

Household asset portfolio diversification: Evidence from the Household, Income and Labour Dynamics in Australia (HILDA) Survey

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Portfolio theory revisited

- When we combine individual securities, assets or asset classes, we are talking about a portfolio.
- While now accepted in texts and practice, the most famous insight in the history of modern investment appeared in a short paper titled “Portfolio Selection” in the *Journal of Finance* in 1952. The author, Harry Markowitz (later a Nobel Prize winner), was then a 25-year old graduate economics student from the University of Chicago.
- The concepts of return and risk (the variability of expected returns) have always been understood to some extent, and portfolio holders through time have intuitively followed the heuristic "don't put all your eggs in one basket".
- Markowitz argued that individual security/asset risk in a portfolio context was not important.
- What mattered was how securities/assets returns covaried with the returns of other assets/securities in the portfolio.

- Portfolio theory provides a straightforward mathematical approach whereby portfolios can be constructed whose risk is less than the weighted sum of its components assets or securities.
- We attain this by changing the weights of the assets/securities in the portfolio, both positive or negative (short-selling).
- We refer to this process as diversification.
- This means that we are creating synthetic risk-return combinations that are not necessarily reflective of those opportunities available in the market.
- The widening of risk-return combinations is generally associated with an increase in utility. At least some of these will be efficient: less risk, same return or more return, less risk.
- Diversification is one of the more basic requirements we expect of a portfolio manager.
- They may not be able (or want to) to engage in selectivity or timing, but they should be able to diversify (within the constraints of the portfolio objectives).
- Generally speaking, restricting the number of assets in our portfolio constrains the investable universe and portfolios will be less efficient.

Household diversification

- By analogy with corporate finance, household finance also asks how financial decisions are used to attain certain objectives.
- However, households have features that make the direct transfer of the tools of corporate finance to a household setting difficult.
- Households must plan over long (but finite and uncertain) horizons,
- They have important non-traded assets (notably their own human capital),
- They hold mostly illiquid assets (especially housing), and
- They face constraints on their ability to borrow and to engage in short selling.
- Further, many household assets have consumption properties (like housing and vehicles),
- Households may have strong desires for intergenerational transfer, and they are subject to complex taxation, high market entry costs, demanding information requirements, and transaction costs.

- As a result, households often make constrained decisions based on preferences shaped by their own behavioural circumstances.
- These particularly include, amongst others, loss aversion—the tendency to prefer avoiding losses to acquiring gains—and mental accounting—the division of assets into separate, non-transferable portions with different levels of utility that affect household consumption decisions and other behaviour.
- In many instances, these provide non-optimal solutions to their posited efforts to maximise wealth.
- Sometimes they forgo profitable investment opportunities. At other times, they hold extremely undiversified portfolios that expose themselves to excessive levels of risk.

Research objectives

- First, evaluate the diversification of Australian household asset portfolios using a variety of measures suited to the nature of the available survey data.
- This should provide a better understanding of Australian household risk preferences and their exposure to assets overall.
- Second, examine the demographic, socioeconomic and financial determinants of household asset portfolio diversification.
- This will allow a better understanding importance of various household characteristics in determining the composition and distribution of household asset portfolios.

Data

- The data used is from Wave 6 of the Household, Income, and Labour Dynamics in Australia (HILDA) Survey conducted in 2006 and made available in 2008.
- Wave 6 directed a series of questions on household wealth to the household member knowing most about the household's finances.
- The questions concerned their holding of various classes of assets and debt: these subsequently provide measures of financial and non-financial assets and debt and, ultimately, household net worth.
- The survey included the dollar value of 14 classes of assets at the finest level of enumeration; these correspond to the assets specified in this study with the exception that we combine joint, own, and children's bank accounts and retiree and non-retiree superannuation at the household level.
- The 11 household assets are then: (i) bank accounts (BNK), (ii) home assets (HOM), (iii) other property assets (OTH), (iv) superannuation (SPR), (v) equity investments (EQI), (vi) cash investments (CSH), (vii) life insurance (LFE), (viii) trust funds (TST), (ix) business assets (BUS), (x) vehicles (VEH), and (xi) collectibles (COL).
- This taxonomy is similar to comparable overseas studies.

