

The Equity Premium and the One Percent

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Question

Question: Does wealth/income distribution matter for asset pricing?

Intuitive answer: Yes: as the rich get richer, they buy risky assets and drive up prices

*[Statements] that “business is good” and “times are booming” . . . represent the point of view of the ordinary business man who is an “**enterpriser-borrower**.” They do not represent the sentiments of the **creditor, the salaried man, or the laborer** . . .*

—Irving Fisher, “Introduction to Economic Science”, 1910

Motivation

- With complete markets and time- and state-separable utility, a representative agent (RA) exists (Constantinides, 1982)
- **But**, that does not mean that the wealth distribution is irrelevant for asset pricing, because:
 - ① RA's preference in general depends on the initial wealth distribution, and non-standard
 - ② RA constructed using Second Welfare Theorem, but possibility of multiple equilibria (ambiguous comparative statics)
 - ③ Requirement for Gorman (1953) aggregation very strong (identical homothetic preferences)

Contribution

- Theoretical** Show in a heterogeneous-agent GE model that wealth inequality among risk aversion/belief types affects the equity premium:
- equilibrium uniqueness in a two period model with Epstein-Zin agents with heterogeneous risk aversion, belief, and discount factor
 - shifting wealth from less-stock holder to more-stock holder reduces equity premium
- Empirical** Rising inequality (top 1% income share) negatively predicts returns:
- holds in- and out-of-sample in U.S.
 - robust to controls and using top estate tax rate change as instrument
 - holds in post-1970 cross-country panel

Literature

Asset pricing theory Dumas (1989), Wang (1996), Basak & Cuoco (1998), Gollier (2001), Chan & Kogan (2002), Hara, Huang, & Kuzmics (2007), Guvenen (2009), Longstaff & Wang (2012), Bhamra & Uppal (2014), Gârleanu & Panageas (2015), etc.

Return prediction Shiller (1981), Lettau & Ludvigson (2001), Welch & Goyal (2008), Hansen & Timmermann (2015)

Inequality and asset pricing Johnson (2012)

(Simplified) Model

- Standard general equilibrium model with incomplete markets (GEI) and constant relative risk aversion (CRRA) preferences:
 - States: $s = 1, \dots, S$
 - Assets: $j = 1, \dots, J$. Asset j pays A_{sj} in state s
 - Agents: $i = 1, \dots, I$. Agent i has CRRA utility

$$U_i(x) = \begin{cases} \left(\sum_{s=1}^S \pi_{is} x_s^{1-\gamma_i} \right)^{\frac{1}{1-\gamma_i}}, & (\gamma_i \neq 1) \\ \exp \left(\sum_{s=1}^S \pi_{is} \log x_s \right), & (\gamma_i = 1) \end{cases}$$

where $\gamma_i > 0$: relative risk aversion, $\pi_{is} > 0$: subjective probability of state s

- Aggregate endowment $e \in \mathbb{R}_{++}^S$; agent i 's endowment $e_i = w_i e$, where w_i : wealth share (collinear endowments)
- $U_i(x)$ is homogeneous of degree 1 (for convenience); just a monotonic transformation of additive CRRA utility

Definition of equilibrium

- Agent i solves

$$\begin{array}{ll} \underset{x,y}{\text{maximize}} & U_i(x) \\ \text{subject to} & q'y \leq 0, \quad x \leq e_i + Ay, \end{array}$$

where

- $q = (q_1, \dots, q_J)'$: vector of asset prices,
 - $y = (y_1, \dots, y_J)'$: number of shares held,
 - $A = (A_{sj})$: payoff matrix of assets
- Equilibrium $(q, (x_i), (y_i))$ is defined by
 - 1 (Agent optimization) $(x_i, y_i) \in \mathbb{R}_+^S \times \mathbb{R}^J$ maximizes utility,
 - 2 (Market clearing) $\sum_{i=1}^I y_i = 0$

Characterization of equilibrium

Theorem

Let everything be as above. Then there exists a unique equilibrium. The equilibrium portfolio (y_i) is the solution to the planner's problem

$$\begin{aligned} & \underset{(y_i) \in \mathbb{R}^I}{\text{maximize}} && \sum_{i=1}^I w_i \log U_i(e_i + Ay_i) \\ & \text{subject to} && \sum_{i=1}^I y_i = 0. \end{aligned}$$

Letting $\sum_{i=1}^I w_i \log U_i(e_i + Ay_i) - q' \sum_{i=1}^I y_i$ be the Lagrangian with Lagrange multiplier q , the equilibrium asset price is q .

