THE IMPACT OF POPULATION AGEING ON FINANCIAL MARKETS, INTERMEDIARIES AND FINANCIAL STABILITY

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The core questions

- How ageing impacts on economic agents (households, intermediaries, policy makers)
- How longevity risk is transferred among economic actors
- To what extent the existing new risk-transferring techniques ultimately impact on financial stability
The structure of the project

Modena Unit
- Demand-side: Household portfolio choices in relation with age and ageing
- Intermediaries and financial markets

Bergamo Unit
- Supply side: new ageing-related financial products (pricing and managing problems)
Intermediaries, regulation and financial stability


Financial markets and policy

- Marotta G. (2009), Per una politica lungimirante del credito bancario: vincoli e condizioni, *Cefin Short Notes* n. 7
- Marotta G. (2007), Fondi pensioni ed equity risk premium, *Cefin Short Notes* n. 1
Other related project publications


Household portfolio choices

Theoretical underpinnings and empirical evidence


Household portfolio choices

Empirical analyses

• Household portfolios based on SHIW


• Financial returns

The age-effect on Italian household portfolios

- Dataset: Bank of Italy HA-SHIW
- Descriptive analyses w.r.t. Guiso and Jappelli (2002)
  - different risk-classification of financial assets
  - test the robustness of age-effect to different wealth conditions

Average portfolio examined in 3 dimensions:
1. Over the decade:
   - what has changed?
2. Dividing households into age-classes:
   - age-effect on portfolios?
3. Dividing households by age and net-wealth classes:
   - age-effect even under different economic conditions?
## Financial assets risk-classification

<table>
<thead>
<tr>
<th>Market Credit</th>
<th>Interest Rate</th>
<th>Mixed</th>
<th>Price</th>
<th>Exchange Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower</td>
<td>Current accounts Savings deposits Certificate of deposits Postal deposits Cooperative loans</td>
<td>Postal bonds BOT CTZ CCT BTP Other Govern. Bonds</td>
<td>Investment funds Personal assets managements Repo Non-life insurances Health-insurances Life insurances Pension funds</td>
<td></td>
</tr>
<tr>
<td>Higher</td>
<td>Corp. Bonds</td>
<td></td>
<td>Stocks</td>
<td></td>
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<td>-</td>
<td></td>
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<td>Foreign assets</td>
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</tbody>
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<tbody>
<tr>
<td>Lower</td>
<td>DEPOSITS</td>
<td>GOVERN. BONDS</td>
<td>MANAGED INVESTMENTS + LIFE INSURANCES + PENSION FUNDS</td>
<td>MANAGED INVESTMENTS + LIFE INSURANCES + PENSION FUNDS</td>
</tr>
<tr>
<td>Higher</td>
<td>CORP. BONDS</td>
<td></td>
<td>STOCKS</td>
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<td></td>
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# Average portfolio evolution

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</thead>
<tbody>
<tr>
<td>Deposits</td>
<td>65.15</td>
<td>73.46</td>
<td>67.78</td>
<td>71.45</td>
<td>74.57</td>
<td>74.23</td>
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<tr>
<td>Government bonds</td>
<td>20.94</td>
<td>8.74</td>
<td>8.91</td>
<td>7.27</td>
<td>7.15</td>
<td>7.73</td>
</tr>
<tr>
<td>Corporate bonds</td>
<td>0.97</td>
<td>1.79</td>
<td>2.08</td>
<td>2.53</td>
<td>2.53</td>
<td>2.84</td>
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<tr>
<td>Stocks</td>
<td>5.68</td>
<td>8.44</td>
<td>10.81</td>
<td>9.50</td>
<td>8.53</td>
<td>8.49</td>
</tr>
<tr>
<td>Managed Investments</td>
<td>1.34</td>
<td>2.78</td>
<td>4.23</td>
<td>3.93</td>
<td>3.15</td>
<td>2.54</td>
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<tr>
<td>Life-Insurances</td>
<td>4.54</td>
<td>3.50</td>
<td>3.98</td>
<td>3.70</td>
<td>2.41</td>
<td>2.42</td>
</tr>
<tr>
<td>Pensions Funds</td>
<td>1.26</td>
<td>1.12</td>
<td>1.90</td>
<td>1.27</td>
<td>1.32</td>
<td>1.49</td>
</tr>
<tr>
<td>Foreign Activities</td>
<td>0.12</td>
<td>0.16</td>
<td>0.30</td>
<td>0.36</td>
<td>0.33</td>
<td>0.26</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
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Average portfolio by age and NW, 1995, between 2°-3° quartile
Average portfolio by age and NW, 2006, between 2°-3° quartile
## Comparison with relevant literature