TABLE 1. Household asset statistics

	All households					Asset-holding households					Proportion
	Number	Mean	Std. deviation	Skewness	Kurtosis	Number	Mean	Std. deviation	Skewness	Kurtosis	
BNK	7058	27.924	78.650	7.998	84.985	6862	28.721	79.622	7.900	82.845	0.972
HOM	7058	296.639	414.946	6.217	68.499	4607	454.456	438.254	7.124	73.897	0.653
OTH	7058	124.847	623.665	14.158	235.135	1437	613.203	1269.569	7.048	53.583	0.204
SPR	7058	112.092	235.822	5.674	45.988	5537	142.883	257.858	5.195	38.115	0.784
EQI	7058	51.006	270.072	11.064	143.320	2659	135.390	426.877	6.844	53.669	0.377
CSH	7058	2.410	33.414	21.798	526.758	166	102.477	193.486	3.148	9.416	0.024
LFE	7058	7.940	63.539	13.168	195.872	551	101.701	205.545	3.540	12.709	0.078
TST	7058	11.277	136.503	17.241	319.092	243	12.861	95.965	8.321	69.764	0.034
BUS	7058	52.954	333.761	10.210	120.491	883	423.268	856.958	3.457	12.695	0.125
VEH	7058	22.238	37.266	8.561	118.318	6289	24.957	38.610	8.452	112.752	0.891
COL	7058	3.440	28.287	23.302	649.396	987	24.598	72.151	9.161	96.564	0.140

Notes: All dollar figures in thousands. BNK – bank accounts, HOM – home assets, OTH – other property assets, SPR – superannuation, UQI – equity investments, CSH – cash investments, LFE – life insurance, TST – trust funds, BUS – business assets, VEH – vehicles, and COL – collectibles. Asset-holding households are conditional on non-zero asset holding. All skewness and kurtosis statistics are significant at the .01 level. Proportion is the share of asset holding households among all households.

Measures of diversification

- Markowitz (1952) portfolio theory states that a portfolio is fully diversified if it has minimum risk (variance) at a given level of return, or equivalently, maximum return at a given level of risk.
- Unfortunately, the concept of mean–variance efficiency is unlikely to apply to household asset portfolios.
- First, and as shown above, the return distribution of household assets, both financial and nonfinancial, is unlikely to be normal and therefore variance is an inappropriate measure of risk in an expected utility framework.
- Second, even though the Markowitz model is extremely parsimonious—requiring only the expected return, variance and covariance of each asset along with its share of wealth—we are unable to obtain even this basic level of detail using the data available.
- The only alternatives are heuristic measures of diversification constructed using the asset classes collected by survey.

- Here we follow the work on industry diversification in bank loan portfolios, as recently exemplified by Kamp et al. (2007), as both streams of research rely on insufficiently detailed data at the unit level.
- We calculate eight measures of diversification: three using information on the number or shares of wealth in household assets, two with reference to a benchmark portfolio, and one in terms of the risk profile of the chosen asset concentration.
 - D_p – naïve measure of diversification,
 - D_h – Hirschman-Herfindahl index of concentration,
 - D_s - Shannon entropy index of diversification,
 - D_a - absolute differences in benchmark diversification,
 - D_r – relative differences in benchmark diversification,
 - D_m – proportion of market assets in portfolio
- The bounds for all measures of diversification vary, however larger values are always associated with more concentrated (less diversified) portfolios.

TABLE 2. Diversification measure statistics

Statistic	D_p	D_h	D_s	D_a	D_r	D_m
Mean	0.280	0.578	-0.760	0.457	0.697	0.367
Std. deviation	0.163	0.213	0.387	0.189	0.108	0.316
25 th percentile	0.200	0.412	-1.037	0.322	0.621	0.105
50 th percentile	0.250	0.532	-0.788	0.420	0.694	0.263
75 th percentile	0.333	0.734	-0.496	0.551	0.781	0.578

Notes: D_p – naïve measure of diversification, D_h – Hirschman-Herfindahl index of concentration, D_s - Shannon entropy index of diversification, D_a - absolute differences in benchmark diversification, D_r – relative differences in benchmark diversification, D_m – proportion of market assets in portfolio

TABLE 4. Explanatory variable definitions and statistics

Variable	Definition	Mean	Std. deviation
HSH	Number of persons in household	2.448	1.407
PCH	Proportion of children in household, number of children < 15 years ÷ number of persons in household	0.128	0.215
FEM	1 if female responding to most questions in household; 0 otherwise	0.490	0.500
AGE	Age in years at 30 June 2006 of person responding to most questions in household	47.955	17.689
CPC	Couples with children aged < 15 years; 0 otherwise	0.224	0.417
LPC	Lone parents with children aged < 15 years; 0 otherwise	0.056	0.229
GRI	Gross income in \$ thousands at 30 June 2006	72.399	68.710
PWS	Proportion of wage and salary income, gross wages and salary (\$) ÷ gross income (\$)	0.575	0.488
PBZ	Proportion of business income, business income (\$) ÷ gross income (\$)	0.058	0.422
PIN	Proportion of investment income investment income (\$) ÷ gross income (\$)	0.061	0.201
PPP	Proportion of private pensions and transfers, private pensions and transfers (\$) ÷ gross income (\$)	0.045	0.148
AST	Total assets in \$ thousands at 30 June 2006	709.700	1267.586
HRS	1 if takes substantial risks expecting substantial returns; 0 otherwise	0.014	0.119
MRS	1 if takes above-average risks expecting above-average returns; 0 otherwise	0.056	0.230
RAV	1 if not willing to take financial risks; 0 otherwise	0.341	0.474
NSC	1 if never has any spare cash; 0 otherwise	0.156	0.363

