Household Finance
PhD Course

Risk Taking - Real Estate and Other Factors

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Real Estate and Leverage

Lifecycle Model – Real Estate

$$\max_{\{C_t, w_{t-1}\}_{t=1,\dots T}} E_0\left[\sum_{t=1}^{T} \frac{1}{\Delta^t} u(C_t)\right]$$

s.t. $W_{t+1} = \left(1 + r_f + w_t r_{t+1}^e\right) W_t + L_{t+1} - C_{t+1}$

vs

$$\max_{\{C_t, w_{t-1}, H_t, O_t\}_{t=1,\dots T}} E_0\left[\sum_{t=1}^{T} \frac{1}{\Delta^t} u(C_t^{1-\omega} H_t^{\omega})\right]$$

Owner: $W_{t+1} + P_{t+1} H_{t+1} =$

$$= \left(1 + r_f + w_t r_{t+1}^e\right) W_t + P_t H_t (1 + r_{h,t+1} - \xi) + L_{t+1} - C_{t+1}$$

Renter: $W_{t+1} = \left(1 + r_f + w_t r_{t+1}^e\right) W_t - \rho_{t+1} H_{t+1} + L_{t+1} - C_{t+1}$

Composite Consumption

- Residential real estate provides housing services and generates utility

$$u(C_t^{1-\omega} H_t^{\omega})$$

  - H_t is the number of sq mt the agent owns or rents

- The parameter $\omega \in (0,1)$ regulates the preference for housing services
  - Everyone has to live somewhere ($u'(0) = \infty$)
  - We are born short of housing

- Two ways to obtain housing services
  - Renting
  - Owning

Owners in *t* and *t*+1

$$W_{t+1} + P_{t+1}H_{t+1} =$$

$$= \left(1 + r_f + w_t r^e_{t+1}\right)W_t + L_{t+1} - C_{t+1} +$$

$$+ P_t H_t (1 + r_{h,t+1} - \xi)$$

- P_t price per sqmt at time *t*
- $r_{h,t}$ net price appreciation on real estate during period *t*
- ξ maintenance cost
- Note: only borrowing for levered position in liquid risky assets

Real estate generates housing services (consumption) and is a form of investment

- Contributes to wealth accumulation with the return $r_{h,t+1}$
- Risky investment because of fluctuations in selling price P_{t+1}

Renters in *t* and *t*+1

$$W_{t+1} = \left(1 + r_f + w_t r_{t+1}^e\right) W_t - \rho_{t+1} H_{t+1} + L_{t+1} - C_{t+1}$$

- ρ_t rent per sqmt at time *t*
- Renters do not accumulate wealth through housing
- Rent fluctuations represent risk for renters
- In competitive rental markets (if ξ=0)

$$P_t = \sum_{\tau=1}^{\infty} m_{t,t+\tau}\, \rho_{t+\tau}$$

Real Estate: Decisions

$$\max_{\{C_t, w_{t-1}, H_t, O_t\}_{t=1,\dots T}} E_0 \left[\sum_{t=1}^{T} \frac{1}{\Delta^t} u(C_t^{1-\omega} H_t^{\omega}) \right]$$

Owner in *t*+1 ($O_{t+1} = 1$):

$$W_{t+1} + P_{t+1} H_{t+1} =$$

$$= \left(1 + r_f + w_t r_{t+1}^e\right) W_t + L_{t+1} - C_{t+1} + O_t P_t H_t (1 + r_{h,t+1} - \xi)$$

Renter in *t*+1 ($O_{t+1} = 0$):

$$W_{t+1} + \rho_{t+1} H_{t+1} =$$

$$= \left(1 + r_f + w_t r_{t+1}^e\right) W_t + L_{t+1} - C_{t+1} + O_t P_t H_t (1 + r_{h,t+1} - \xi)$$

- House size H_{t+1} given tenure decision
  - House size is not continuous in reality
  - Agents might face a minimum size constraint

Ownership and Stocks

$$W_{t+1} + P_{t+1}H_{t+1} = \left(1 + r_f + w_t r^e_{t+1}\right)W_t + L_{t+1} - C_{t+1} +$$
$$+P_t H_t (1 + r_{h,t+1} - \xi)$$

- Households have to sell liquid assets to buy real estate wealth
  - W_t ↓ and H_t ↑

  and thus are less willing to incur the stock market participation cost: ↓ participation
- Housing investment is risky (background risk), and it is positively correlated with the stock market, hence it crowds out stock investment
  - $corr(r^e_{h,t}, r^e_{t+1})$ is 21% in Sweden
  - Lower portfolio risky share w_t conditional on participation
  - Flavin and Yamashita (2002), Cocco (2004)