- Note: Pareto weights (w_i) are exogenous

General model

- General model:
 - Two period ($t = 0, 1$), two assets (stock and bond)
 - $I + 1$ agents, $i = 0$: hand-to-mouth laborer with income share $1 - \alpha_t$; $i \geq 1$: capitalist with income share $\alpha_t w_i$ with $\sum w_i = 1$
 - EZ preference with unit EIS, arbitrary discount factor, risk aversion, and belief
- Main theoretical results:
 - ① Unique equilibrium and analytical characterization
 - ② Equity premium independent of labor income share $1 - \alpha_t$
 - ③ Shifting wealth from bond investor to stock investor reduces equity premium (Shifting wealth from impatient to patient investor increases P/D ratio)
- **Note:** all top wealth & income share data include poor agents in population, but theoretically the poor are irrelevant, at least for equity premium (only within-capitalist inequality matters)

Who holds more stocks?

- Individual problem reduces to $\max_{\theta} E_i[u_i(R(\theta))]$, where
 - θ : fraction of wealth invested in stock,
 - $R(\theta) = R\theta + R_f(1 - \theta)$: gross return on portfolio,
 - $u_i(x) = \frac{1}{1-\gamma_i} x^{1-\gamma_i}$: CRRA utility, and
 - E_i : expectation under agent i 's belief
- A risk tolerant or optimistic agent is the natural stock holder

Proposition

- 1 *Suppose agents have common beliefs. If $\gamma_1 > \dots > \gamma_I$, then $0 < \theta_1 < \dots < \theta_I$.*
- 2 *Suppose agents 1, 2 have common risk aversion. If agent 1 is more pessimistic, then $\theta_1 < \theta_2$.*

Does inequality predict returns?

- According to theory, shifting wealth from less- to more-stock holder reduces equity premium
- Using household asset allocation data (e.g. from Survey of Consumer Finances), many papers show that the rich are more heavily invested in stocks (Carroll, 2002; Campbell, 2006; Buccioli & Miniaci, 2011; Calvet & Sodini, 2014)
- Hence rising inequality should negatively predict subsequent returns

Proxying capitalist inequality from income inequality

- Using Piketty & Saez (2003) top income share data w/o realized capital gains, by Taylor approximation

$$\text{KGR}(x) := \frac{\text{top}(x) - \text{top}(x)^{\text{excg}}}{1 - \text{top}(x)} \approx \alpha \rho_x \frac{Y_x^k}{Y^k},$$

where

- $\alpha = Y^k/Y$: aggregate capital income share,
 - ρ_x : fraction of realized capital gains income to capital income for top $x\%$,
 - Y_x^k/Y^k : capital income share of top $x\%$ to aggregate capital income
- KGR = capital gains ratio
 - Saez & Zucman (2016) data suggests ρ_x explains almost all of KGR(x)

Decomposition of KGR

Regressors (t)	Dependent Variable: $\log(\text{KGR}(x))$					
	(1)	(2)	(3)	(4)	(5)	(6)
	0.1%	1%	10%	1%	1%	1%
Constant	-0.11 (0.39)	-0.31 (0.38)	0.87 (0.41)	-4.10 (1.72)	-2.68 (0.088)	-2.67 (0.44)
$\log(\alpha)$	1.38*** (0.29)	0.93*** (0.31)	1.63*** (0.31)	-0.00 (1.11)		
$\log(\rho_x)$	0.90*** (0.08)	1.04*** (0.11)	1.22*** (0.11)		1.00*** (0.11)	
$\log(Y_x^k / Y^k)$	0.85*** (0.10)	1.22*** (0.24)	3.64*** (0.56)			1.87*** (0.55)
Sample	1922- -2012	1916- -2012	1962- -2012	1916- -2012	1916- -2012	1916- -2012
R^2	0.93	0.90	0.93	0.00	0.78	0.14

