Outline

1. Introduction
2. The Model
3. Empirical Results
4. Conclusion
Contribution

- New description of aggregate fundamental risk
- Systematic risk factor created by innovation: displacement risk
- Empirical evidence for displacement risk
- Value-growth factor and the value premium, equity premium
- Long-horizon asset allocation and risk faced by retail investors
Motivation

- Innovation generates systematic risks
- Existing firms may lose market share to competition
  Risk to financial capital
- Human capital of the current generation of workers is less compatible with new technologies than human capital of new generations
  Risk to human capital
- Displacement Risk
Motivation

- Benefits of future technological innovation will be partly captured by the innovators creating new firms and new generations of workers with superior human capital
- Risk sharing is not perfect: no trading with future generations
- Older cohorts of agents cannot hedge displacement risk
- Displacement risk is a priced risk factor
Key Implications

- Standard Consumption-CAPM is misspecified: omits displacement risk
- Value-growth factor captures exposure to displacement risk
- Value premium due to hedging demand for growth stocks
- Long-horizon investing: indexing ≠ keeping up
Consumption Risk

SDF = marginal rate of substitution for the same agent

\[ \frac{\xi_{t+1}}{\xi_t} = \beta \left( \frac{Y_{t+1}}{Y_t} \right)^{-\gamma} \times \left[ \frac{1}{1 - \lambda} \left( 1 - \lambda \frac{C_{t+1,t+1}}{Y_{t+1}} \right) \right]^{-\gamma} \]

Future per-capita aggregate consumption is not the same as the future per-capita consumption of the current population of agents.

Garleanu, Kogan, Panageas (2009)
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Hedging Demand and the Value Premium

- Some firms more innovative than others, higher valuation ratios: growth firms
- Growth and value firms have unequal exposure to innovation shocks ⇒ growth-value factor
- Growth-value factor tracks displacement shocks ⇒ priced risk factor
- Growth firms provide a valuable hedge against displacement risk ⇒ positive value premium
Key Implications

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Long-Horizon Investing

- An average investor cannot beat the market
- Popular advice: index, stay average
- Holding the market does not protect against displacement risk
- A typical investor will fall behind the “market” on average!
- A growth tilt in the portfolio could help mitigate displacement risk, but it is costly
Agents

- Arrive and die randomly each period
- Supply labor to firms, trade in financial markets
- Behave rationally and competitively
Technology

- Representative competitive firm produces the final consumption good using labor and intermediate goods.
- Many intermediate goods produced by monopolistically competitive firms.
- Innovation = Increased variety of intermediate goods.
- Innovation $\Rightarrow$ Higher output and more competition between intermediate-good producers.
Innovation

Inventions, firms, and inventors

- Inventions are patents for production of new intermediate goods
- Intellectual property of inventions belongs to inventors (new firms) and old firms
- New firms can be of “value” and “growth” type
- **Value** firms **produce** and do not invent, responsible for a fraction of production of new goods
- **Growth** firms produce and **invent**, responsible for the rest of production and a fraction of invention
- Old generations capture a fraction of inventions through ownership of growth firms
A fraction of new generation are workers

Workers are born with endowment of hours

Assumption: older workers do not keep up with innovative technologies as well as the younger workers
Asset Markets

- Complete set of state-contingent claims
- Assets are priced by the standard DCF formula
**Equilibrium**

- Consumers (workers and inventors) chose their consumption optimally subject to their budget constraints.
- Firms maximize their profits.
- Markets for labor and goods clear.
Summary

- **Innovation** = Increased variety of intermediate goods

- **Agents**
  - Inventors (own patents/firms)
  - Workers (sell labor)

- **Firms**
  - Value (production, no innovation)
  - Growth (some innovation)
The Displacement Factor

- Theory: can estimate the displacement factor as a change in relative consumption of a group of households:

\[
\log \left( \frac{c^{i}_{t+1,s}}{C_{t+1}} \right) - \log \left( \frac{c^{i}_{t,s}}{C_{t}} \right)
\]

- Use household-level consumption data (CEX, 1984-2003)
- Group all cohorts of households that entered the economy before date \(s\)
The Displacement Factor

Garleanu, Kogan, Panageas (2009)
Empirical Results

- (log) Displacement factor (left axis)
- HML return (right axis)
Correlation: .27

- Diff. aggr. log(consum.) (left axis)
- HML return (right axis)
Correlation: -.01

Garleanu, Kogan, Panageas (2009)
Consumption Cohort Effects

- Time-series dimension of CEX is limited
- Use theory to exploit the cross-section of consumption
- Our model implies existence of consumption cohort effects

\[
\log c_{t,s} = a_s + b_t
\]

- Displacement shocks are the permanent component of consumption cohort effects \(a_s\)
Consumption Cohorts

- Detrended cohorts (left axis)
- Detrended cumulative HML return (right axis)

Garleanu, Kogan, Panageas (2009)
Value Premium

Innovation Betas and Book-to-Market

Long-short B/M portfolios: Decile $i$ — Decile 10: 1927-1995

Garleanu, Kogan, Panageas (2009)
Alternative Measures of Innovation

- We extract innovation shocks from consumption cohort effects
- Can one identify other, more direct proxies for innovation?
- Motivated by the model: changes in the stock of trademarks
- Relate average returns on the book-to-market decile portfolios to innovation betas
Innovation Betas and Book-to-Market


Garleanu, Kogan, Panageas (2009)
Conclusion

- Displacement risk is a fundamental risk factor
- Empirical evidence for displacement risk
- Calibration (not shown) is quantitatively realistic
- Better understanding of the value-growth factor, value premium, equity premium