Housing as a Hedge

We are all born short of housing

- Owners are hedged against rent fluctuations
- Housing investment risk is limited by
  - the tenure horizon
    - Owners with occupancy of infinite horizon never face capital gain risk
  - the spatial correlation of house prices
    - if prices in the new location of residence are the same as the old, owners are perfectly hedged
  - the autocorrelation in house prices
    - Is house prices are very persistent over time, moving is not risky even at short horizons
- Ownership might be less risky than renting and thus might even encourage stock participation
  - Sinai and Souleles (2005)

Experiment: Homeownership

Institutional background

- Stockholm as of 2000: **3 municipal landlords** owned 110,000 rental apartments (30% of all apts)
- **Municipal rental properties** are used as **benchmarks** in the rent-setting for all rental properties
- **Mass-privatization** in Stockholm 1998--2004 (politically motivated)
  - 12,200 municipal apartments privatized
  - Households formed hundreds of co-ops
- April 1st 2002: **Stopplag** law comes into effect, adding an additional layer of approval to the privatization process
  - Only municipal properties that are not critical benchmarks in the rent-setting can be privatized
  - Local county boards given mandate to approve or deny privatization attempts based on this principle

Treatment and Control

38 co-ops/46 buildings pending as of April 1, 2002

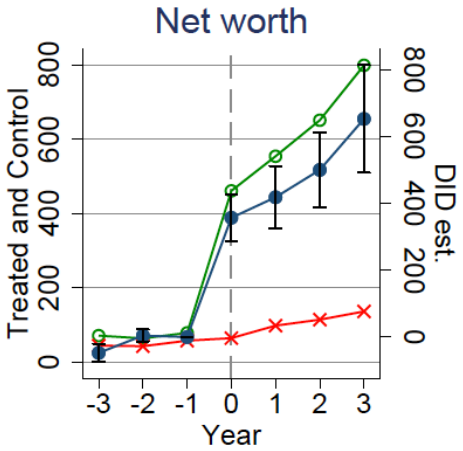
- **Treated**: 13 co-ops/13 buildings approved for conversion
- **Control**: 25 co-ops/33 buildings denied
  - One very large one-bedroom apartment (54 sqm) in the building is unique in the neighborhood.
  - Some studios, with area 17 to 25 sqms, are unique in the neighborhood.
  - The only municipal building in the neighborhood with an elevator
- From the perspective of the household, **denial is random**
  - Building characteristics are balanced
  - Similar behavior of treated and control households before approval decision
- 556 households are treated (become homeowners)
- 1347 households in the control group (remain renters)

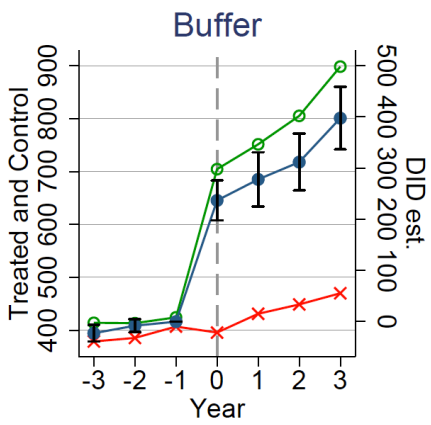
Random Credit Access

The municipal landlords set the asking price so that they break even

Cash neutrality: Co-op dues + mortgage payment = rent

Credit access: 100% loan-to-asking price < 80% loan-to-market value





Treated households become **richer** in the form of housing wealth

Treated households gain borrowing capacity (**buffer**)

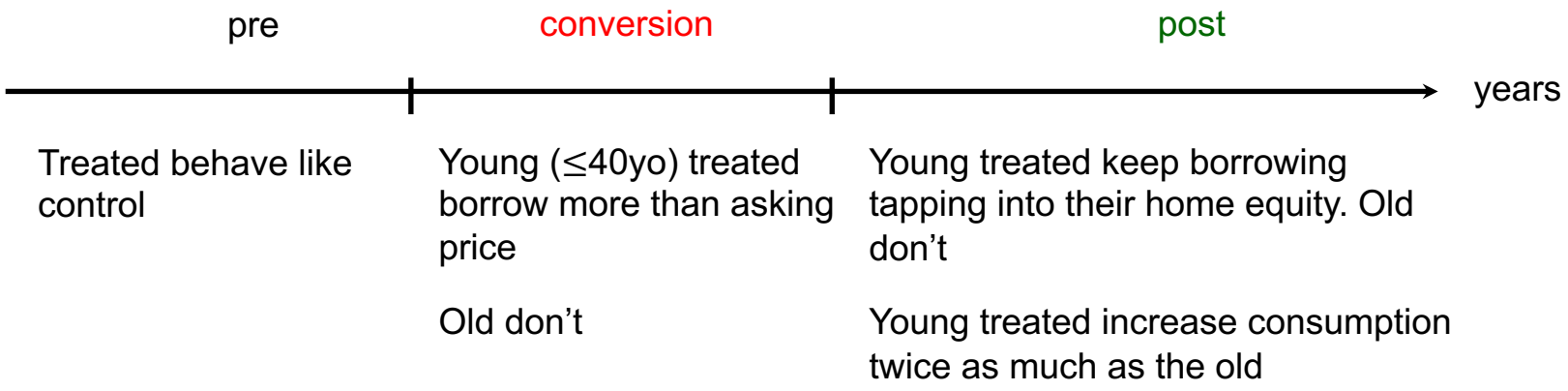
Treated Control DID est. 90 % C.I.

