Understanding 100 Years of the Evolution of Top Wealth Shares in the U.S.: What is the Role of Family Firms?

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The Rich are Different From You and Me ....

1. They have a lot of money
2. Lots of wealth mobility
   - Many at the top got rich quickly
3. Top wealth shares have changed rapidly and by large amounts over last 100 years
4. Data on Innovations to top wealth
   - Bloomberg and Forbes Billionaires
   - Gomez 2021, Zheng 2021
   - Bach, Calvet, Sodini 2020
   - Fagareng et. al. 2019

This paper: Quantitative model to match these four facts based on Family Firms and their changing dynamics over the past 100 years

Empirical Challenge

Quantitative model of level and dynamics of top wealth shares

Simple random growth models: large top wealth shares imply slow dynamics for those top shares

- Luttmer (2016)
- Gabaix, Lasry, Lyons, and Moll (2016) Appendix E
- Hubmer, Krusell, and Smith (2020) Figure 8

also imply low wealth mobility from the bottom

- Luttmer (2011)
- Benhabib, Bisin, and Luo (2019)

Challenge: how to match facts 2 and 3 conditional on matching facts 1 and 4?

Family Firms and Dynamics of Top Wealth Shares

Family Firms: Striking Feature of Capitalist Economies

- Concentrated position even in large public firms
- Small minority overall but prevalent among very wealthy
- Families can remain undiversified for multiple generations
- Alessandra Peter (2020)

Family Firms and the Nouveau Riche

- Many of the very rich have recent fortunes
- Some of them came from very poor backgrounds
- Rapid mobility from the bottom

Family Firms and Dynamics of Top Wealth Shares

This paper: simple model of wealth dynamics

- Analytical link between dynamics of top wealth in response to shocks and wealth mobility from the bottom
  Facts 2 and 3 tied together in both a one-type and two-type model
- GLLM 2016 has slow dynamics of top wealth shares because it doesn't have enough wealth mobility from the bottom
- Two-type model with "family firms" goes a long way to reconcile facts 1 - 4
- Difference in volatilities versus difference in means: Bach, Calvet, Sodini 20
- Hypothesis: changing dynamics of family firms can account for evolution of U.S. top wealth shares over the past century

Plan for the talk

Motivating Facts

Model: Champernowne (1953) with two types

Transitions: Gabaix, Lasry, Lions and Moll (2016) and Luttmer (2016)

- Top wealth dynamics and wealth mobility from the bottom

Calibration, drivers of wealth mobility

Transitions 1920-2020

Four Facts

The very rich have a lot of money

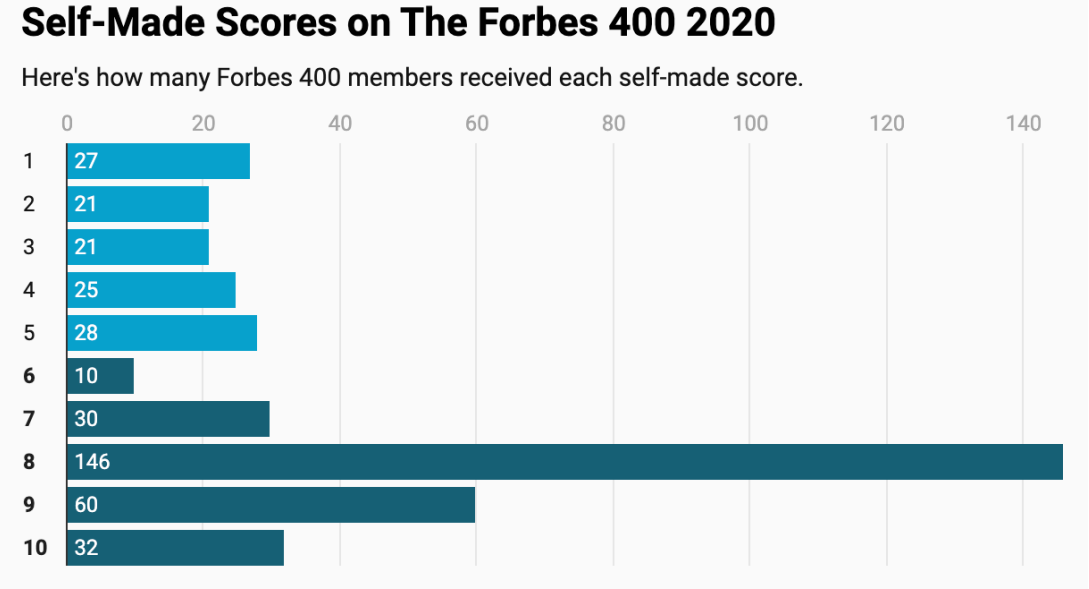
Forbes 400 have \$3.2 Trillion in 2020

Equivalent to 2.9% of Household Net Worth

Bloomberg top 100 Billionaires worldwide have \$3.5 Trillion

Pareto tail coefficient ≈ 1.5

Wealth mobility: many get rich quickly



10 is truly bottom, 9 is working class, 8 is middle to upper middle class

8 of these self-made are under 40
(2 Snap, 2 Facebook, 3 Airbnb, 1 Nikola Motor)

