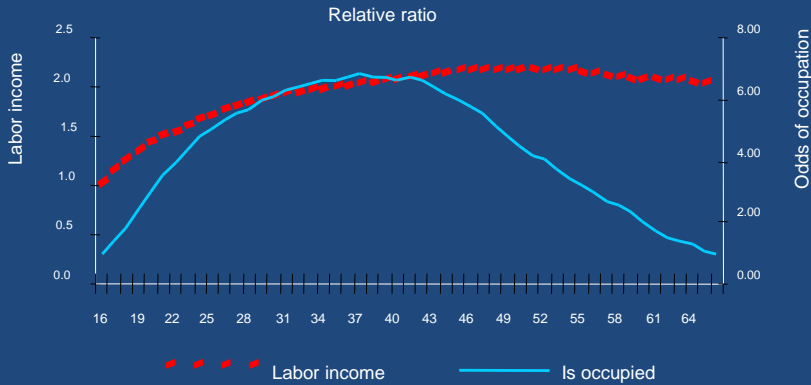


*Temporal Choice, Life-Cycle & PIH Models: Impact of Non-Linearities on Savings and Welfare

Financial Life-Cycle as much as a downfall in labor income at old age there is a rise of income in youth years



Comes from Mincerian and Logistic regression years of age dummies

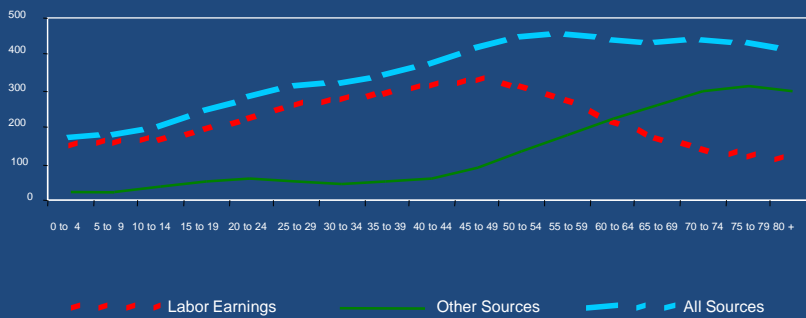
mcneri@fgv.br

Source: FGV Social based on the microdata from PNAD 2002 /IBGE

Key Question pursued: Why does consumption seem to track income across the life-cycle?

Financial Life

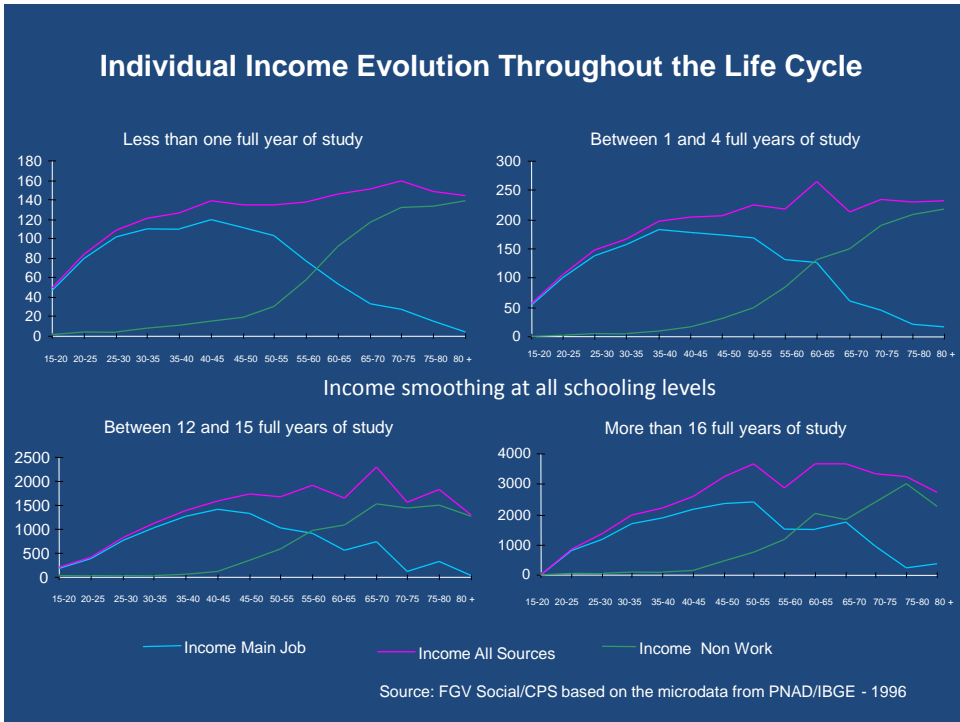
Per Capita Income (R\$)