Evidence: Consumption Smoothing

Post conversion, compared to the control, **treated** households

- **consume** more
- **borrow** more

… **on average** … not everyone behaves the same!!

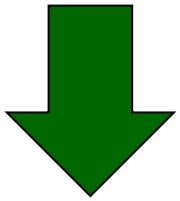


- Households face **borrowing constraints** that are more severe for young households
- When access to credit is restored, households borrow to **smooth consumption** over the life-cycle, as predicted by theory
- Young and old households do not exhaust their borrowing buffer

Evidence: Precautionary Savings

We identify households that face an income decline of 25% or more

- **treated** households which experience the income shock subsequently tap into their buffer to **maintain their pre-shock consumption level**
- the consumption in the **control** group falls 1-to-1 with the income shock



- Households save by maintaining debt capacity through home equity
- … in the face of adversities, they borrow against home equity and are able to smooth consumption across states of the world

The Collateral Effect

- Housing equity allows households to relax their borrowing constraint and smooth consumption …
- … over time
  - young households are able to borrow against their labor income in order to consume
- … across states of the world
  - households that negative income shocks are able to borrow against their housing equity and maintain their consumption level pre-shock
  - older households, who are in the wealth accumulation part of their lifecycle participate more and save a larger fraction of their financial wealth in risky financial assets

Renting and Stocks

$$W_{t+1} = \left(1 + r_f + w_t r_{t+1}^e\right) W_t - \rho_{t+1} H_{t+1} + L_{t+1} - C_{t+1}$$

- Renting allows households to separate housing consumption choice from housing investment choice
- Rents are volatile and thus discourage investment in stocks
  - Limited effect since rents mostly represent a source of background risk
- Since stocks are correlated with real estate, perspective buyers have an incentive to buy stocks as a hedge for the future home purchase (Yao and Zhang, 2005)
  - Rationale for home bias
  - Renters should participate more and invest a larger portfolio share in stocks: against evidence (Vestman, 2018)

Real Estate

Risky investment

- *discourages* households from taking financial risk and thus crowds out risky financial assets such as stocks and funds
  - Like for human capital there is a correlation and a background risk effect
  - Capital gain risk is limited by tenure horizon, spatial correlation and persistence

Provides residential services

- residential real estate is a hedge against fluctuations in rents thus *encourages* risk taking

***Residential** real estate has both functions*

***Commercial** real estate only represents a risky investment*

Exogenous Leverage

Borrowing constraints

- reduce risk taking when binding (mechanically), and because they might be binding in the future
  - a higher risky share implies a larger probability of hitting the borrowing constraint in the future and thus ending up in a suboptimal portfolio allocation

Default risk

- households might not be able to service their debt after bad income shocks
- variable interest rate mortgages expose households to the risk of fluctuations in interest rates
- fixed rates mortgages are not a good inflation hedge

Leverage discourages financial risk taking

Cvitanic and Karatzas (1992), Grossman and Vila (1992)

Summary: effect on risk taking

Financial wealth: +/-, effect depends on:

- Merton: no efffect
- Nature of HC: +/-
- Habit preferences: +, affects also the elasticity

Close to zero for the very rich

High for the poor

Human capital: +/-

Habit: -

- Proxies can be past average income, family size, house size

Real Estate: residential +/-, commercial –

Leverage: -

How do household choose their portfolios?

Empirical Evidence

Empirical Evidence: Previous Literature

Is the financial wealth elasticity of the risky share positive?

Cross Section

- YES

  Cohn, Lewellen, Lease and Schlarbaum 75; Friend and Blume 75; Guiso, Jappelli, and Terlizzese 96; King and Leape 98; Guiso, Haliassos and Jappelli 02, Lupton 02, Vissing-Jorgensen 02, Calvet, Campbell, and Sodini 07, Palia, Qi and Wu 09

- Regressors might proxy for household unobservables

Panel Data

- OLS Chiappori and Paiella (08): NO
- IV Brunnermeier and Nagel (AER 08): NO

- Results are sensitive to the validity of the instruments
- Cannot test persistent variables

Individual Fixed Effect: Dynamic Panel

$$\ln(w_{h,t-1}) = \delta_{0,t-1} + \alpha_h + \eta \ln(W_{h,t-1}) + \varepsilon_{h,t-1}$$

$$\ln(w_{h,t}) = \delta_{0,t} + \alpha_h + \eta \ln(W_{h,t}) + \varepsilon_{h,t}$$

$w^p_{h,t}$

$$\Delta_t \ln(w_{h,t}) = \delta_t + \eta \Delta_t \ln(W_{h,t}) + \varepsilon_{h,t} - \varepsilon_{h,t-1}$$

Two issues:

1. Passive portfolio variations
2. Endogenity

   liquid wealth at *t* depends on the risky share chosen at *t*-1
   (need an instrument uncorrelated with the error at *t*-1)

Novel Identification Strategy: TWINS

Does the richer twin have a larger risky share?

