochastic labour income which follows the following exogenous stochastic process:

$$Y_{t+1} = P_{t+1}U_{t+1} \tag{11}$$

$$P_{t+1} = G_{t+1}P_tN_{t+1} \tag{12}$$

Permanent income P_t grows at the rate G_t and it is subject to multiplicative i.i.d shocks N_t. Current income Y_t is composed of a permanent and a transitory component U_t. The growth rate of income is assumed to be nonstochastic and G is set to be 1. I also assume that the transitory shocks U_t are distributed independently and identically, take the value of zero with some small but positive probability and are otherwise lognormal such that $\ln(U_t) \sim N(-0.5\sigma^2_u, \sigma^2_u)$. Similarly, permanent shocks N_t are iid and $\ln(N_t) \sim N(-0.5\sigma^2_n, \sigma^2_n)$. Assuming that the innovations to income are independent over time and across individuals I simply assume away aggregate shocks to income. However, aggregate shocks are not completely eliminated from the model since all agents face the same asset return process.

Introducing zero income risk into the life cycle model is motivated by Carroll (1992) and adapted by Gourinchas and Parker (2002). Surely such an assumption has important implications for optimal behavior. Given the fact that the iso-elastic utility function yields an infinite marginal utility of consumption at the zero consumption level, backward induction dictates that a consumer who faces such a risk optimally chooses never to borrow. Thus, the consumer saves at every level of wealth and more importantly, the Euler equation is always satisfied. The implications of the model when borrowing is allowed and income is bounded away from zero are also presented. Excess return on risky asset is assumed to be i.i.d:

$$r^e_{t+1} - r = \mu + \varepsilon_{t+1} \tag{13}$$

where μ is mean excess return and ε_{t+1} is distributed normally with mean 0 and variance σ^2_ε and not correlated with the innovations to permanent income.

The maximization problem involves solving the Bellman equation via backward induction. The problem is:

$$V_t(X_t, P_t) = \max_{S_t, B_t} \left\{ \frac{(C_t)^{1-\gamma}}{1-\gamma} + \beta E_t V_{t+1} \left[(1 + r^e_{t+1}) S_t + (1+r) B_t + Y_{t+1}, P_{t+1} \right] \right\} \tag{14}$$

subject to

$$S_t \geq 0, \;\; B_t \geq 0$$

where $V_t(.)$ denotes the value function.

In order to reduce the computational burden, the necessary variables are normalized by permanent income. Doing this, the number of endogenous state variables is reduced to one, namely, ratio of cash on hand to permanent income. The resulting Bellman equation after normalizing is as follows:

$$V_t(x_t) = \max_{s_t, b_t} \left\{ \frac{(c_t)^{1-\gamma}}{1-\gamma} + \beta E_t (G_{t+1} N_{t+1})^{(\gamma-1)} V_{t+1} \left[(1 + r^e_{t+1}) s_t + (1+r) s_t / G_{t+1} N_{t+1} + U_{t+1} \right] \right\} \tag{15}$$

where $x_t = \frac{X_t}{P_t}$, $s_t = \frac{S_t}{P_t}$, $b_t = \frac{b_t}{P_t}$ and $c_t = \frac{C_t}{P_t} = x_t - s_t - b_t$.

I assume away the bequest motive and since the end of life is certain (no accidental bequest) normalized consumption at the final period is:

$$c_T = x_T$$

In order to obtain the policy rules for the earlier periods I define a grid for the endogenous state variable x and maximize the above equation for every point in the grid. The value function and policy functions are approximated with a cubic spline. Details of the solution method are in the appendix.

A.1 A Simple Characterization

Parameter values used for the solutions are presented in Table 7. The model is solved four times assuming different income variance values. Working life is assumed to begin at the age of 20 and the life ends at the age of 80. To make the illustrations simple retirement years and the bequest motive are not modelled. In the first two solutions, the standard deviation of log transitory income shock is set to be 0.1 so that the two solutions differ only in permanent shock variance. The standard deviations of the logarithm of permanent income are assumed to be either 0.04 and 0.05. This is intended to compare the effect of permanent income uncertainty on wealth accumulation and allocation. The numbers are chosen to be close in order to illustrate the strong impact of permanent income shocks on wealth and allocation even with a slight increase in permanent income variance. I then set the permanent income standard deviation to 0.05 and do a similar comparison for transitory income.