Evidence of income smoothing in Brazil?

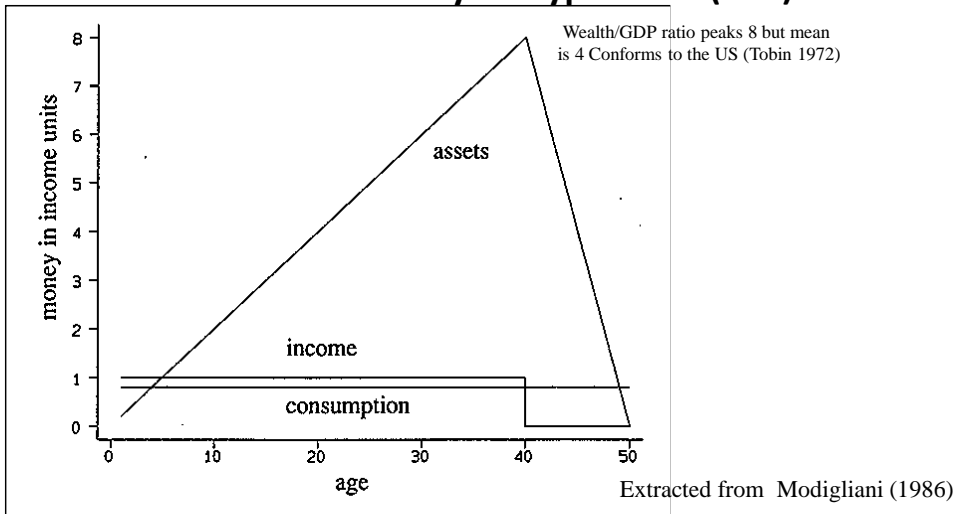
mcneri@fgv.br

Source: FGV Social/CPS based on the microdata from PNAD 2002 /IBGE



*Temporal Choice: Life-Cycle Savings

Consumption, income and assets in a stripped-down version of the Life Cycle Hypothesis (LCH)



** Agregating Over Age Groups

$$C = \int_{t-L-R}^t \frac{L}{L+R} y_0 e^{g\tau} n_0 e^{n\tau} d\tau, \quad Y = \int_{t-L}^t y_0 e^{g\tau} n_0 e^{n\tau} d\tau.$$

$$\frac{C}{Y} = \frac{L}{L+R} \frac{1 - \exp(-(g+n)(L+R))}{1 - \exp(-(g+n)L)}$$

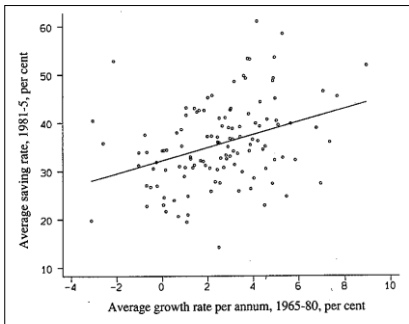
g, n are income & population Growth rates
L, R Work and Retirement Periods
 Deaton (1992)

in %	Growth	National saving rate
Simulating	0	0
The Model	1	4,5
	3	11
	5	15
Empirical Evidence	Growth	National saving rate
OECD		(1- C/Y)
1961-70	4.9	16.6
1971-80	3.4	15.3
1981-7	2.4	10.3