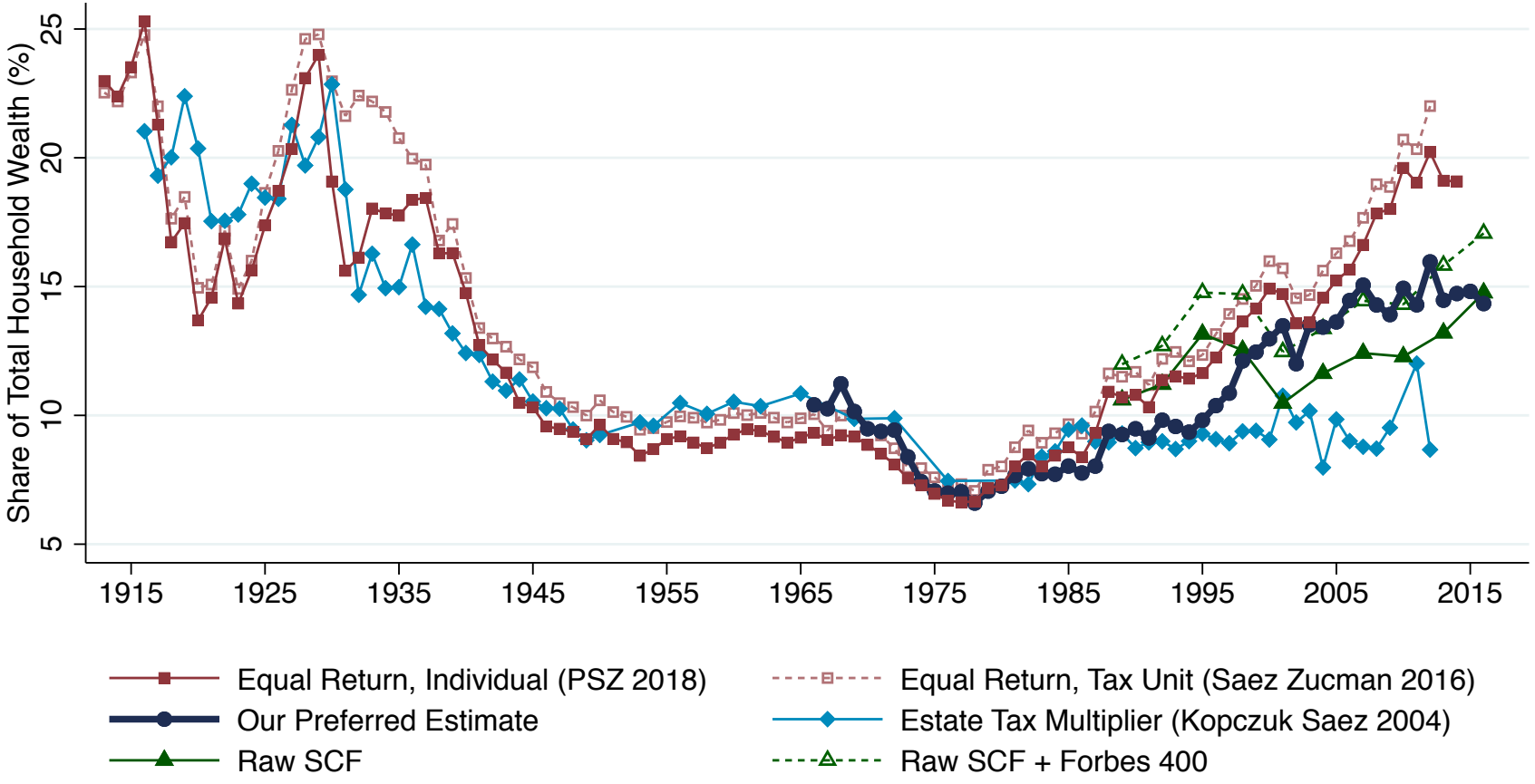
70% of wealth of Bloomberg top 100 Billionaires is self-made

Proportion of self made has increased: was less than 1/2 in 1984 downward

US Top Wealth Shares move a lot and quickly over 100 years

Figure 1: Wealth Concentration in the United States

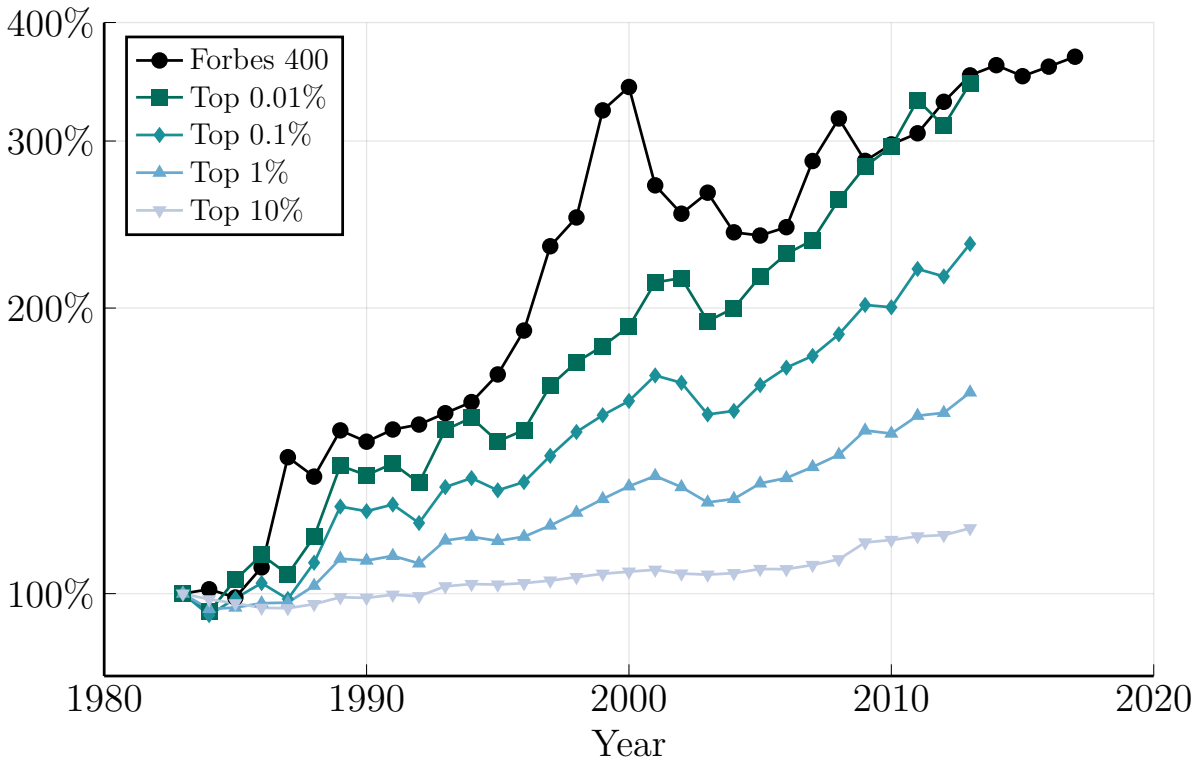
A. Top 0.1% Share of Total Wealth



from Smith, Zidar, Zwick 2020

US Forbes 400 wealth share more than triples since 1980's

Figure 2: Growth of the Forbes 400 and Top 1%, 0.1%, 0.01% Wealth Share



Notes. The figure plots the cumulative growth of top wealth shares for groups defined in the top Forbes percentile, includes 400 households in 2017. Data for the top 10%, 1%, 0.1%, 0.01% is from Saez and Zucman (2016).

from Gomez 2021 and Zheng 2020

The very wealthy have very concentrated portfolios

Statistics for Top 100 Billionaires in Bloomberg Data

Total Net Worth in Billions	$	3,547
Fraction Cash		0.11
Fraction Private Assets		0.21
Fraction Public Shares		0.68
Fraction of Public Shares in top holding		0.93
Fraction of Public Shares in top three holdings		0.98
Fraction of Net Worth in Private Assets plus largest public holding		0.84
Fraction of Net Worth Self Made		0.70
Fraction of Net Worth Inherited		0.30

from Bloomberg Billionaires. Exceptions Bill Gates and Ernesto Bertarelli
Goldsmith: Also true for top wealthy families in 1930's

Model

Model Overview

- Discrete Time Random Growth Model: Champernowne (1953)
- Trinomial model with reflecting barrier at bottom
  - allows for type-dependent processes for wealth
  - Gabaix, Lasry, Lions, and Moll (2016)
  - Luttmer (2016)
  - Jones and Kim (2018)
- Family Types: Family Firm (F) and Diversified (D)
  - Switch $D \to F$: start a family firm
  - Cagetti and De Nardi (2009), Quadrini (2009)
  - Switch $F \to D$: diversify the family holdings
  - Bertrand and Schoar (2006), Peter (2019)
- Abstract from labor income: Benhabib, Bisin, Luo (2017)
  - The rich are different from you and me ...