True and tried method in Labor Economics

- Taubman (AER 76), Bronars and Grogger (AER 94), Ashenfelter and Krueger (AER 94), Ashenfelter and Rouse (QJE 98), Behrman and Rosenzweig (AER 00)

Controls for ability, upbringing, expected inheritance or genes

- 25% to 45% of individual variation in risk taking due to genes (Cesarini et al. QJE 08, JF 09; Barnea, Cronqvist and Siegel JFE fort.)

Twin Studies Methodology

Cross sectional regression

$$\ln(w_{i,j,t}) = \alpha_t + \eta \ln\left(W_{i,j,t}\right) + \gamma' x_{i,j,t} + \varepsilon_{i,j,t}$$

year fixed effect

Twin regression

$$\ln(w_{i,j,t}) = \alpha_{i,t} + \eta \ln\left(W_{i,j,t}\right) + \gamma' x_{i,j,t} + \varepsilon_{i,j,t}$$

yearly pair fixed effect

$f_{i,j,t}$ log of financial wealth of twin *j* in pair *i* in year *t*

$x_{i,j,t}$ characteristics of twin *j* in pair *i* in year *t*

Twin Pair Fixed Effect

Coefficient estimates in the cross sectional regression are biased if there are **latent variables** that

1. affects risk taking
2. are correlated with observable characteristics

Twin regressions provide unbiased estimates if the **twin pair fixed effect** α_{it} is a good **proxy** for latent characteristics

- observable characteristics do not significantly explain latent variables in addition to the twin pair fixed effect

Evidence on twin pair fixed effect's

1. impact on coefficient estimates
2. explanatory power

Twin vs Cross-Sectional Regressions

	Yearly Fixed		Yearly Twin Pair Fixed Effects	
	(4)			
	Estimate	*t*-stat	Estimate	*t*-stat
Financial characteristics				
Log financial wealth	0.231	38.10	0.223	24.60
Log residential real estate wealth	0.005	2.97	0.002	1.03
Log commercial real estate wealth	-0.008	-6.04	-0.005	-2.43
Leverage ratio	-0.007	-2.84	-0.006	-2.46
Human capital and income risk				
Log human capital	0.020	2.10	0.002	0.19
Beta of income innovation	0.032	1.37	0.027	1.09
Permanent income risk	-0.384	-2.31	-0.276	-1.32
Transitory income risk	-0.120	-2.86	-0.073	-1.79
Entrepreneur dummy	-0.200	-4.93	-0.257	-4.89
Unemployment dummy	-0.090	-3.89	-0.075	-2.55
Habit				
Log internal habit	-0.111	-5.30	-0.089	-2.82
Log external habit	-0.059	-1.06	0.038	0.44
Demographic characteristics				
High school dummy	0.116	5.27	0.046	1.33
Post-high school dummy	0.066	4.60	0.037	1.50
Number of adults	-0.110	-5.30	-0.071	-2.38
Number of children	-0.037	-5.02	-0.050	-4.37
Wealth-weighted gender index	-0.029	-1.33	-0.076	-2.49
Adjusted R^2	11.5%		19.1%	
Number of observations	55 898		55 898	
Number of twin pairs	8 394		8 394	

Risk taking increases with financial wealth: habit

Residential RE does not crowd out stocks, but commercial RE does: residential RE as a hedge

Leverage discourages risk taking

Human capital and its beta does not affect risk taking

Income risk discourages risk taking

Households with high standards of living (internal habit) or consumption commitments (family size) take less financial risk: internal habit

Twin vs Cross Sectional Regressions

Twin regression

- estimates the elasticity of the risky share at 22.3% (vs 23.1%)
- confirms the findings of the cross sectional regression and the previous literature but some regressors become insignificant
  - differences in **education** might proxy for ability and upbringing in explaining risk taking
  - **income risk** might be correlated with risk tolerance
  - however, income risk is measured with error (human capital and permanent income risk are significant in the identical twin regression)
- Adjusted R^2 of the regression with yearly twin pair fixed effects is almost twice the R^2 of the pooled cross sectional regression with time fixed effects