The panels in Figure 1 display the policy functions of the model at different ages when the standard deviation of log permanent income shock is 0.05. The first and the third panels depict consumption functions for the age of 79 (period before the end of life) and 20 (beginning of working life) respectively. An important feature to note here is that the function is curved at lower levels of wealth. Since an explicit borrowing constraint was not imposed, the generic consumer optimally chooses not to borrow, leading to everywhere differentiability in his consumption function. At low cash on hand levels, the consumer's desired consumption is very close to his available wealth level but he still manages to save in this setting. The implications of the model would be very different especially for a poor consumer if he could borrow to achieve his optimal consumption level. In that case, he would borrow not only to consume more but also to invest in the risky asset market to take advantage of the high equity premium.

The second and the fourth panels in Figure 1 depict normalized stock and bond holding functions in the period before the end of life (age of 79) and at the age of 20 respectively[28]. Note that the stock and bond holding policy rules are also smooth . If instead explicit borrowing and shortsale constraints were imposed, the functions would take the value zero at low cash on hand levels i.e., at low levels of wealth the consumer would not be able to save in any form. However, as soon as his optimal consumption level is lower than his wealth (higher cash on hand levels), not only would he start saving but he would also allocate almost all his savings to the risky asset. Even though the labour income is risky, since its risk is uncorrelated with the

[28]Note that this a finite life model where policy rules are functions of age as well as cash on hand. The solution of the model for 60 periods results in 60 different policy rules for stocks, bonds and consumption. See the Appendix for the details of the solution method.

return on the risky asset it still acts as a risk-free bond. This leads the consumer to bet rather aggressively in the risky asset market. Another way of looking at this is that since at the low end of the wealth distribution consumption is afforded mainly through labour income and since labour income is not correlated with risky asset returns, it is only natural to invest all available savings in the stock market to take advantage of the high equity premium offered.

Introducing a positive probability of a zero income event results in diversification at every wealth level for older consumers. In the second panel we see a reasonably balanced portfolio. It is only at higher levels of wealth and later in the life cycle that we see a clear diversification towards bonds. The reason is that as more financial wealth is accumulated, it becomes more important than labour income for consumption decisions. Since a risk averse agent will try to avoid consumption fluctuations, he will reduce the correlation between his wealth and asset returns by tilting his portfolio toward the riskless asset. However, at younger ages, the consumer will want to take advantage of the equity premium and hold a riskier financial portfolio since his labour income is more relevant for his consumption decisions at this stage of the life cycle. As can be seen in Panel 4 it is only when the young saver has sufficiently little wealth do we observe some portfolio diversification.

Evidence from the structural estimation of life cycle models suggest that households usually engage in precautionary savings early in the life cycle. It is only after prime ages that they seriously start accumulating for retirement[29]. Based on this, I document the effect of income risk on wealth and allocation for different ages. Simply, I consider the age before death (79) and the age at the beginning of working life (20). Figure 2 depicts policy functions for the permanent income standard deviation 0.05 minus those for 0.04 when borrowing is not allowed.

[29] See Gourinchas and Parker (2002) and Gakidis (1998)

The first column of pictures shows the differences at the age of 79 and the second column at the age of 20. The horizontal line is drawn at zero. Not surprisingly, the consumption function under higher permanent income variance is everywhere below the one under lower variance at every stage in the life cycle implying precautionary savings. Increasing income uncertainly unambiguously leads to higher consumption growth and higher wealth accumulation under borrowing constraints.