Trinomial Implementation

Individual assets on a grid

$$W(n) = \exp(n\Delta)$$

for $n = 0, 1, 2, \ldots$.

probability up p_{uit} for type $i = F, D$

for $n = 1, 2, \ldots$.

probability down p_{dit}

probability stay $1 - p_{uit} - p_{dit}$

for $n = 0$.

probability stay $1 - p_{ui}$

$1 - \phi_F$ probability transition $F \to D$

$1 - \phi_D$ probability transition $D \to F$

ν_F, ν_D stationary fractions of each type

Trinomial vs. Binomial Model

Moments of innovations:

Mean

$$(p_{u,j,t} - p_{d,j,t})\Delta = \mu_{jt}\Delta_t$$

Uncentered second moment

$$(p_{u,j,t} + p_{d,j,t})\Delta^2 = \sigma_{jt}^2\Delta_t + \mu_{jt}^2\Delta_t^2$$

Binomial Model: $p_u + p_d = 1$ Trinomial Model: $0 \leq p_u + p_d \leq 1$

In trinomial model, given grid step size Δ, flexibility in picking level of moments

Transitions of Top Wealth Shares and Wealth Mobility: Analytical Results

Steady State with one type

Second order difference equation for asset density $g_{ss}(n)$

1 stable eigenvalue $1 > \lambda > 0$

$$\lambda = \frac{p_u}{p_d}$$

Steady-state asset density

$$g_{ss} = \Lambda$$

$$\Lambda(n) = (1 - \lambda)\lambda^n$$

Asset tail coefficient

$$\zeta_{ss} = -\frac{1}{\Delta}\log(\lambda)$$

Can hit same tail coefficient with small or large asset innovation moments $\mu\Delta_t$ and $\sigma^2\Delta_t$ with small or large p_d

Continuous time limit

Step Size

$$\Delta = \sigma_{max}\sqrt{2\Delta_t}$$

Mean

$$(p_{u,j,t} - p_{d,j,t})\Delta = \mu\Delta_t$$

Uncentered second moment

$$(p_{u,j,t} + p_{d,j,t})\Delta^2 = \sigma^2\Delta_t + \mu^2\Delta_t^2$$

Expected growth in the level of wealth

$$g_{j,t} = \mu_{j,t} + \frac{\sigma_{j,t}^2}{2}$$

$$\lim_{\Delta_t \to 0} \zeta_{ss} = -\frac{2\mu}{\sigma^2}$$

GLLM (2016) transition experiment

Initial distribution of assets by type

$$g_0 = \Lambda_0 \neq \Lambda_{ss}$$

$$\Lambda_0(n) = (1 - \lambda_0)\lambda_0^n$$

Initial Tail Coefficient

$$\zeta_0 = -\frac{1}{\Delta}\log(\lambda_0)$$

New Steady State Tail Coefficient

$$\zeta_{ss} = -\frac{1}{\Delta}\log(\lambda_{ss})$$

What does asset density at t look like?

$$g_t = \mathbb{T}^t(\Lambda_0)$$

GLLM (2016) transition experiment

Let $\mathbf{1}$ be a density that puts weight one on lowest node.

Let $\mathbb{T}^t(\mathbf{1})$ be the density after t periods for a cohort that started at the bottom.

Proposition:
The sequence $g_t = \mathbb{T}^t(\Lambda_0)$ satisfies

$$g_{t+1} = Ag_t + (1-A)\mathbb{T}^t(\mathbf{1})$$

where A is a scalar given by

$$A \equiv \left(p_d(1-\lambda_0)(\frac{\lambda_{ss}}{\lambda_0} - 1) + 1 \right)$$

Alternatively

$$g_t = \mathbb{T}^t(\Lambda_0) = A^t\Lambda_0 + (1-A)\sum_{k=0}^{t-1} A^{t-k-1}\mathbb{T}^k(\mathbf{1})$$

GLLM (2016) transition experiment

Proposition:
The sequence $g_t = \mathbb{T}^t(\Lambda_0)$ satisfies

$$g_{t+1} = Ag_t + (1-A)\mathbb{T}^t(\mathbf{1})$$

where A is a scalar given by

$$A \equiv \left(p_d(1-\lambda_0)(\frac{\lambda_{ss}}{\lambda_0} - 1) + 1 \right)$$

Proof.

Direct calculation gives that

$$\mathbb{T}(\Lambda_0) = A\Lambda_0 + (1-A)\mathbf{1}.$$

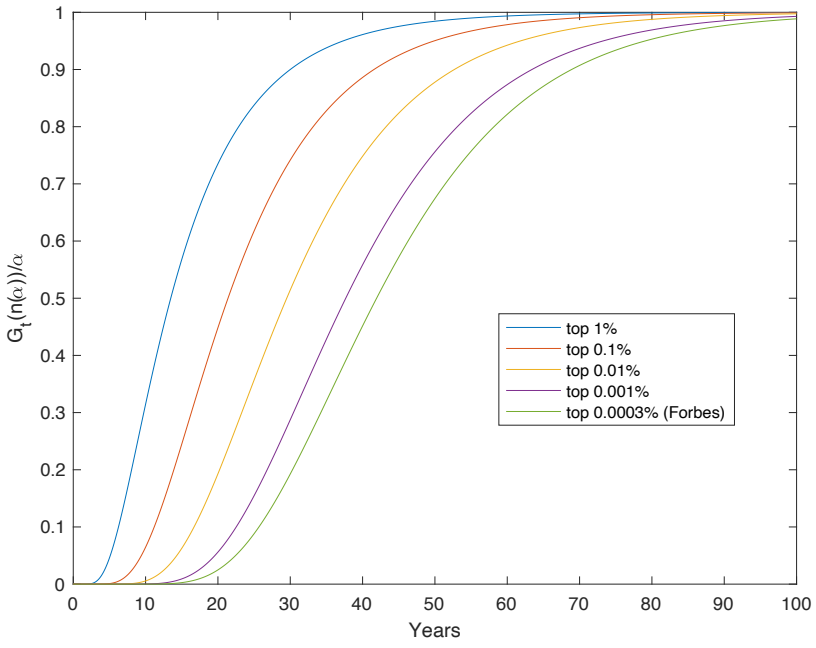
The operator $\mathbb{T}$ is linear. Repeated application of this operator to $g_{t+1} = \mathbb{T}(g_t)$ starting from $g_0 = \Lambda_0$ then gives the result. $\square$