<-Here each 1 pp growth leads to 2 pp Savings

<-Conforms with simple theory in levels

** Savings and Growth Empirical Evidence



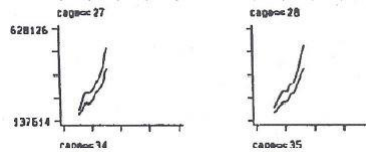
$$(2.3) \frac{s}{y} = \frac{0.06}{(4.2)} + \frac{1.81g_{-1}}{(6.1)} \quad \bar{R}^2 = 0.37$$

Modigliani in his Nobel Lecture celebrates accuracy of LCH predictions

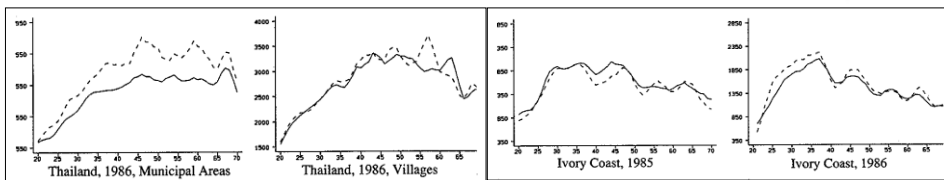
But when you look closely to the microdata...

Consumption seems to track income closely over the Life-cycle.

Cohorts for Taiwan Ages 27 and 28 in 1990 – C and Y

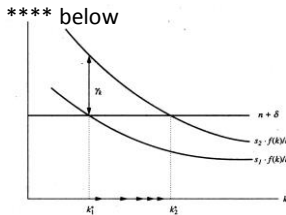


Cross-Country Savings and Growth Equation: 120 Countries Penn World Tables, Summers and Heston (1991)

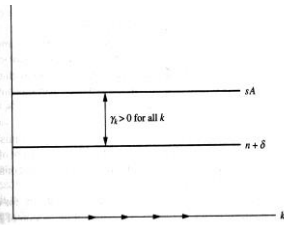


Savings and Growth Empirical Evidence in LCH Growth causes Savings

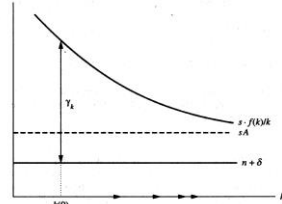
Rise in Savings rate in Solow model
Inverse Causality to LCH & in Income
Levels Growth is Transitory



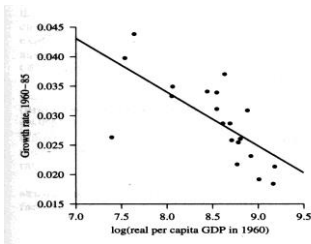
Rise in Savings rate in AK
Endogenous Growth model
Inverse Causality to LCH &
Growth is Permanent



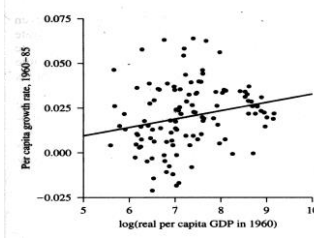
Rise in Savings rate in Endogenous
Growth model Inverse Causality
to LCH, Growth is Permanent plus
Convergence