Panels 3 and 4 in Figure 2 depict stock holding difference created by different permanent income variance values for old and young ages respectively. The effect is positive, i.e higher permanent income risk leads to higher stock holding at lower levels of wealth for both ages. For the old, if the accumulated wealth is too little, labour income is still very important for consumption decisions and since income shocks are not correlated with returns we see higher stock holding and lower bond holding in case of a higher income uncertainty . The situation is reversed if there is enough wealth accumulated until that age. The picture is quite different for the young. At almost any wealth level, higher labour income risk leads to higher stock and lower bond holdings (Panels 5 and 6 for bond holdings). The reason why the young agent still wants to invest in the stock market even when he has large accumulated wealth is that he has a very long investment horizon to take advantage of the high equity premium even though this may cause more volatile consumption. In this case, high wealth accumulation as a result of aggressive stock market betting is worth the disutility incurred by volatile consumption.

The implications of permanent income variance are quite different if we relax the borrowing constraint. In this case, we see the effects of prudence (generating precautionary saving) and temperance (generating avoidance of risky investment) separately. Figure 3 presents policy function differences when borrowing is allowed[30]. The top two panels show the unambiguous effect of income risk on saving. Even with borrowing opportunities consumption/saving is lower/higher in the case of higher income uncertainty, more so for younger agents. However, the effect on the allocation is now different. Income risk now discourages stock holding in favor of bond holding, more so for the young (lower 4 panels in Figure 3). Since the optimal consumption can always be achieved through borrowing, the stock market is not as attractive anymore for buffer stock saving; temperance now is much more pronounced.

Turning to simulated life cycle paths implied by the model, Figure 4 depicts smoothed life cycle path differences for consumption, wealth, stock and bond holdings when borrowing is allowed. Graphs are generated by subtracting the paths created by the permanent income standard deviation of 0.04 from those of 0.05. For example, after solving the model without a borrowing constraint for both permanent income variance values, consumption paths from age 20 to 80 for 10,000 individuals are simulated for both cases. Then the cross section averages are taken to obtain age profiles for both variance values. The same procedure is followed for the other paths. As the first and the second panels in Figure 4 show, a higher income variance leads to a lower consumption level (and higher consumption growth) and higher wealth accumulation. However, as opposed to the borrowing constraint case, wealth accumulation is achieved mostly through risk free asset holding. Aversion to stock holding is much more pronounced at younger ages. As an individual ages, risk induced by labour income becomes less important, and thus higher stock holdings and lower bond holdings are observed.

[30] Note that this is a finite life model and borrowing is, although allowed, not unlimited. An agent can borrow the amount that he can pay back with certainty, i.e no one is allowed to die with debt or positive assets. This corrensponds to the borrowing limit $\frac{\min(income)}{r}$ in the infinite life case. Given the utility function is strictly concave this constraint will never bind.

A.1.1 Permanent versus Transitory Income Shocks

It is well established that the income uncertainty that is relevant for precautionary saving is the permanent income risk. Even though the risk induced by transitory shocks also generates higher wealth accumulation and alters the portfolio allocation, the magnitude of the effect is much smaller[31]. Figure 5 presents differenced life cycle paths when borrowing is not allowed. Dashed lines represent differences created by increasing the permanent income standard deviation from 0.04 to 0.05 (keeping the transitory income standard deviation at 0.1) whereas solid lines show those created by increasing the transitory income standard deviation from 0.05 to 0.1 (keeping the standard deviation of permanent income at 0.05).

There are two important implications clear in all panels. First, when borrowing is not allowed, lifetime consumption, wealth, stock and bond holdings are higher in the case of higher income uncertainty whether it is transitory or permanent. Prudence triggered by higher income risk dominates risk aversion and reverses the effect of temperance. Second, the effect of transitory shocks is minimal in magnitude compared to that of permanent shocks although the direction of the effect is the same. In light of these findings, it is clear that borrowing constraints should be accounted for when precautionary saving and allocation decisions are investigated.