Twin Regressions - Communication

	All twins				Identical twins			
Communication	**Infrequent**		**Frequent**		**Infrequent**		**Frequent**	
	Coeff	**t-stat**	**Coeff**	**t-stat**	**Coeff**	**t-stat**	**Coeff**	**t-stat**
Financial Characteristics								
Log financial wealth	0.241	11.00	0.205	8.18	0.220	5.45	0.240	5.47
…								
Fixed Effects	yearly-twin		yearly-twin		yearly-twin		yearly-twin	
Coefficient of determination	15.32%		27.33%		15.02%		40.24%	
Fixed effect	4.63%		19.73%		6.95%		32.42%	
Log financial wealth	9.96%		7.46%		8.25%		11.41%	
Other observable characteristics	2.16%		2.50%		2.95%		4.71%	
Correlation of characteristics and fixed effect	3.09%		-5.99%		-12.34%		-12.54%	

- Consistent estimates of the financial wealth elasticity
- For twins that communicate frequently the coefficient of determination is much higher and reaches 40.2% for identical twins (with the fixed effect explaining 32.4%)
- Even for monozygotic twins that communicate infrequently the fixed effect has low explanatory power

Disentangling Nature vs Nurture

ACE decomposition

- identical twins have the same genes whereas fraternal twins have only 50% of their genome in common: genetic effect $2(\rho_{MZ} - \rho_{DZ})$
- Most recent literature argues interaction between nature and nurture

Genetic effects can be measured at best by considering twins reared apart at birth

- There are too few cases for statistical inference

Twins that communicate infrequently?

- communication strongly affects the estimated genetic component

ACE Decomposition	No Controls Genetic Component	With Controls Genetic Component
Frequent communicators	28.19%	31.52%
Infrequent communicators	8.53%	12.21%

The Financial Wealth Elasticity

Poor → Rich

Financial Wealth Elasticity of the Risky Share

The financial wealth elasticity of the risky share is strongly decreasing with financial wealth

- consistent with habit formation

Does the habit positively affect the elasticity?

Does the elasticity depend on other household and portfolio characteristics?

η_{it} is a linear function of within pair average financial wealth, household and portfolio characteristics

$$\eta_{i,t} = \eta_0 + \eta_1 f_{i,t} + \psi' x_{i,t}$$

Financial Wealth Elasticity of the Risky Share

	Regression (1)				Regression (2)			
	Direct Effect		Interacted		Direct Effect		Interacted	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
Financial Characteristics								
Log financial wealth	0.216	24.70	-0.104	-11.60	0.224	25.50	-0.102	-10.90
Log residential real estate wealth	0.002	0.73			0.002	0.98	0.007	2.91
Log non-residential real estate wealth	-0.004	-1.83			-0.004	-1.88	-0.001	-0.77
Leverage ratio	-0.002	-0.65			0.000	0.06	0.004	1.16
Human Capital and Income Risk								
Log human capital	0.003	0.25			-0.001	-0.04	-0.019	-1.64
Permanent income risk	-0.264	-1.28			-0.173	-0.81	-0.065	-0.28
Transitory income risk	-0.052	-1.28			-0.035	-0.79	0.023	0.42
Beta of income risk wrt portfolio return	0.027	1.06			0.032	1.09	-0.018	-0.69
Entrepreneur dummy	-0.257	-4.91			-0.241	-4.61	-0.039	-0.79
Unemployment dummy	-0.069	-2.35			-0.059	-2.02	0.050	1.53
Habit								
Log internal habit	-0.051	-1.58	0.137	5.79	-0.015	-0.47	0.034	1.17
Log external habit	0.029	0.34			0.026	0.30	-0.040	-0.50
Demographic Characteristics								
High school dummy	0.043	1.27			0.039	1.16	0.030	1.06
Post-high school dummy	0.032	1.31			0.027	1.08	-0.013	-0.62
Number of adults	-0.103	-3.36			-0.102	-3.35	0.132	4.09
Number of children	-0.060	-5.24			-0.071	-6.08	0.057	5.48
Wealth-weighted gender index	-0.066	-2.17			-0.055	-1.76	0.054	1.63
Adjusted R^2	20.04%				20.65%			

Financial Wealth Elasticity of the Risky Share

The financial wealth elasticity of the risky share is highly heterogeneous across investors

The elasticity

- decreases with financial wealth and human capital
- increases with various proxies of habit and consumption commitments

Rebalancing

Merton Model Implications

Optimal/desired risky share:

$$w_t^d = \frac{E_t(r_{t+1}^e)}{\gamma Var_t(r_{t+1}^e)}$$

The change in desired risky share is driven by changes in beliefs, as long as risk aversion is does not change over time.