Wealth mobility: A Transition starting from the bottom $\zeta_{ss} = 1.5$

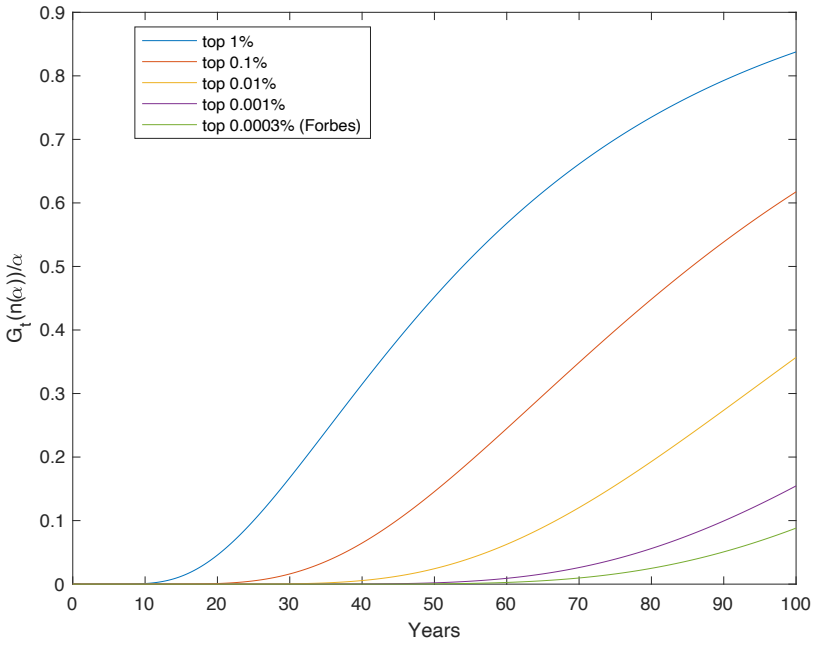
Compare CCDF of $\mathbb{T}^t(\mathbf{1})$ to steady-state CCDF at percentile α:

$$G_t(n(\alpha))/\alpha$$

Wealth mobility high when asset innovation moments are large



(a) High $\sigma = 0.5$

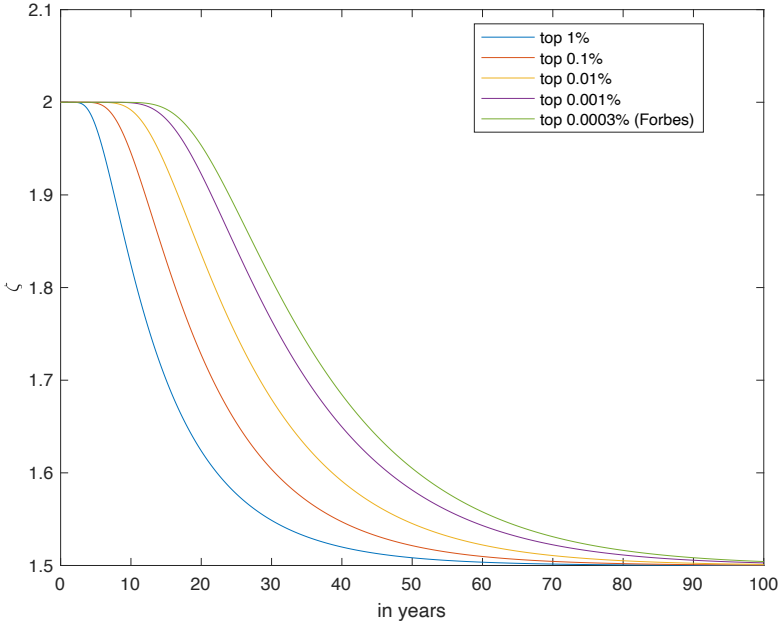


(b) Low $\sigma = 0.25$

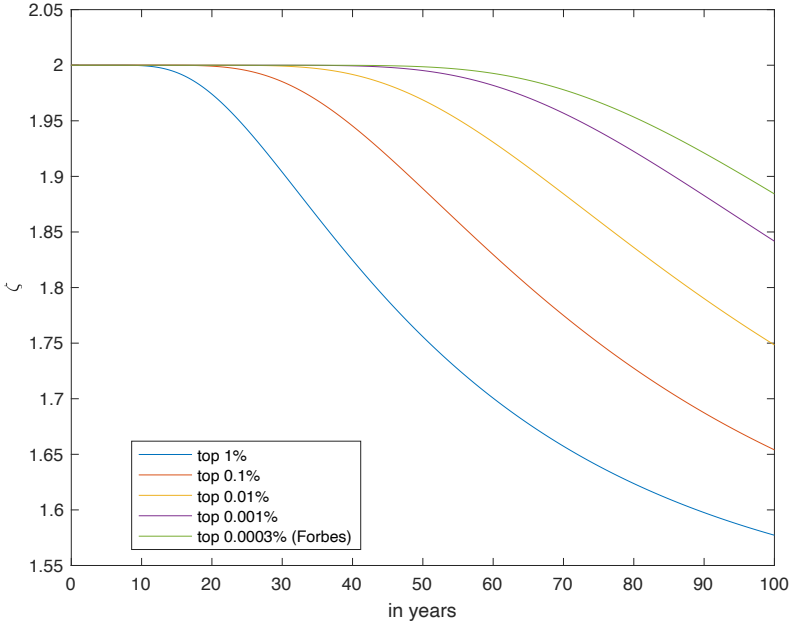
Convergence of Tail Coefficient $\zeta_{ss} = 1.5$

Plot of tail coefficient $\zeta_t(n(\alpha))$ for percentiles α

Rapid convergence of tail coefficient for high percentiles when asset innovation moments are large



(a) High $\sigma = 0.5$



(b) Low $\sigma = 0.25$

downward2

Summary of one-type model: option in the literature

1. The very rich have a lot of money ✓
2. Lots of wealth mobility
   - Many at the top got rich quickly ✗
3. Top wealth shares have changed rapidly and by large amounts over last 100 years ✗
4. Innovations to top wealth are volatile ✓