Explanatory variables

- Number of persons in the household (HSH) as an indicator of size. Generally, an increase in the size of the household suggests an increase in the level and diversity of human capital and the development of investment needs, interests and abilities not encountered in a smaller household.
- Proportion of children in the household (PCH). While children imply an increase in the need for many forms of asset investment (especially those with consumption properties), including home property, vehicles, life insurance, and trust funds, the need for human capital investment (children's education) and their high expenditure needs reduces the resources available for investment elsewhere.
- Sex (FEM) and age (AGE) of the principal household respondent. A typical hypothesis is that females may lack financial skills through education and experience. With age, the lifecycle hypothesis commonly used to support a hump-shaped accumulation of wealth over an individual's lifetime has some applicability to diversification in that portfolios will increase in complexity and risk during the working years and simplify and become less risky with retirement.

- At the same time, older households may better meet the needs of information-intensive assets, like own-business, collectibles and equity investment.
- Moreover, the housing owned by many older households may overcome the borrowing constraints facing younger households and a number of studies have already considered the interrelationships between housing and other areas of investment
- Couples with children (CPC) and lone parents with children (LPC) households. Generally, CPC households are typically younger working families actively engaged in building their asset portfolio, especially those assets expected to deliver services over time (like housing and vehicles).
- LPC households often suffer a disadvantage in the composition of their asset portfolios because of their less-diverse human capital, ongoing workforce constraints, and the impact of the factors sometimes responsible for their creation (especially separation and divorce).
- Gross annual income (GRI) is used as a proxy for the resources available for investment, and thereby the ability to overcome barriers to asset market entry, along with an indirect proxy for education.

- Proportion of household income from wages and salaries (PWS), business (PBZ), investments (PIN), and private pensions and transfers (PPP). A
- All follow the argument that there is a strong relationship between the sources of household income (as proxies for financial abilities, knowledge and constraints) and the composition of their asset portfolios.
- Total assets of the household (AST). Typically, the argument is that the increase in assets is associated with increasingly diversified portfolios
- Self-declared level of risk aversion of the principal respondent for each household.
- Theory would suggest that investors with higher risk aversion would maintain more diversified portfolios to minimise the variance of returns.
- Alternatively, risk-averse individuals are more likely to limit their portfolios to relatively safe assets, like bank accounts and government bonds, and this necessarily implies less diversification.
- Conversely, more risk-averse individuals will have relatively more diversified portfolios, but only because they tend to accumulate more wealth, and this links with an increase in the diversity of assets held.