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</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>UK</td>
<td>US</td>
<td>Germany</td>
<td>Italy</td>
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</table>

- **Clear humped-shaped age-profile**, especially for US and UK
- In other studies, age plays a significant role in the participation decision but has less relevance on portfolio composition
- W.r.t. Guiso and Jappelli (2002) our asset classification enhances hump-shape of life-cycle
Main findings

• Italian household portfolios are scarcely diversified

• Several adjustments between 1995-2006:
  
  - market changes (e.g. Gvmt yields reduction, stocks fluctuations)
  
  - social security reforms (e.g. weak increase in pension funds)

• humped-shaped age-effect = evidence supports life-cycle
  
  - over the whole decade ➔ more towards the sample-end
  
  - across NW quartiles ➔ overall robust to wealth conditions (except for lowest quartile and Top 5%)

  - consistent with the empirical literature for other countries

- our asset classification enhances hump-shape w.r.t. Guiso and Jappelli (2002)
What underlying theory/model?

- **Household finance**: field with much interesting research but still lacking in definition and status (cfr. Campbell, AFA 2006)

- Tufano (2009): functional definition of **consumer finance** and historical explanation for lack of attention

- Main question: how do households use financial instruments to attain their objectives?
Positive vs. Normative Analyses

• Positive analysis: how do household invest
  • difficult to measure, complicate to model

• Normative analysis: how should household invest
  • hard to model and hard to solve and calibrate
Household portfolio theory

• The evolution: normative-positive $\Rightarrow$ normative

• Which are the *main stylized facts to be explained*?
  
  • static facts: scarce diversification and stock market participation
  
  • dynamic facts: hump-shape life-cycle pattern of portfolios

• In sum: *heterogeneity* of household portfolios
Determinants of hld portfolios

1. “Genetic”: different genes or different human capital

2. Objectives: can be different due to twofold role of hld (C&S)
   - Lifetime consumption (personal or heirs too)
   - Retirement
   - Both

3. External factors: return distributions, opportunity set, institutional setting, frictions etc.
   - 1. & 2. mainly responsible for heterogeneity
   - Their combination determines the types and quantity of risks the hld faces => portfolio implications
Paradigm and models

- **One** dominating paradigm: expected utility maximization subject to constraints

- **Many** models depending on:
  - static/dynamic
  - hps modelling 1., 2., 3.

\[\downarrow\]

*Life cycle asset allocation problem*

Calls for multiperiod setup ➔ dynamic optimization
Multiperiod setting

- Optimal portfolio and consumption rules
- Seminal papers: Mossin (1968), Merton (1969), Samuelson (1969)
- Summing up, 3 determinants
  1. Time diversification effect: ceteris paribus, longer horizon \(\Rightarrow\) easier consumption smoothing \(\Rightarrow\) younger are more risk tolerant
  2. Wealth effect: for a given discounted wealth, longer horizon \(\Rightarrow\) less consumption each period \(\Rightarrow\) younger less risk tolerant
  3. Repeated risk effect: more risk today \(\Rightarrow\) more or less risk in the future?
- 1. determined by age, 2.&3. depend on risk-aversion
- Common hp time separable CRRA: time diversification effect offsets wealth effect & independence between risk–taking in each period
Myopic portfolios

• Optimal multiperiod portfolio = sequence of one-period optimal portfolios => no age-effect