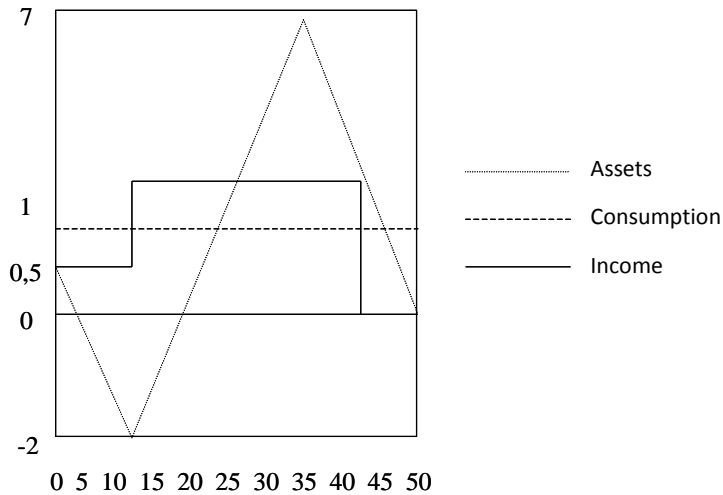
& Convergence in OECD



Lack of Convergence among 118 Countries

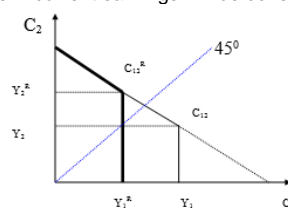
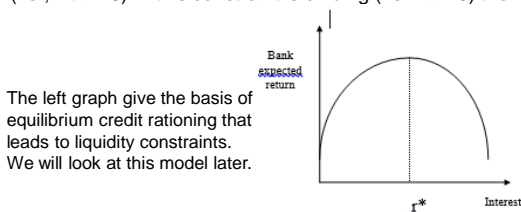


With Youth Age – If the Youth can Contract Loans



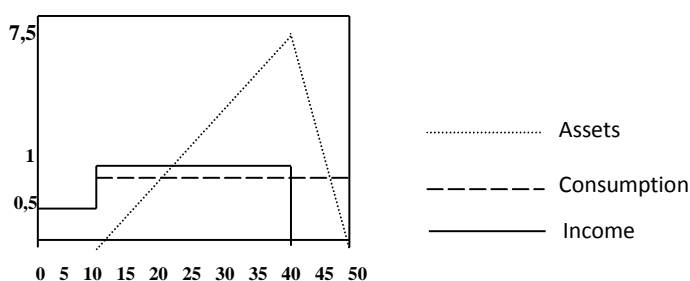
LIQUIDITY CONSTRAINTS

Overview: In terms of consumption/savings decision, credit rationing generates the possibility that agents whose payment capacity is not directly perceived (or warranted) by financial institutions are restricted in the credit market. The credit constraint would generate a high marginal propensity to consume in relation to available net resources (i.e. current income). Typically, the probability of liquidity constraint to be effective is higher among agents whose wealth is human capital intensive (i.e., workers with an income profile with + Slope and/or impatient agents (in the sense of having a rate of time preference above the interest rate). Liquidity constraint can be seen as a response to arguments of Ricardian Equivalence and rational expectations, in which changes in current income in general would not impact consumption over the same period. In the case of liquidity restricted agents, even temporary changes in current income, for example the result of a tax policy, would affect consumption in a one-to-one relationship. One way to incorporate credit constraints in framework is through a non-negativity constraint on net assets (i.e.; $A_t \geq 0$). If this constraint is binding (i.e. $A_t = 0$) then all increases in current earnings will be consumed



If the Youth Can't Contract Loans

B – The Young are liquidity constrained



Liquidity Constraints and Goods Indivisibilities

Financial assets accumulation for the acquisition of indivisible assets may result from lack of access to credit when individual monthly income flows are not sufficient to purchase indivisible and high unit value assets such as real estate or entrepreneurial assets. This situation is induced by the existence of rationing and imperfections in the credit market. In this sense, **liquidity constraints could induce greater and not less accumulation of financial assets**. In spite of the fact that by the very definition that **borrowing is negative savings**.

Saving for the purchase of goods is therefore the result of the interaction of two factors: indivisibility of goods and imperfections in the credit market.

Two key related policy instruments are the maximum number of instalments in durables financing or

Demand for Consumption Savings Canonical Model – to add non linearities

Blanchard and Fischer (1989), section 6.2

$$\text{Max } E \left[\sum_{t=0}^{T-1} (1+\theta)^{-t} U(C_t) / 0 \right] \quad (1)$$

Equation (1) represents the present value discounted of the expected utility conditioned to the information available in $t=0$.

Uncertainty sources are the future work's income and the assets return (z risky asset return)

Subjected to :

$$A_{t+1} = (A_t + Y_t - C_t) [(1+r_t)w_t + (1+z_t)(1-w_t)] \quad (2)$$

$$Y_t \in I_t, A_t \geq 0.$$

Where $[(1+r_t)w_t + (1+z_t)(1-w_t)]$ is the portfolio's return rate.