If you calibrate to the tail coefficient of wealth and the standard deviations of innovations to wealth with normal innovations to log wealth, then you miss wealth mobility and the dynamics of top wealth shares

Summary of one-type model: high volatility

1. The very rich have a lot of money ($\zeta_{ss} = 1.5$) ✓
2. Lots of wealth mobility
   - Many at the top got rich quickly ✓
3. Top wealth shares have changed rapidly and by large amounts over last 100 years ✓
4. Innovations to top wealth are volatile ✗

If you calibrate to the tail coefficient of wealth and wealth mobility, you get top share dynamics, but then the standard deviation of innovations to wealth with normal innovations to log wealth is too high

Two Type Model

Steady State Two Type Model

One high variance type F and one low variance type D

Two linked second order difference equations for densities $g_{j,ss}(n)$

2 stable eigenvalues $1 > \lambda_a > \lambda_b > 0$

Steady-state densities for $j = F, D$

$$g_{j,ss} = a_j \Lambda_a + b_j \Lambda_b$$

$$a_j + b_j = 1$$

$$\Lambda_i(n) = (1 - \lambda_i)\lambda_i^n \qquad i = a, b$$

$$g_{ss}(n) = \sum_{i=1,2} \nu_i g_{i,ss}(n)$$

Limiting tail coefficient and fraction of family firms at the top

$$\lim_{n\to\infty} \zeta_{ss}(n) = -\frac{1}{\Delta}\log(\lambda_a) \qquad \nu_F(n) \to \frac{\nu_F a_F}{\nu_F a_F + \nu_D a_D}$$

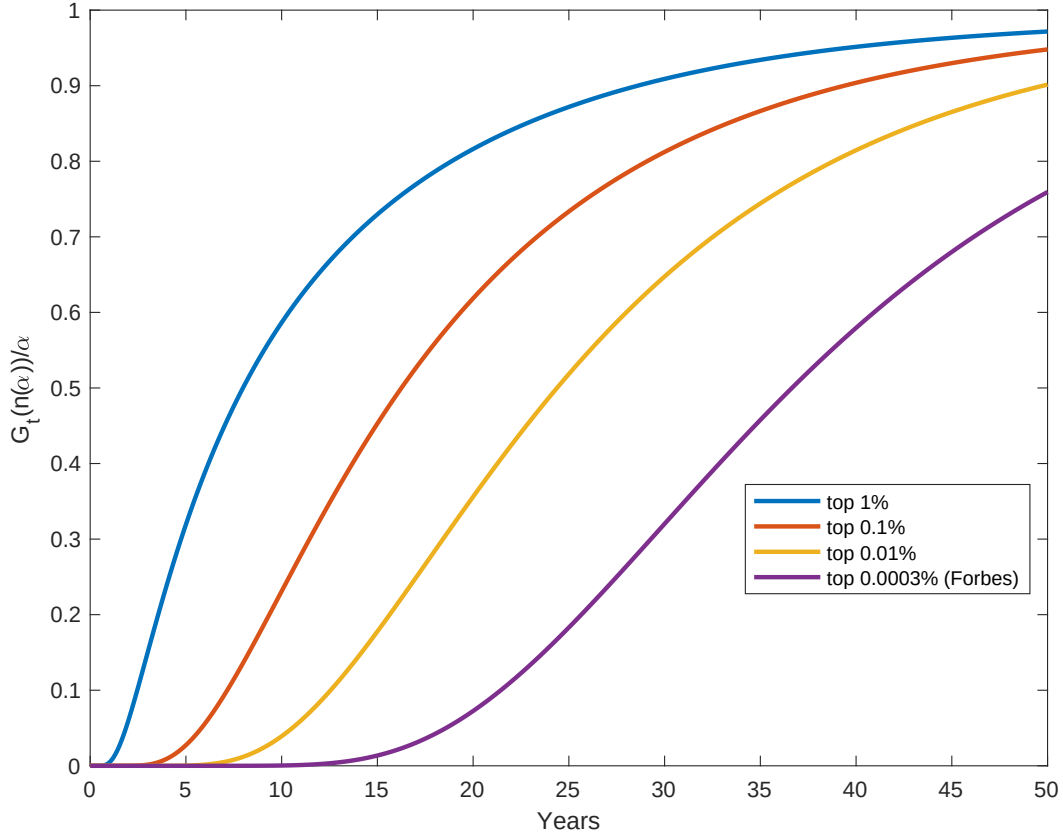
Calibrating Parameters and Moments

Eight parameters: $\Delta_t, \Delta, \nu_F, \phi_F, p_{uF}, p_{dF}, p_{uD}, p_{dD}$

1. Step size and time period
   - $\Delta = \underbrace{\sigma_{max}}_{50\%} \sqrt{2 \underbrace{\Delta_t}_{1/15000}}$
2. Switching rates
   - $F \to D$ 6.66% per year: persistence of family firms
   - $D \to F$ unconditional fractions $\nu_F = 5\%$ and $\nu_D = 95\%$
   - Bhandari and McGrattan (2020) Census data suggest $F \to D$ 10% per year Business Age
3. Two probabilities of innovations to wealth for each of two types
   - limiting tail coefficient of wealth at the top $-\log(\lambda_a)/\Delta = 1.5$
   - Bach et. al. moments
   - gap in wealth growth rate top 10% and 0.01%: 3.43%
   - $\sigma_{10\%} = 10.3\%$, and $\sigma_{0.01\%} = 35.79\%$