• 3 main routes away from myopic portfolios
  1. return predictability
  2. preferences (not time separable CRRA)
  3. trading frictions & mkt incompleteness

• Here: concentrate on hld related explanations vs. external ones
  Hld preferences, hld related trading frictions, hld related mkt incompleteness
Specifically

- *Epstein-Zin preferences*: generalization of CRRA based on recursive utility, retain the wealth scale independence, but allow to distinguish between RA and EIS

- **Market incompleteness** here
  - liquidity/borrowing constraints
  - illiquid asset

Typical risks of households:
- Labour income risk => uninsurable
- Longevity risk => illiquid annuity mkt

- CRRA preferences over consumption and bequest, finite horiz.
- Labour income (Y) risk = Transitory + Persistent
- Borrowing constr. = hld cannot capitalize or borrow against future Y → uninsurable labour risk
- Retirement income = const. fraction of labour income
- i.i.d. risk premium
- Choice variables: consumption & portfolio rules
- State variables: cash on hand (W+Y) and persistent component of labour income
Cocco-Gomes-Maenhout, 2005

• model calibrated over real income data (low corr. labour & market risk), numerical solutions

• **Age pattern of portfolio rule: stock investment roughly decreasing in age**

• Consistent with professional rule & popular textbook (Malkiel’s rule): (100-age%) in well diversified stock port.

• **Idea underlying main result:** here labour is a bond-like asset → young rich in labour diversify buying stocks & vicev.

• Result rather robust in many directions (e.g. E-Z preferences)

• **Sensitive** to higher correlation between mkt & labour risks
• Continuos-time model very similar to CGM, but for assuming
• Cointegration between stock (dividend) and labour mkt (aggregate component) ➔
• Optimal portfolio decision: 3 components
  1. Merton-like term: $\mu - r/\gamma \sigma^2$
  2. Term capturing stochastic labour income
  3. Term capturing cointegration

• Age pattern of portfolio rule: investment in stock hump shaped ➔ life-cycle pattern where the peak depends on the coint. coeff. value

- **Idea:** here the risky nature of labour depends on whether cointegration has enough time to act:
  - For *young* (rich in labour) YES => labour is a stock-like asset => diversify with low investment in stocks
  - *Old/Middle aged:* cointegration does not have time to act => bond-like asset, BUT
  - Approaching retirement the implicit bond position in human capital decreases and this effect might prevail *twisting* again portfolios towards bonds for *Old*

- Problem with the fundamental assumption: cointegration tests, low power, can take decades (= lack of data for tests)

- NB cointegration should be made dependent on human capital (i.e. education), observed portfolio peak dependent on human capital
Summing up: reconciling theory and micro-evidence

Mainly labor income risk
(correlation with market risk appropriately modelled)

Stock-holdings

\[ \text{theory/ financial consultants rule of thumb} \]
\[ = \text{what we/other empirical paper find} \]
The role of labour income risk

• Li-Smetters (2011) rationalise hump shaped patterns by including a wage-indexed social security system
• Underlying idea much in line with Benzoni et al.
• Correlation labour and market risk in the long run
Risky assets by education level, 2008
Risky assets by education level, 2006
Risky assets by education level, 1989
Longevity risk considered

Annuity mkt: incomplete, illiquid immediate single premium annuity (force of mortality = Gompertz law)

One more choice variable (optimal annuity level) & one more state variable (the annuity payout)

Annuity = bond-like asset with mortality credit, i.e. excess return over a bond

Question is: is mortality credit enough to compensate for illiquidity? Trade-off between liquid financial savings and illiquid annuities
Horneff-Maurer-Stamos, JEDC 2008

- **Portfolio rule**: as in CGM but in most cases annuities crowd out bonds → mortality credit compensate for illiquidity
- Optimal annuity holding increases with age (NB here as in CGM labour is a bond-like asset)
- Result *sensitive* to correlation of mkt & labour risks and to replacement ratio
- Overall robust demand for annuities at odds with evidence
- Extended to endogenous labour supply Chai et al.(2009)
- Many other papers: Cocco-Gomes(2011) but not asset allocation etc.