Return realizations induce passive variations in actual risky share

If belief do not change

- the desired risky share remains constant
- households should rebalance to their previous period risky share

Inertia: the desired and realized risky share might differ

Dynamics of Household Portfolios

Theory

Partial equilibrium:

- if beliefs and risk aversion do not change over time, all investors rebalance to the initial risky share and thus follow contrarian strategies

General equilibrium:

- uninformed investors are contrarian investors (Grossman, 1976; Grossman and Stiglitz, 1976)
- more risk averse investors follow contrarian strategies in equilibrium (Kimball, Shapiro, and Zhang, 2011)

Dynamics of Household Portfolios

Empirical Evidence

Past Performance Sensitivity

- **Contrarian** behavior in direct stockholdings
  - Choe, Kho and Stulz (1999), Goetzmann and Massa (2002)
  - Grinblatt and Keloharju (2000 and 2001b)
  - Disposition effect: Shefrin and Statman (1985), Odean (1998)
- **Trend chasing** behavior in mutual fund flows
  - Ippolito (1992), Sirri and Tufano (1993), Chevalier and Ellison (1997)

Dynamics of Risky Asset Share

- Observe individual asset holdings at end of year t and t+1
- Actual risky shares at t and t+1: $w_{h,t}$ and $w_{h,t+1}$
- Passive share $w^{p}_{h,t+1}$: risky share at t+1 if the household makes no trades during the year

$$w_{h,t+1} - w_{h,t} = \left(w_{h,t+1} - w^{p}_{h,t+1}\right) + \left(w^{p}_{h,t+1} - w_{h,t}\right)$$

Active change $A_{h,t+1}$ Passive change $P_{h,t+1}$

- Portfolio **inertia** implies zero active change $A_{h,t+1}$

Representative Agent

Actual and passive risky share must be the same

$$w_{t+1} = w_{t+1}^{p}$$

Hence the desired share must also be equal to the actual share

$$w_{t+1}^{d} = w_{t+1}^{p}$$

No rebalancing is possible in the aggregate

No inertia is possible in the aggregate

The representative agent must hold all asset supply

Asset prices adjust so the representative agent is willing to do so

Aggregate Risky Share

during	1999	2000	2001	2002
Interest rate	3.1%	3.9%	4.1%	4.1%
MSCI Sweden index	79.2%	-18.0%	-26.8%	-48.6%
MSCI World index (in Swedish Kronor)	27.2%	-7.1%	-11.3%	-37.9%

at the end	1999	2000	2001	2002
Average risky share (equal weighted)	56.5%	56.6%	52.3%	45.2%
Average risky share (wealth weighted)	74.9%	73.7%	66.1%	54.7%

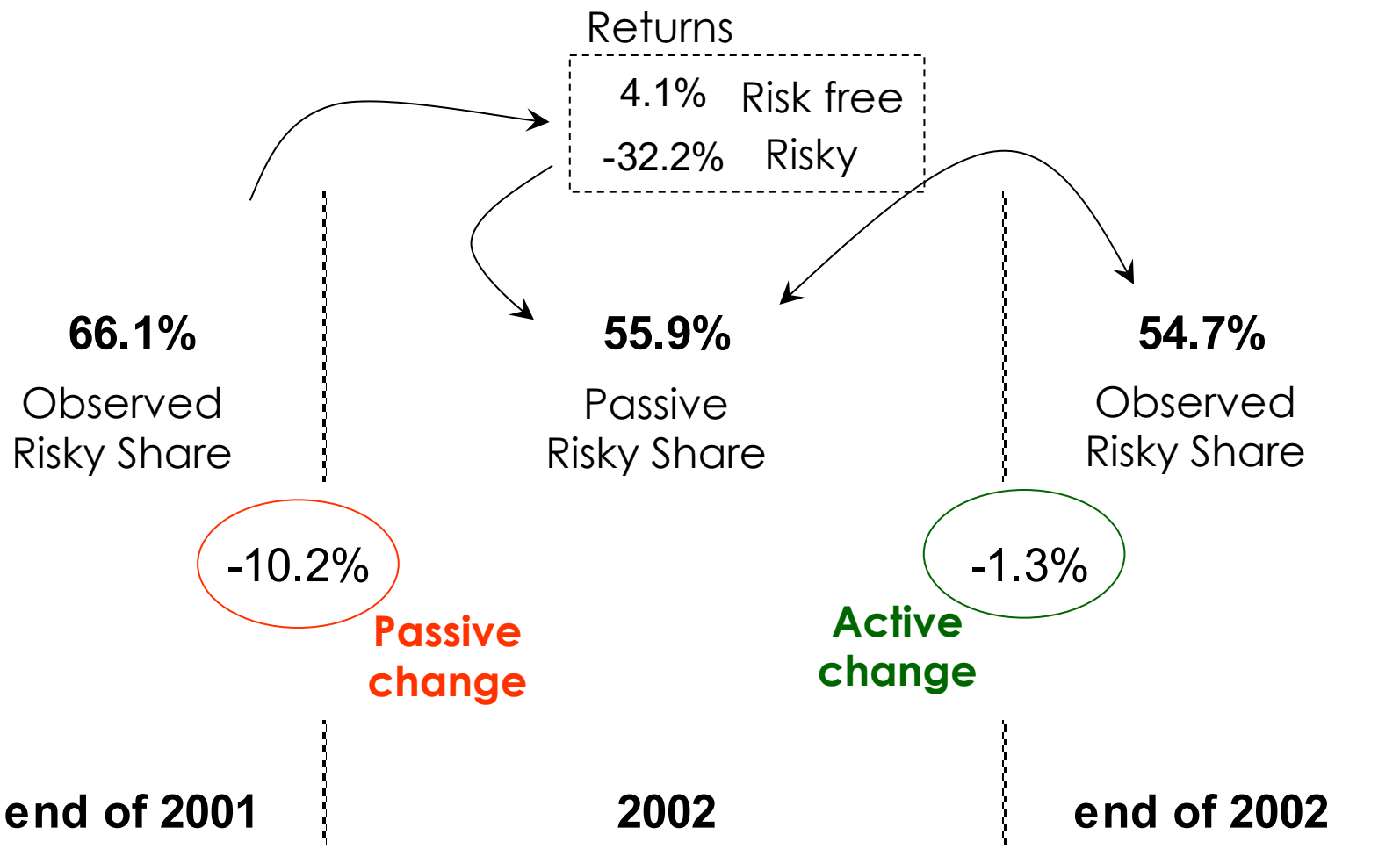
High stock returns in 99, then bear market 00-02