B Solution and Simulation of the Model

The standard life cycle model for portfolio choice described in Section A is solved via backward induction by imposing a terminal wealth condition in the final period T. Simply, the last period

[31] See Bertaut and Halaissos (1997).

of life is certain and the policy rule for normalized consumption is

$$c_T = x_T$$

In order to solve for the policy rules at $T-1$ the state variable x (cash on hand to permanent income ratio) is discretized by defining an exogenous grid $\{x_j\}_{j=1}^{J}$ $j = 1...50$. Since the borrowing constraint is implicit (due to zero income risk), the lower bound for cash on hand is always positive and it is not necessary to adjust the grid as the solution goes back in time[32]. I set the lower bound to 0.1 and the upper bound to 20.

The algorithm finds the investment on risky and riskless assets that maximizes the value function for each value in the grid of x. In practice, policy function iteration (solution using the Euler equations) proved to be more stable so I chose to proceed with solving two nonlinear Euler equations for each point in the x grid for each time period. To take expectations 10 point Gaussian Quadrature is used. Finally, I use a cubic spline to approximate policy functions for the periods before $T-1$.

For simulations, first, $10,000$ income shocks for 60 years are generated using the income process described in Section A. Sixty years of returns are generated in similar fashion. The probability of zero income shocks is obtained using the uniform random number generator in Gauss 5. After generating all necessary shocks, life cycle paths of consumption, stock and bond holding for $10,000$ agents are simulated.

[32] In general, when borrowing is allowed, cash on hand in any given period (except for the last period) can be negative. It is then crucial to adjust the grid since the possible ranges for cash on hand are different at different stages of life. For instance, if one wants to impose a borrowing constraint such that all debt must be paid before death, then the possible lower bound for cash on hand at time $T-1$ is minus the minimum possible income realization divided by the gross risk-free rate.

Parameter	**Value**
CRRA (γ)	4 and 2
Discount Rate (δ)	0.05
risk-free rate (r)	0.03
mean excess return on risky asset (μ)	0.06
std of risky asset (σ_ε)	0.20
std of transitory income shocks (σ_u)	0.05 and 0.14
std of permanent income shocks (σ_n)	0.04 and 0.05
probability of zero income	0.01

Table 7: Parameters for Simulations

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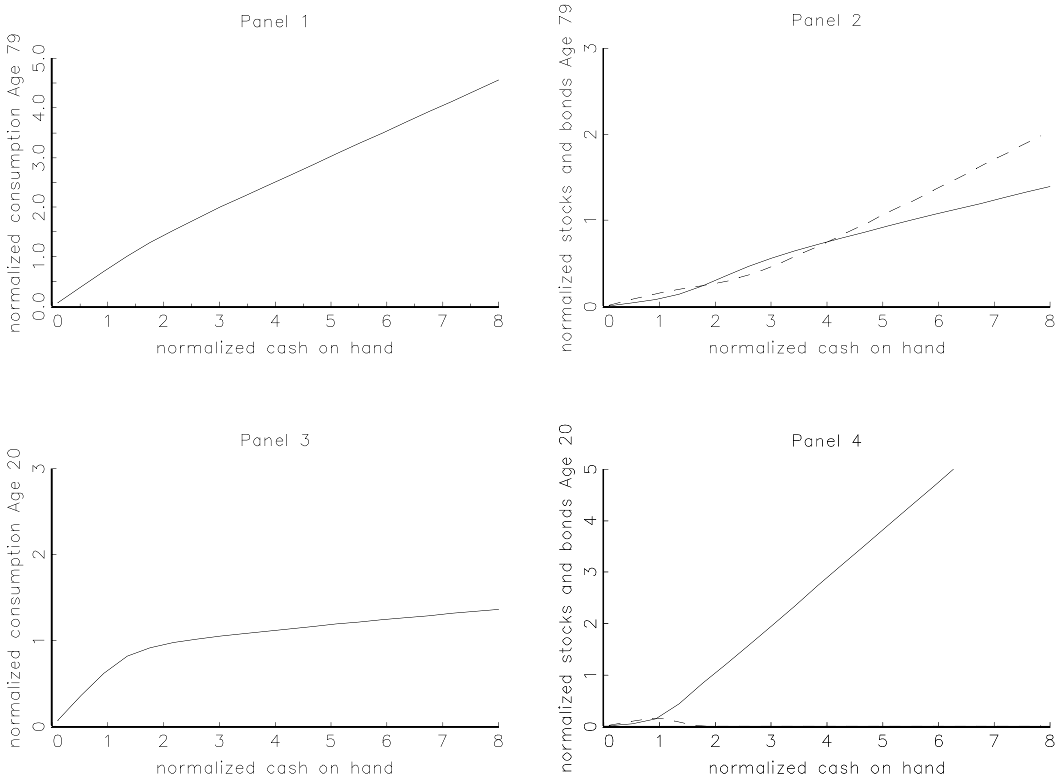