Time series of $KGR(1)$

- $KGR(1)$ actually looks very much like the detrended top 1% income share series

TopkKalmanPlot-eps-converted-to.pdf

Interpretation of KGR(1)

- KGR likely captures capitalist wealth inequality rather than timing of realizing capital gains because
 - 1 Estate tax $\uparrow \implies$ KGR \downarrow ,
 - 2 KGR $\uparrow \implies$ rich invest more in stocks

Regressors (t)	Dependent: t to $t + 1$ change in asset class wealth share					
	Equities share			Bonds share		
	0.1%	1%	10%	0.1%	1%	10%
Constant	-0.98 (0.52)	-1.35 (0.58)	-0.48 (0.21)	-0.03 (0.47)	-0.45 (0.62)	-0.36 (0.28)
KGR(x)	0.64*** (0.24)	0.52*** (0.19)	0.15*** (0.05)	0.07 (0.25)	0.21 (0.21)	0.09 (0.07)
Sample	1913- -2012	1913- -2012	1917- -2012	1913- -2012	1913- -2012	1917- -2012
R^2	0.06	0.06	0.05	0.00	0.01	0.01

Regression using KGR(1)

Regressors (t)	Dependent Variable: t to $t + 1$ Excess Market Return					
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	11.92 (2.74)	11.30 (4.06)	17.30 (8.07)	9.10 (16.82)	14.65 (10.84)	13.59 (3.63)
KGR(1)	-2.69*** (1.00)	-2.70** (1.25)	-3.38* (1.76)	-2.89* (1.54)	-2.56** (1.12)	-2.79** (1.37)
$\Delta \log(\text{GDP})$		0.36 (0.48)				
$\log(\text{CGV})$			-2.15 (2.97)			
$\log(\text{P/D})$				0.99 (5.66)		
$\log(\text{P/E})$					-1.12 (4.21)	
CAY						1.25* (0.76)
Sample	1913- -2015	1930- -2015	1930- -2015	1913- -2015	1913- -2015	1945- -2015

Out-of-sample performance of KGR

- Test $\beta = 0$ (variable x_t not useful for prediction) in

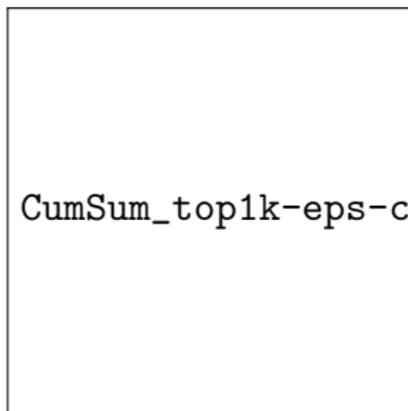
$$R_{t+1} = \alpha + \beta x_t + \varepsilon_{t+1}$$

using Hansen & Timmermann (2015) out-of-sample test

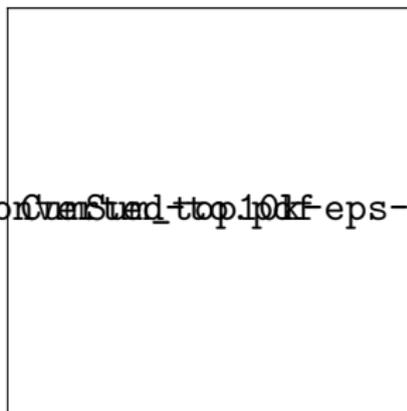
- $0 < \rho < 1$: fraction of sample set aside for initial estimation

Predictor in the ALT Model					
ρ	KGR(1)	KGR(10)	KGR(0.1)	log(P/D)	log(P/E)
0.2	3.67***	6.07***	2.67**	-0.12	0.77*
	(0.0040)	(0.0010)	(0.0131)	(0.1367)	(0.0515)
0.3	2.16**	3.19***	1.43**	0.23	1.34**
	(0.0153)	(0.0068)	(0.0436)	(0.1245)	(0.0360)
0.4	1.42**	2.94***	0.64*	-0.42	0.58*
	(0.0388)	(0.0081)	(0.0901)	(0.2781)	(0.0845)