Aggregate share of risky assets declined substantially

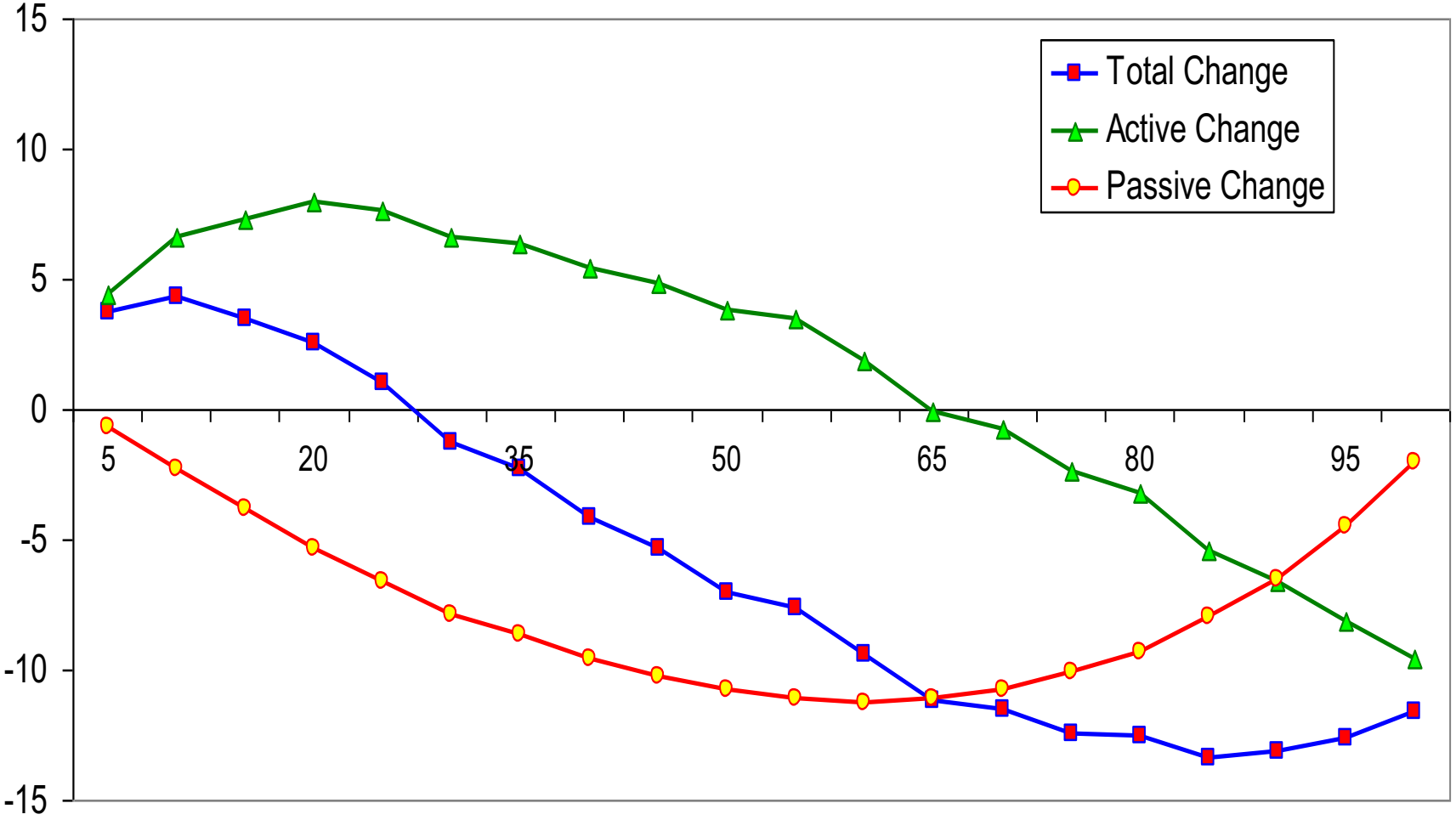
Inertia or decline in the desired risky share?