Figure 1: Policy Functions under Borrowing Constraint

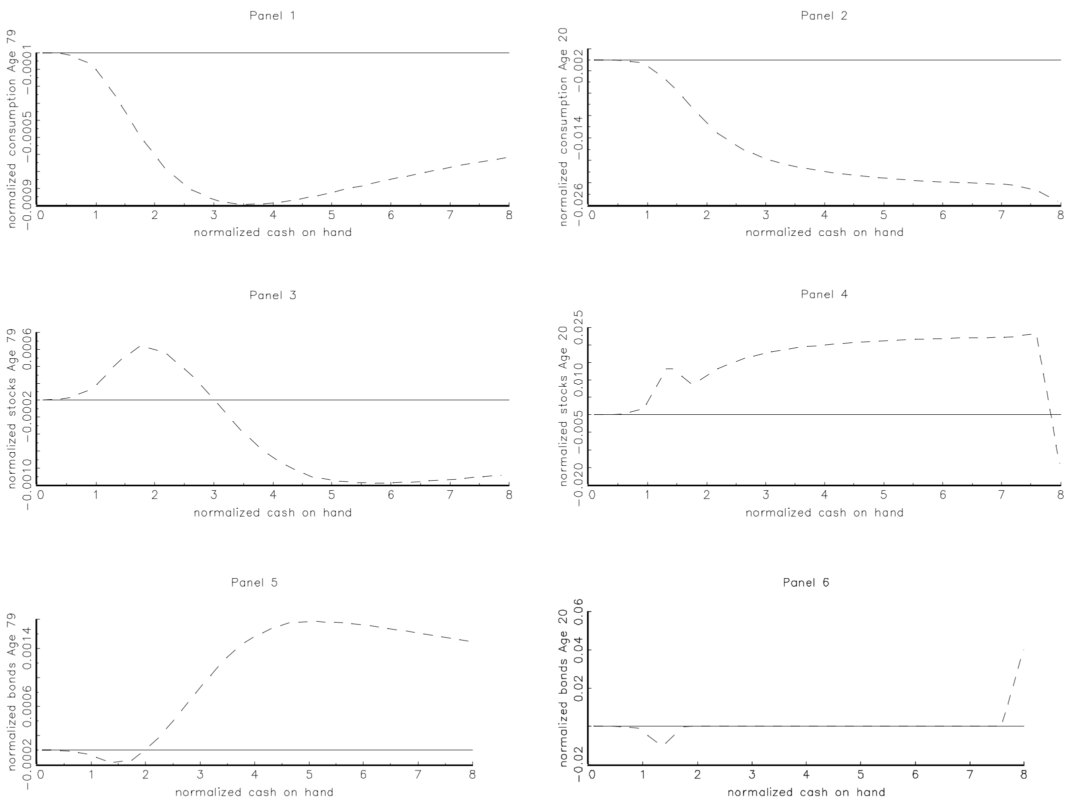

Figure 2: Policy Function