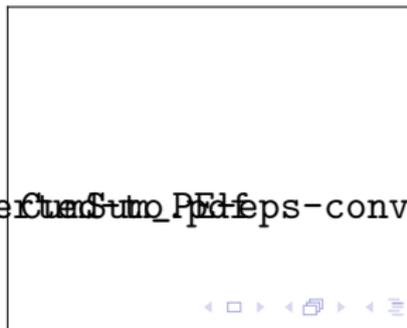
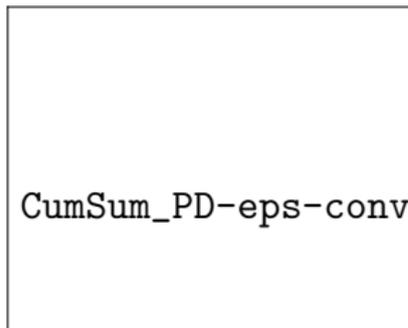
Difference in mean-squared prediction errors



(a) KGR(1).



(b) KGR(10).



Using tax policy as instrument

- Current and lagged top estate tax rate (ETR) changes significantly correlated with KGR
- Can be used as instruments to address causality

Regressors	Dependent Variable: $KGR(x)_t$		
	0.1%	1%	10%
Constant	1.52	2.37	3.11
ΔETR_t	-0.04***	-0.06***	-0.07***
ΔETR_{t-1}	-0.03**	-0.04*	-0.04*
ΔETR_{t-2}	-0.07***	-0.10***	-0.10***
ΔETR_{t-3}	-0.06***	-0.08***	-0.08***
R^2	0.26	0.24	0.19

IV regressions using tax rate change as instrument

Dependent Variable: t to $t + 1$ Excess Market Return

KGR(x) version

Regressors (t)	0.1%	1%	10%
Constant	18.09 (24.05)	22.58 (23.85)	28.43 (24.78)
KGR(x)	-10.79** (4.54)	-7.52** (3.27)	-6.91** (3.08)
% Δ IP	-1.51*** (0.51)	-1.49*** (0.49)	-1.46*** (0.48)
log(P/E)	3.71 (9.98)	2.61 (10.02)	1.90 (10.64)
J statistic	0.65 ($p = 0.72$)	0.69 ($p = 0.71$)	0.75 ($p = 0.69$)

Cross-country panel regressions

- Theoretical model is about a closed economy
- Theory should apply to “relatively closed” economies:
 - 1 Large economy (U.S.),
 - 2 Small country with home bias (emerging countries)
- Theory should not apply to small open economies (e.g., Europe)
- For any relatively open economy, inequality of international investors (proxy: U.S.) should matter
- Hence redo exercise with local and U.S. inequality series and Mishra (2015) home bias measure

Regressions using local and U.S. top income shares

Dependent Variable: t to $t + 1$ Stock Return				
Regressors (t)	(1) All	(2) Advanced	(3) ex-U.S.	(4) ex-U.S.
Top 1%	-0.94* (0.52)	-1.01* (0.49)	-0.42 (0.70)	2.61 (1.55)
U.S. KGR(1)			-2.51*** (0.43)	-0.53 (0.75)
Top 1% × homebias				-5.44** (2.42)
U.S. KGR(1) × (1 - homebias)				-4.17** (1.60)
Country FE	Yes	Yes	Yes	Yes
Obs.	815	712	769	687
R^2 (w,b)	(.00,.05)	(.01,.03)	(.02,.13)	(.03,.27)

Conclusion

- Effect of wealth distribution on asset prices is intuitive (Fisher narrative) but there are only a few theoretical papers and almost no empirical work
- Provided a simple GE model with heterogeneous wealth/risk aversion and derived negative relation between inequality and equity premium
- Rising inequality (top 1% income share) negatively predicts returns:
 - holds in- and out-of-sample in U.S.
 - robust to controls and using top estate tax rate change as instrument
 - holds in post-1970 cross-country panel