Euler's equation, (5') ex-post corresponds to: $\left(\frac{1+r_t}{1+\theta}\right)U'(C_{t+1}) = U'(C_t) + \bar{e}_{t+1}; E[\bar{e}_{t+1}/t] = 0$

PERMANENT INCOME HYPOTHESIS (PIH)

• This Model is seen as the modern version of the PIH

• **PIH:** $Max E_t \sum_{i=0}^{\infty} (1+\theta)^{-i} \left(aC_{t+i} - \frac{b}{2} C_{t+i}^2 \right)$ s.t. $A_{t+1} = (1+r)(A_t + Y_t - C_t)$

a) Quadratic and additive utility; i.e. it leads to linear $U'(C_t)$

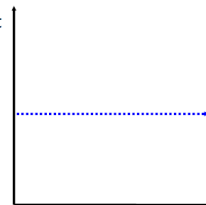
b) Single and predictable interest rate and constant at C_t
the level of the rate of time preference ($r = \theta$);

a) Infinite horizon and rational expectations

• F.O.C (General): $U'(C_t) = E_t \frac{1+r}{1+\theta} U'(C_{t+1})$

• Given $r = \theta$ and quadratic utility: $C_t = E_t C_{t+1}$

• By the rational expectations law: $E_t C_{t+2} = E(E_{t+1} C_{t+2}) = C_t$ then $E_t C_{t+i} = C_t$ for any i



$$C_t = \left(\frac{r}{1+r}\right)A_t + \frac{r}{1+r} E_t \sum_{i=0}^{\infty} \left(\frac{1}{1+r}\right)^i Y_{t+i}$$

• Capital Income $\rightarrow \left(\frac{r}{1+r}\right)A_t$

• Human Capital $\rightarrow E_t \sum_{i=0}^{\infty} \left(\frac{1}{1+r}\right)^i Y_{t+i}$

• Human Capital Permanent Income $\rightarrow \frac{r}{(1+r)} E_t \sum_{i=0}^{\infty} \left(\frac{1}{1+r}\right)^i Y_{t+i}$

How to capture the effects of
acquired prospective social
Transfers (T_t) on consumption:

$$\frac{r}{(1+r)} E_t \sum_{i=0}^{\infty} \left(\frac{1}{1+r}\right)^i T_{t+i}$$

What are the impact of Reforms?

Habit Formation & Conspicuous Consumption

Habit formation and Catching up with the Joneses

Define ex-post utility

$$U_t = \sum_{j=0}^{\infty} \beta^j u(c_{t+j}, v_{t+j})$$

where $v_t = [c_{t-1}^D C_{t-1}^{1-D}]^\gamma$, $\gamma \geq 0$, $D \geq 0$. C_t = aggregate consumption

$\gamma=0$: *time-separable*

$\gamma>0, D=0$: *catching up with the Joneses* (consumo conspícuo)

$\gamma>0, D=1$: *habit formation* (efeito catraca)

Another time effect: 1. As new social standards on consumption are established asymmetry the Impact of adverse shocks is bigger than of positive shocks across the whole distribution,

Distributive Effect: Catching up with the Jones: Inequality Makes people worse off

Precautionary Savings Demand (induced by income uncertainty)

$$\max E_t [\sum (-1/\alpha) \exp(-\alpha C_t)/0]$$

Subject to: $A_{t+1} = (A_t + Y_t - C_t)$ and $Y_t = Y_{t-1} + e_t$ $e_t \sim N(0, \sigma)$

- The consumer has absolute and constant aversion to risk, with coefficient α and lives for T periods. The subjective tax discounted is equal to the interest rate without risk, and both are equal to zero. The work income follows a random path with innovations equally distributed.
- From the problem's First Order Condition, we observe that the optimum consumption satisfies the following Euler equation:

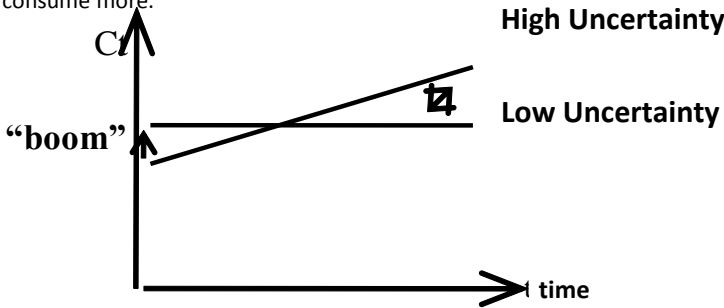
$$C_{t+1} = C_t + (\alpha\sigma)/2 + e_t$$