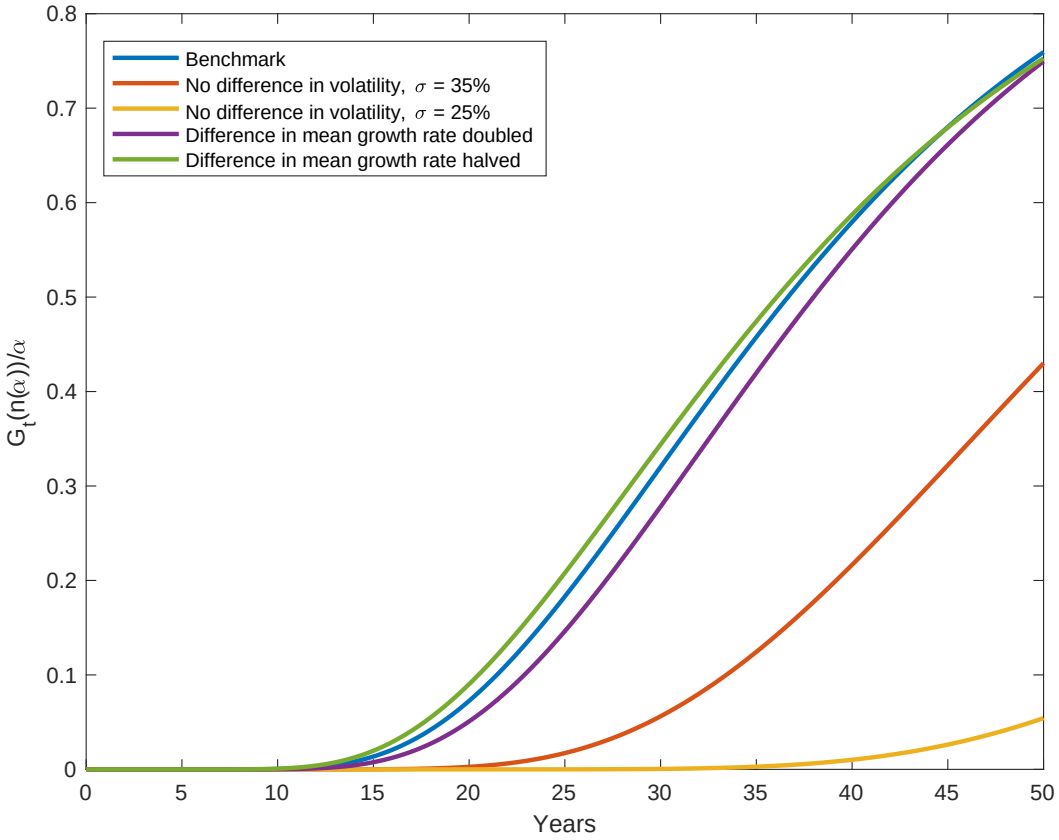
Upward wealth mobility with Family Firms

Still lots of upward mobility with just 5% Family Firms



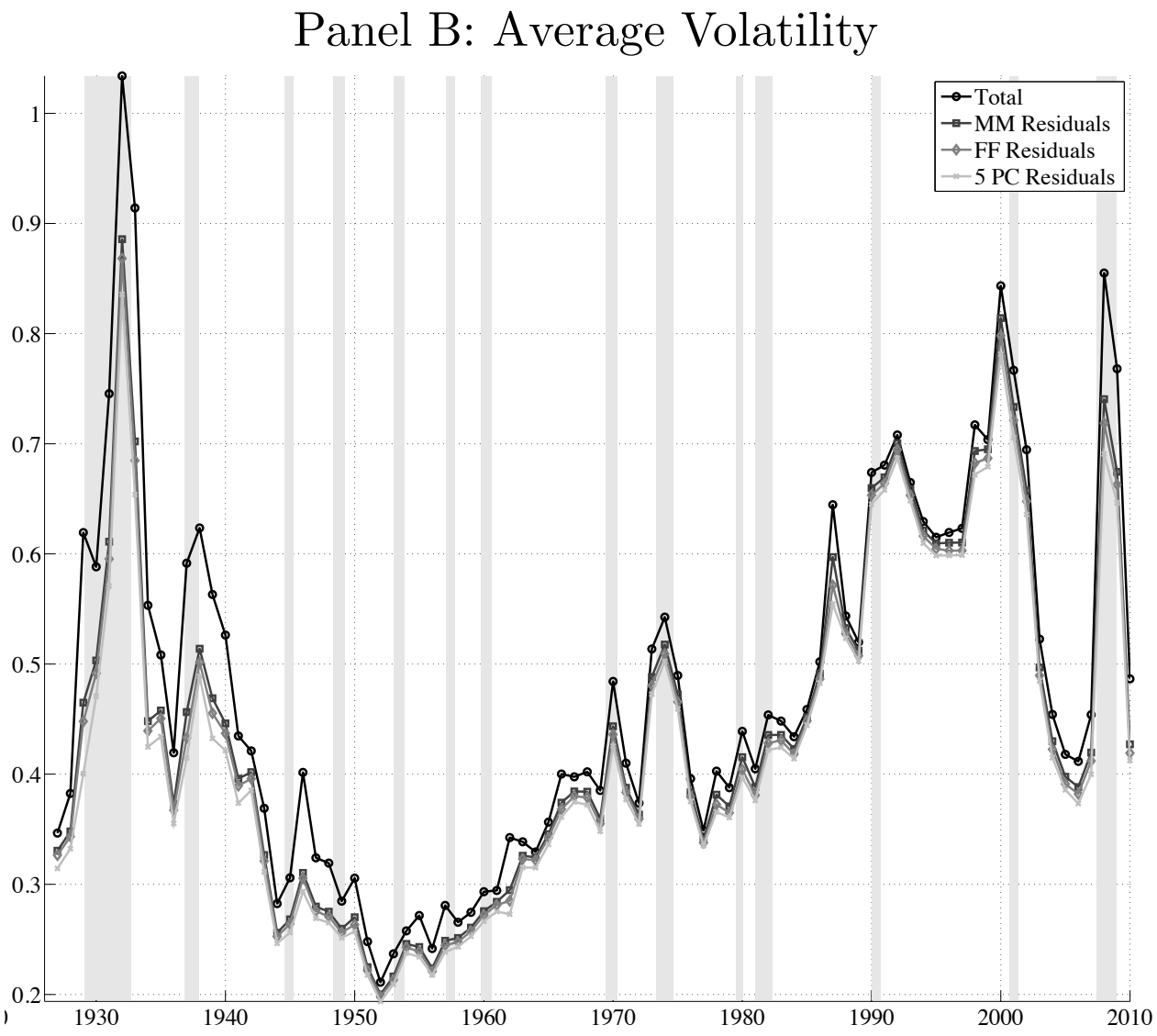
Upward wealth mobility with Alternative Calibrations

Mobility from bottom into Forbes 400:
Is it differences in means or differences in volatilities across types



Transitions 1920-2020

Evolution of idiosycratic volatility of individual stocks



from Herskovic, Kelly, Lustig, van Nieuwerburgh (2014)