Active and Passive Changes

Example on the aggregate risky share

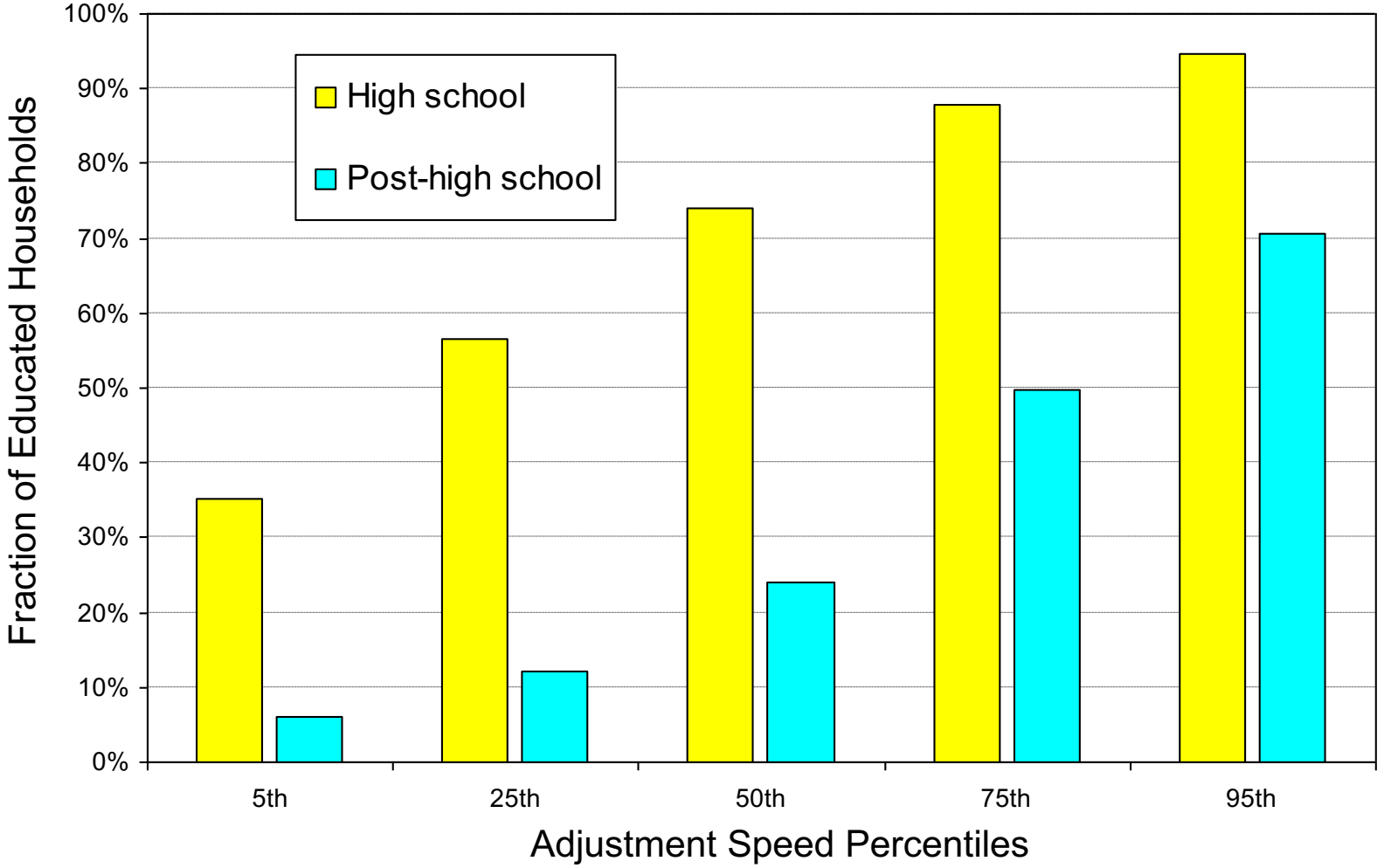


Changes in risky share (01-02)



Regressions of active on passive share reveal that on average household offset about 50% of passive variations in their risky share

Education and Inertia



Inertia → Active Rebalancing

Summary

- How much to invest in risky assets?
- Risk aversion
  - Qualitative and quantitative elicitation
  - Revealed preferences
- Optimal Portfolio choice
  - Merton model
  - Human Capital: valuation, background risk, relation with the stock market
  - Financial Wealth and Habit
  - Real Estate: investment vs hedge?
  - Leverage
- Evidence on risk taking
- Rebalancing: sophistication