- The savings would be equal to:

$S_t = - [1/(T-t)]A_t + (\alpha (T - t - 1) \sigma)$ as people ages t rises and Savings falls for both Life-Cycle and Precaution motives

Precautionary Savings Demand (due to income uncertainty and $U''' > 0$)

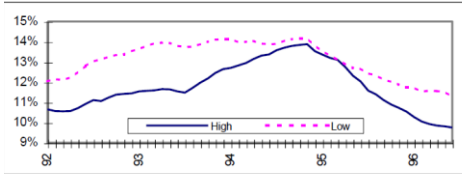
As people age (or as time passes) uncertainties are solved and individuals allow themselves to consume more.



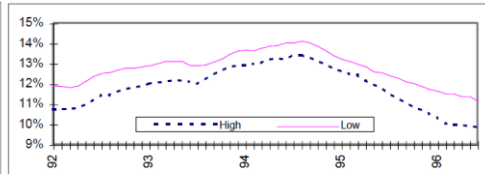
Stabilization Effect due to controlling inflation or reducing directly income risk in

Variability of individual monthly earnings over 4 months using longitudinal data PME/IBGE

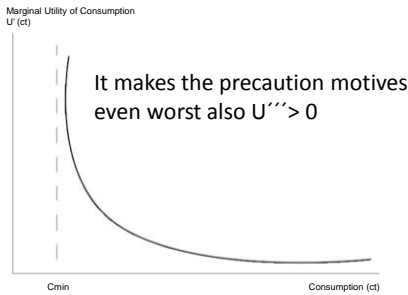
Splitting at the Median per capita Income



Splitting at the Median Heads Schooling level



Survival Constraints



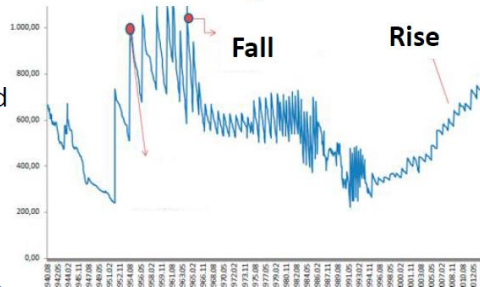
$$U(C_t) = \frac{(C_t - C_{min})^{1-\gamma}}{1-\gamma}$$

As society progresses people are pushed away from low consumption levels where the marginal utility of consumption tends to infinity.

C_{min} is the bliss level of consumption where $\lim_{U' \rightarrow \infty} U' \rightarrow \infty$

Proxy for Individual Income Process

Real Minimum Wage in Brazil 1940 to 2014



- **Bliss Level of Consumption: (C_{min})**
minimum level of consumption below which the possibility of survival of individuals is jeopardized

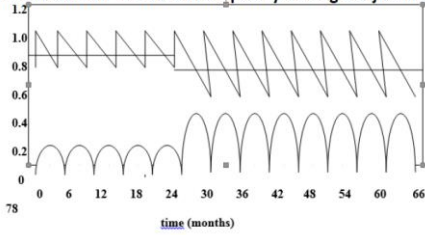
(just like a poverty line)

- $U(C_t) = \frac{\ln(C_t - C_{min})}{1-\gamma}$

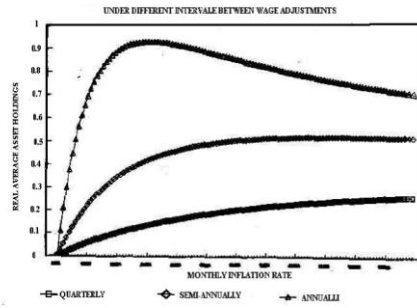
It reinforces Precautionary Motives

Buffer Stock Savings

Real Earnings, Consumption and Asset Holdings Under Constant Inflation with an increase in frequency of Wage Adjustments