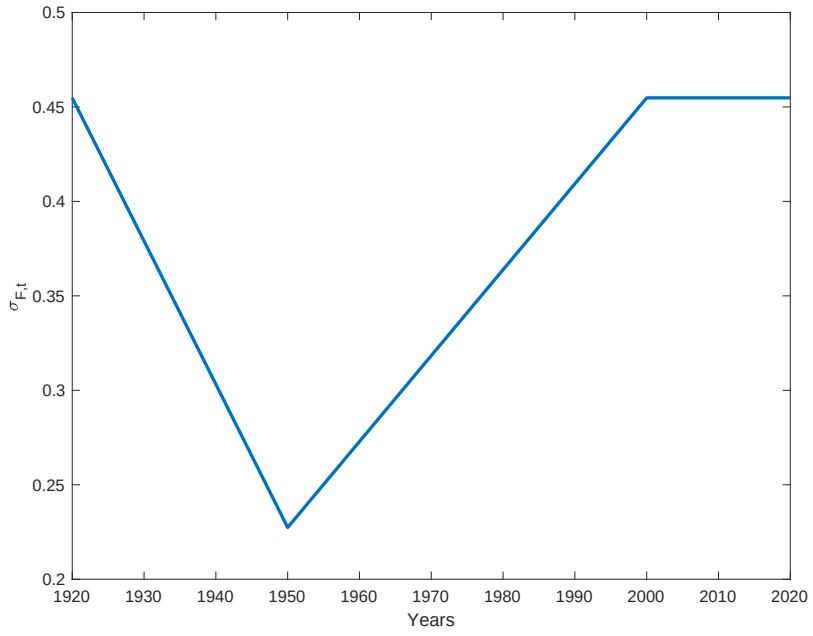
A Full Transition Experiment

100 years from 1920 to 2020

initial distribution with tail coefficient $\zeta_0 = 1.5$

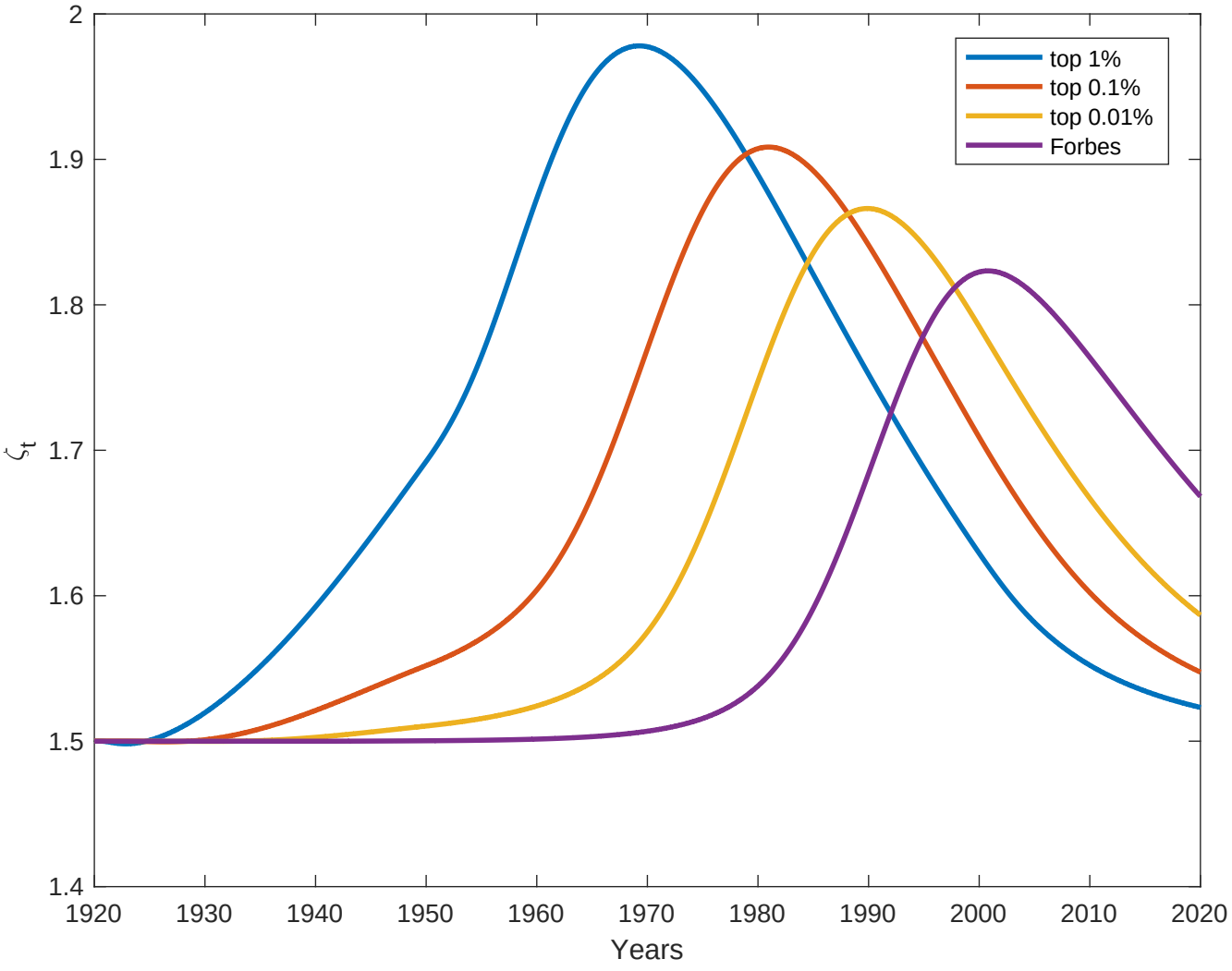
hold $g_j, \sigma_D, \Delta, \Delta_t$ constant