TABLE 4 Parameter estimates and statistics

Variable	D _p			D _n			D _ε			D _α			D _τ			D _m		
	Coef.	Std. error	p-value	Coef.	Std. error	p-value	Coef.	Std. error	p-value	Coef.	Std. error	p-value	Coef.	Std. error	p-value	Coef.	Std. error	p-value
CONS.	0.589	0.015	<0.001	0.837	0.016	<0.001	-0.184	0.027	<0.001	0.888	0.013	0.001	0.924	142.900	<0.001	0.613	0.025	<0.001
HSH	-0.024	0.002	<0.001	-0.022	0.002	<0.001	-0.051	0.004	<0.001	-0.028	0.002	0.001	-0.016	-12.382	<0.001	-0.026	0.004	<0.001
PCH	0.064	0.018	<0.001	0.067	0.029	0.022	0.177	0.051	<0.001	0.075	0.026	0.004	0.059	4.173	<0.001	0.048	0.046	0.303
FEM	0.004	0.003	0.188	0.009	0.005	0.059	0.015	0.008	0.059	0.003	0.004	0.388	0.001	0.031	0.975	-0.003	0.007	0.727
AGE	-0.002	0.001	<0.001	-0.001	0.001	<0.001	-0.002	0.001	0.001	-0.004	0.001	<0.001	-0.002	-24.907	<0.001	-0.004	0.001	<0.001
CPC	-0.031	0.008	<0.001	0.002	0.013	0.903	-0.022	0.023	0.326	-0.047	0.011	<0.001	-0.030	-4.687	<0.001	-0.097	0.021	<0.001
LPC	0.006	0.011	0.574	0.031	0.018	0.080	0.020	0.030	0.514	-0.002	0.016	0.889	-0.013	-1.611	0.107	-0.048	0.029	0.093
GRI	0.001	0.001	0.086	-0.003	0.001	<0.001	-0.007	0.001	<0.001	-0.002	0.001	0.001	-0.002	-8.441	<0.001	0.002	0.001	0.003
PWS	-0.210	0.010	<0.001	-0.215	0.011	<0.001	-0.423	0.018	<0.001	-0.219	0.009	0.001	-0.114	-24.599	<0.001	0.008	0.015	0.598
PBZ	-0.183	0.012	<0.001	-0.205	0.014	<0.001	-0.412	0.024	<0.001	-0.166	0.011	0.001	-0.103	-17.152	<0.001	0.009	0.028	0.733
PIN	-0.205	0.020	<0.001	-0.296	0.028	<0.001	-0.584	0.053	<0.001	-0.122	0.019	0.001	-0.107	-8.026	<0.001	0.136	0.027	<0.001
PPP	-0.236	0.011	<0.001	-0.289	0.016	<0.001	-0.556	0.029	<0.001	-0.260	0.014	0.001	-0.144	-17.974	<0.001	0.169	0.026	<0.001
AST	0.001	0.001	<0.001	0.001	0.001	<0.001	0.001	0.001	<0.001	0.001	0.001	0.053	0.001	-5.311	<0.001	0.001	0.001	<0.001
HRS	-0.010	0.012	0.432	-0.004	0.019	0.818	-0.027	0.038	0.483	0.031	0.018	0.075	0.001	0.135	0.893	-0.023	0.030	0.442
MRS	-0.019	0.005	<0.001	-0.025	0.009	0.007	-0.055	0.018	0.002	0.011	0.009	0.213	-0.012	-2.407	0.016	0.006	0.015	0.710
RAV	0.004	0.004	0.315	0.021	0.005	<0.001	0.041	0.009	<0.001	0.010	0.004	0.022	0.015	6.444	<0.001	0.001	0.008	0.942
NSC	0.034	0.006	<0.001	0.073	0.008	<0.001	0.157	0.012	<0.001	0.042	0.006	0.001	0.039	12.703	<0.001	0.003	0.012	0.813
lnLR	2961.840	-	<0.001	2519.130	-	<0.001	3471.521	-	<0.001	2709.929	-	<0.001	3706.141	-	<0.001	556.422	-	<0.001
χ ² D	584.965	-	<0.001	145.877	-	<0.001	275.694	-	<0.001	1280.486	-	<0.001	1051.894	-	<0.001	360.968	-	<0.001
χ ² SE	2091.015	-	<0.001	1644.214	-	<0.001	2372.652	-	<0.001	1605.986	-	<0.001	2345.110	-	<0.001	131.775	-	<0.001
χ ² RA	59.856	-	<0.001	131.823	-	<0.001	210.667	-	<0.001	55.374	-	<0.001	187.151	-	<0.001	0.7816	-	0.9409

Notes: Dependent variable in top row. All values rounded to three decimal places. Left censoring and right censoring in Tobit models is [0,1], [0,1], [-2.39,0], [0,1], [0,1] and [0,1], respectively. All standard errors are Huber/White covariance consistent standard errors. lnLR is log-likelihood ratio F-test of the null hypothesis that all slope coefficients are zero. χ² D, SE and RA are Wald tests of the null hypothesis that the coefficients for all demographic (HSH, PSCH, FEM, AGE, CPC, LPC), socioeconomic (GRI, PWS, PBZ, PIN, PPP, AST) and risk attitude (HRS, MRS, RAV, NSC) are jointly zero, respectively.

Empirical findings

- Larger households, older households, households composed of couples and children, and households drawing larger portions of their income from wages and salaries, business interests, investments and private pensions and transfers have more diversified portfolios.
- Moderately risk-taking households also tend to hold more diversified portfolios.
- However, households with a greater proportion of children and lone parent households tend to have more concentrated portfolios, along with risk-avoiding households and those with insufficient spare cash.
- Wealthier and higher income households also hold less-diversified portfolios, but the effect is very small.
- The share of market assets is higher for higher incomes and assets and with greater portions of their income from investments and private pensions and transfers and lower for larger and older households or households comprising couples and lone parents with children.
- Very interestingly, risk attitudes have no affect, individually or jointly, on the holding of market-related assets, unlike the other five measures of diversification.

Future research directions

- Possibility of matching the cross-section in this study with the earlier HILDA Wave 2 as it also includes a module on household wealth.
- This would provide estimates that are more robust and some indication of changes in these factors over time, though the time span (2002–2006) is very short.
- A second extension would be to examine more closely the life-cycle hypothesis in Australian household assets, debt and net wealth, perhaps also using panel data.
- Finally, a relatively simple extension would be to re-examine the departures from benchmark diversification in the context of a mean-variance efficient portfolio.
- For example, we could use information on asset returns and risk from outside the HILDA Survey (say, indicative equity and property indices, indicator deposit rates, and asset depreciation schedules) to construct an optimal portfolio and use this to evaluate the relative diversification of Australian household asset portfolios.

Questions and comments