Differences: Borrowing Constraint

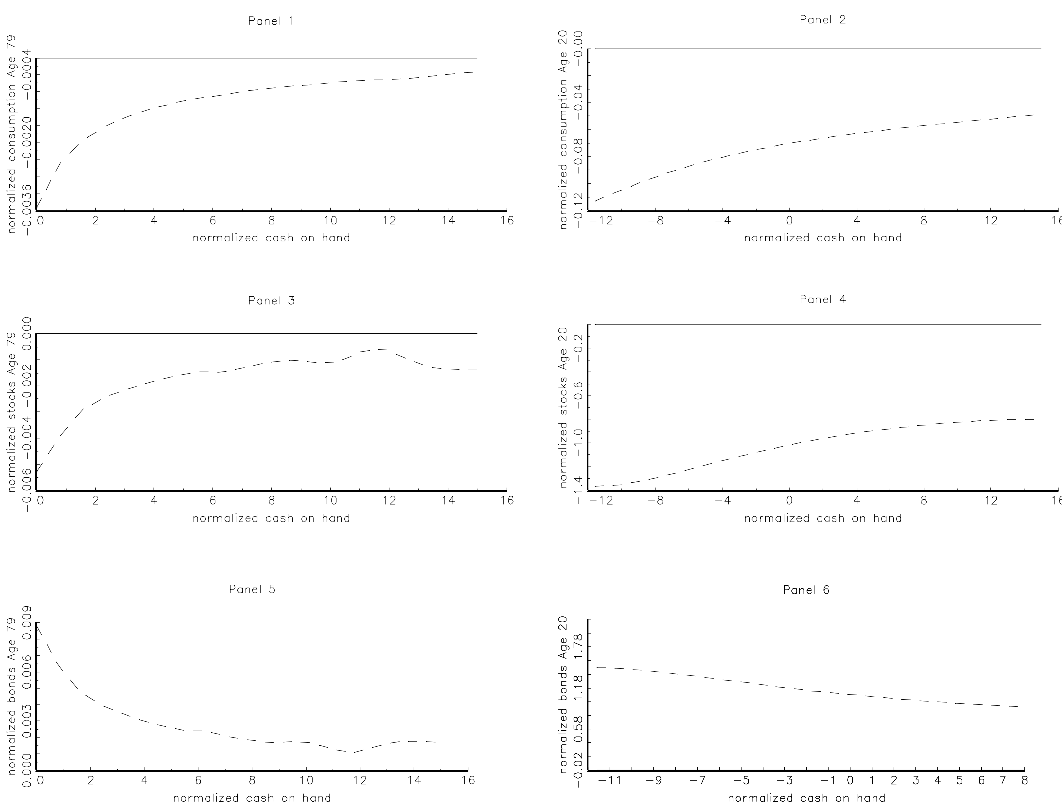

Figure 3: Policy Function Differences: Borrowing Allowed.