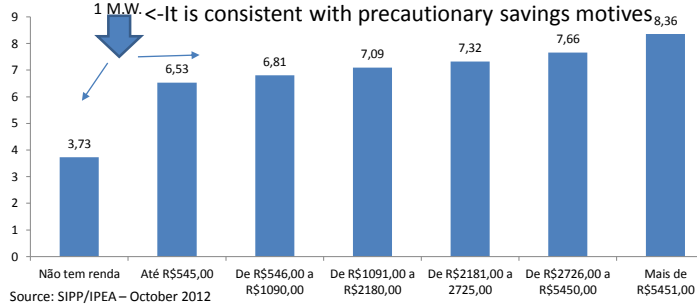


INFLATION AND ASSET HOLDINGS



In Economics we do not have to observe utility just assume its properties and derive its implications. But what if we did observe subjective utility (felicity) functions?

Current Income Brackets and Present Felicity (0 to 10)



$$U_t = \sum_{j=0}^{\infty} \beta^j S_{t+j} u(c_{t+j})$$

S is Survival probability

Deaton (2007) – testable equation from a CRRA

$$\Delta \ln u_t = C \ln a_t + C m_t$$

a is income
m is mortality

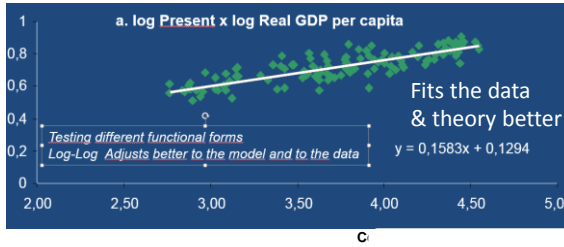
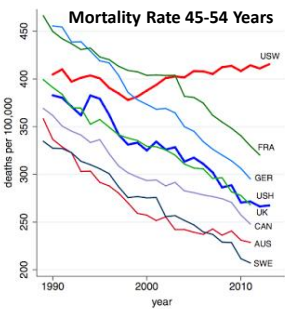
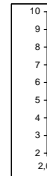
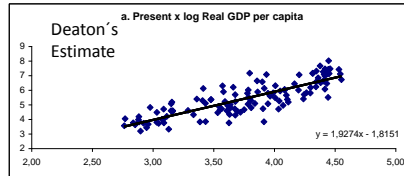
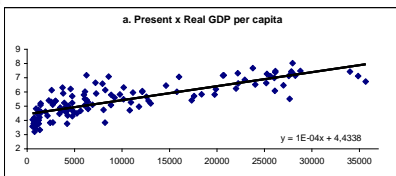
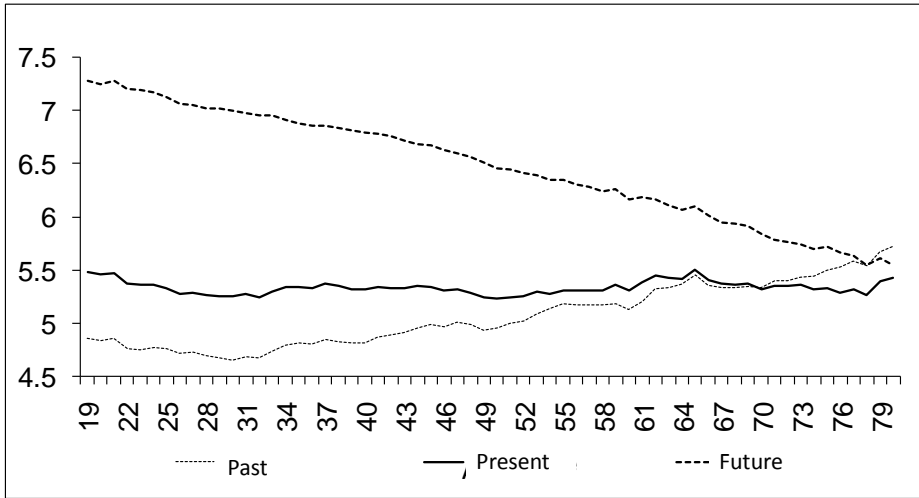


Fig. 1. All-cause mortality, ages 45-54 for US White non-Hispanics (USW), US Hispanics (USH), and six comparison countries: France (FRA), Germany (GER), the United Kingdom (UK), Canada (CAN), Australia (AUS), and Sweden (SWE).



LIFE SATISFACTION AND THE LIFE CYCLE



Source: FGV Social with data from Gallup World Poll 2006

Excess future wrt presente life satisfaction may reflect upward rising consumption levels
 Brazil presents consistently high future life-satisfaction in 5 years. Brazil is also known as *the Country of the Future* and as a *Young Country*. This evidence allows to reconcile both these nicknames and understand Brazil low family savings rate and also high interest rate.

Savings

Only

14,75%

saved money
**In the last 12 months
 (2013)**

01

02

03

04

05

06

07

08

09

10

11

12

Impatience, Savings and Happiness

Who saves more?

INDIVIDUALS WHO ARE MORE RATIONAL/PACIENT SAVE MORE

THE RESEARCH ALLOWS US TO MEASURE THE DEGREE OF IMPATIENCE OF THE INTERVIEWED BY ASKING IF THE INDIVIDUAL RATHERS WIN R\$340 TODAY OR R\$380 NEXT MONTH



Order	Parameter	Estimate	p-Value
3	Impatient	-0,7001	<.0001
9	Optimism when it comes to the Country	0,3029	0,0245

21

Savings – Multivariate Analysis Stepwise

Did you Save in the last 12 months?

Order	Parameter	Estimate	p-Value
	Intercept	-7,2557	<.0001
1	Log of the sum of all household incomes	0,7681	<.0001
2	South	0,8997	<.0001
3	Impatient	-0,7001	<.0001
4	North	-1,9929	0,0008
5	Number of residents	-0,1641	0,0005
6	Own residence	0,445	0,005
7	Northeast	0,4678	0,0054
8	Male	0,3467	0,0074
9	Optimism when it comes to the Country	0,3029	0,0245
10	Net worth over 100 thousand reais	0,5439	0,0125
11	Midwest	-0,7096	0,067
12	Net worth below 10 thousand reais	-0,2967	0,1039

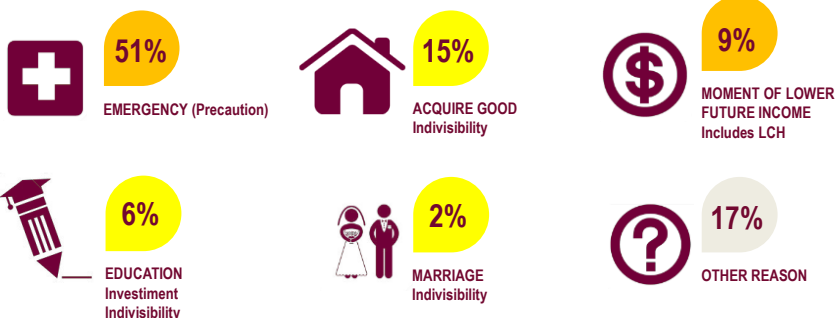
SOUTH and NORTHEAST ARE THE BIGGEST SAVERS

SOURCE: SIPS/PEA 2013 OBS: NOT INCLUDED IN THE FINAL MODEL FUTURE HAPPINESS and INDIVIDUAL INCOME, INCOME and HAPPINESS VARIATION, INCOME SOURCE DIVERSITY, CAPITAL, SUBURBS, RACE, AGE

22

Savings

Main reason pointed out was to prevent from a possible emergency (**precautionary savings**)



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*Savings in Brasil: Micro Empirical Perspective

What are the main reasons for low family savings here?

- Life cycle motives (Demographic Transition & Reforms).
- Precautionary savings (Social Policies & Formalization)
- Interest rates, Impatience (Optimism) & Substitution Effects
- Credit constraints (Consigned and Public credit)
- Indivisibilities: Housing and Durables financing
- Inequality (Indivisibility)
- Habit Lags (Previous Boom & Stocks of Durables)
- Demonstration Effects (Globalization & Internet)

¼ of the Chinese family savings rate & yet mostly tends to fall