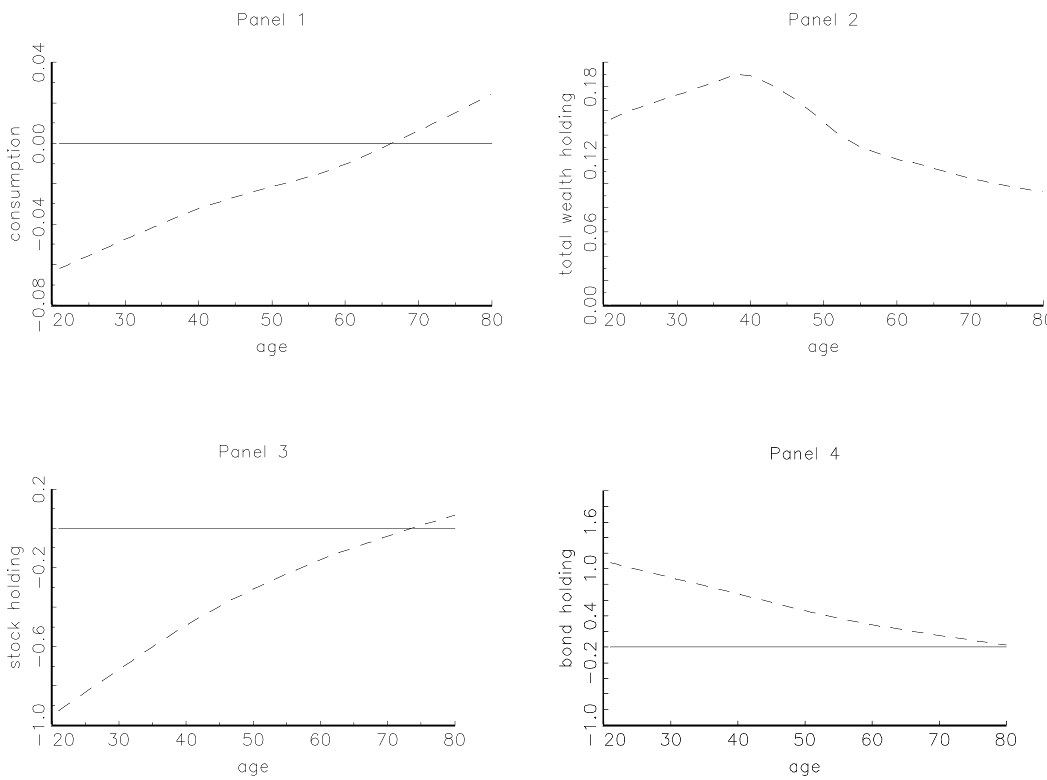

Figure 4: Life Cycle Path Differences due to Permanent Income Variance Difference: Borrowing Allowed.

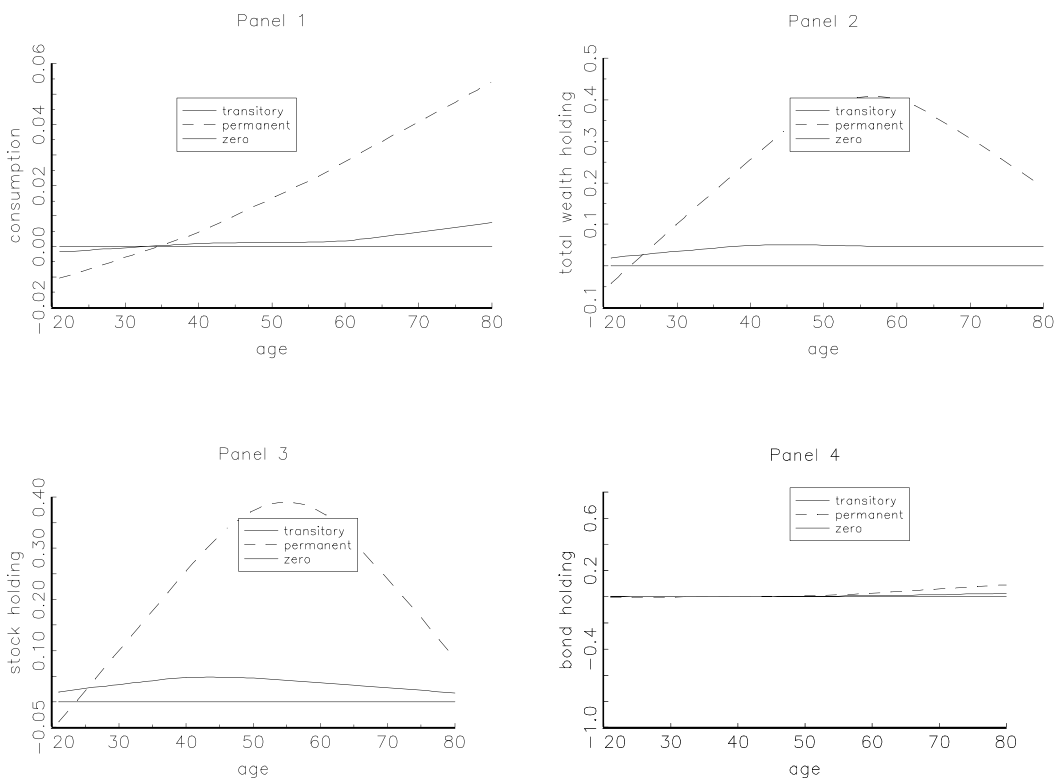

Figure 5: Life Cycle Path Differences due to Permanent and Transitory Income Variances: Borrowing not Allowed.

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