For Family Firms σ_{Ft}



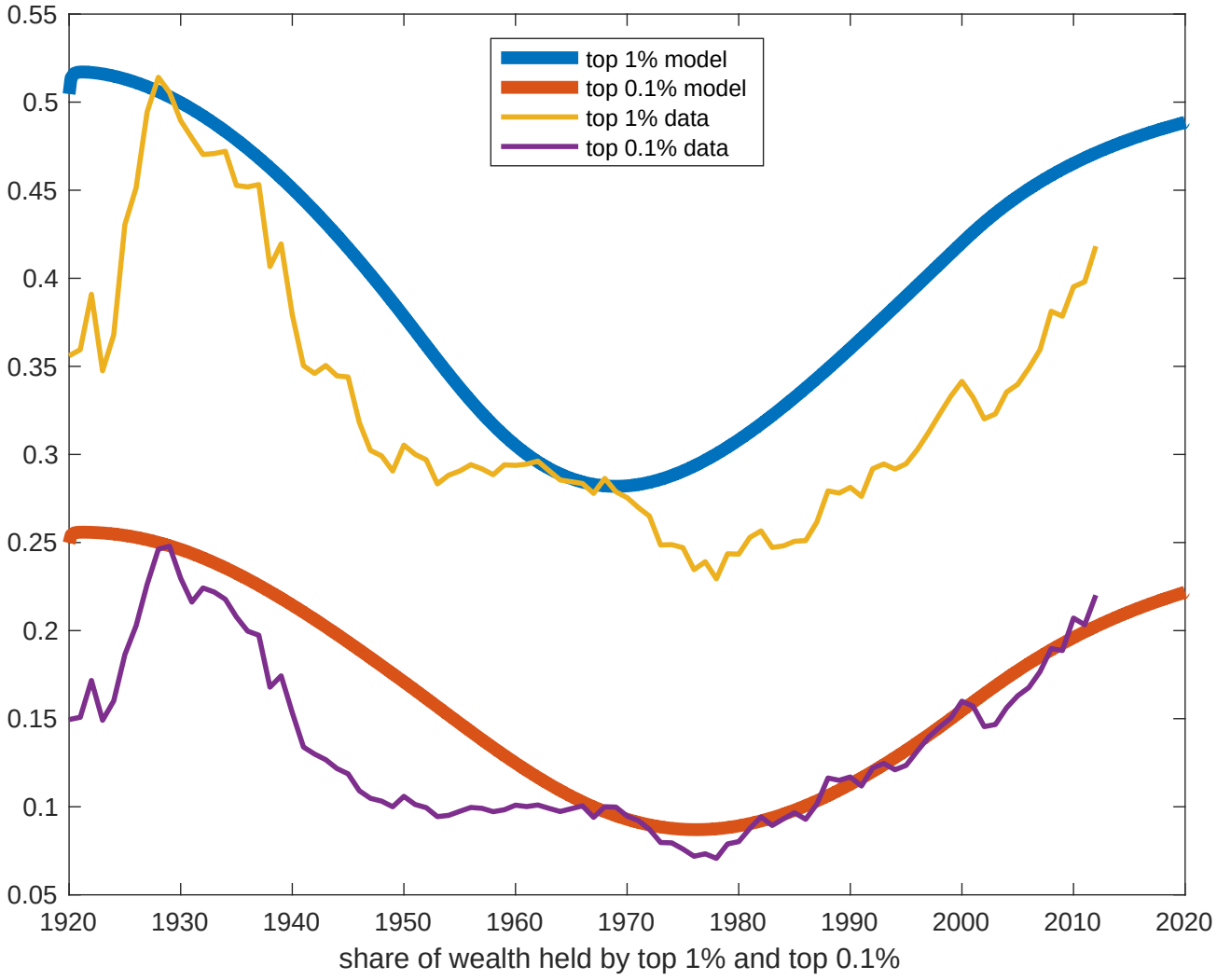
Model implied top tail coefficients 1920 - 2020

inequality bottoms out 20-40 years after bottom of equity volatility



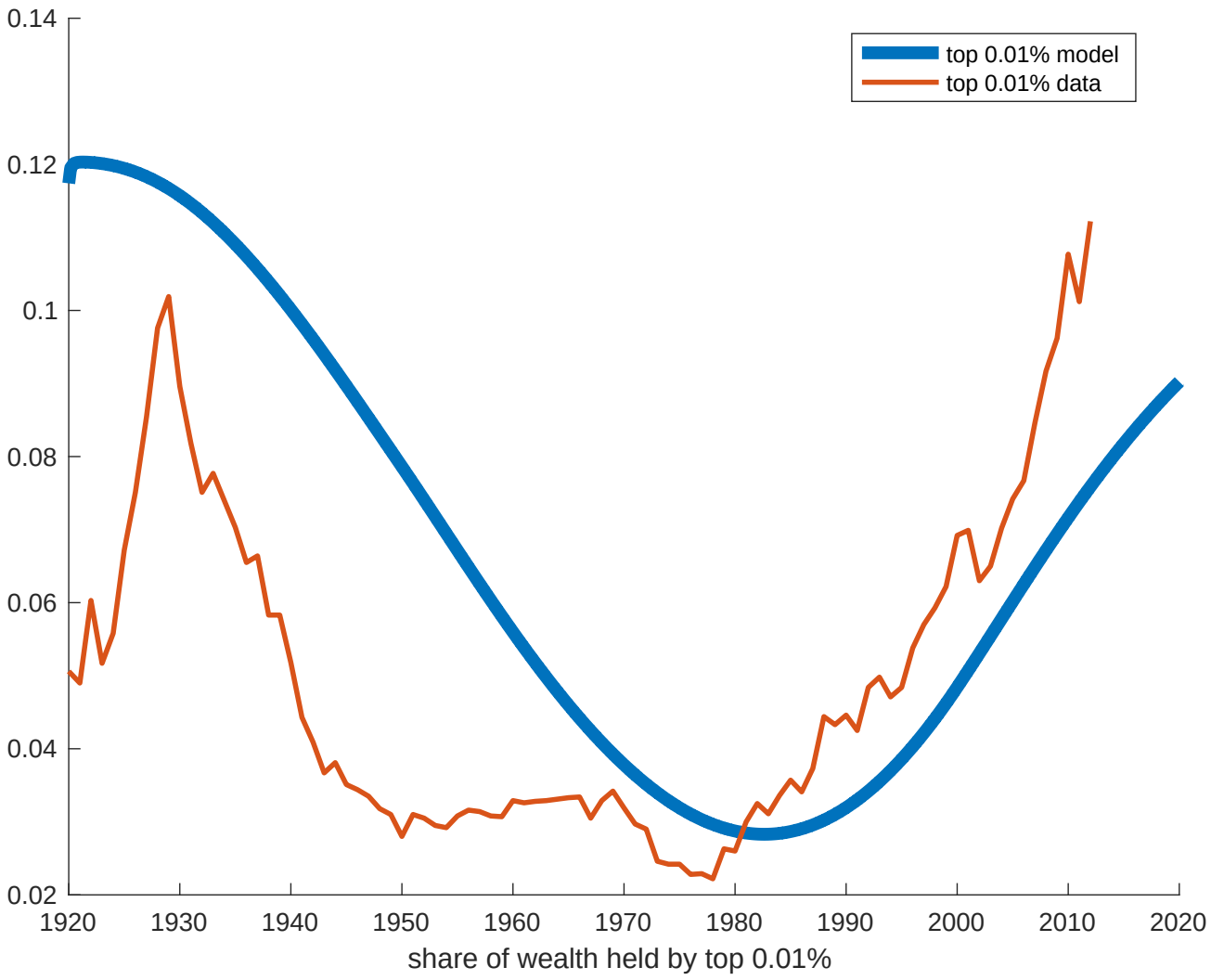
Model implied top wealth shares 1920 - 2020

bottoms out 20-25 years after bottom of equity volatility $d = 0.9486$



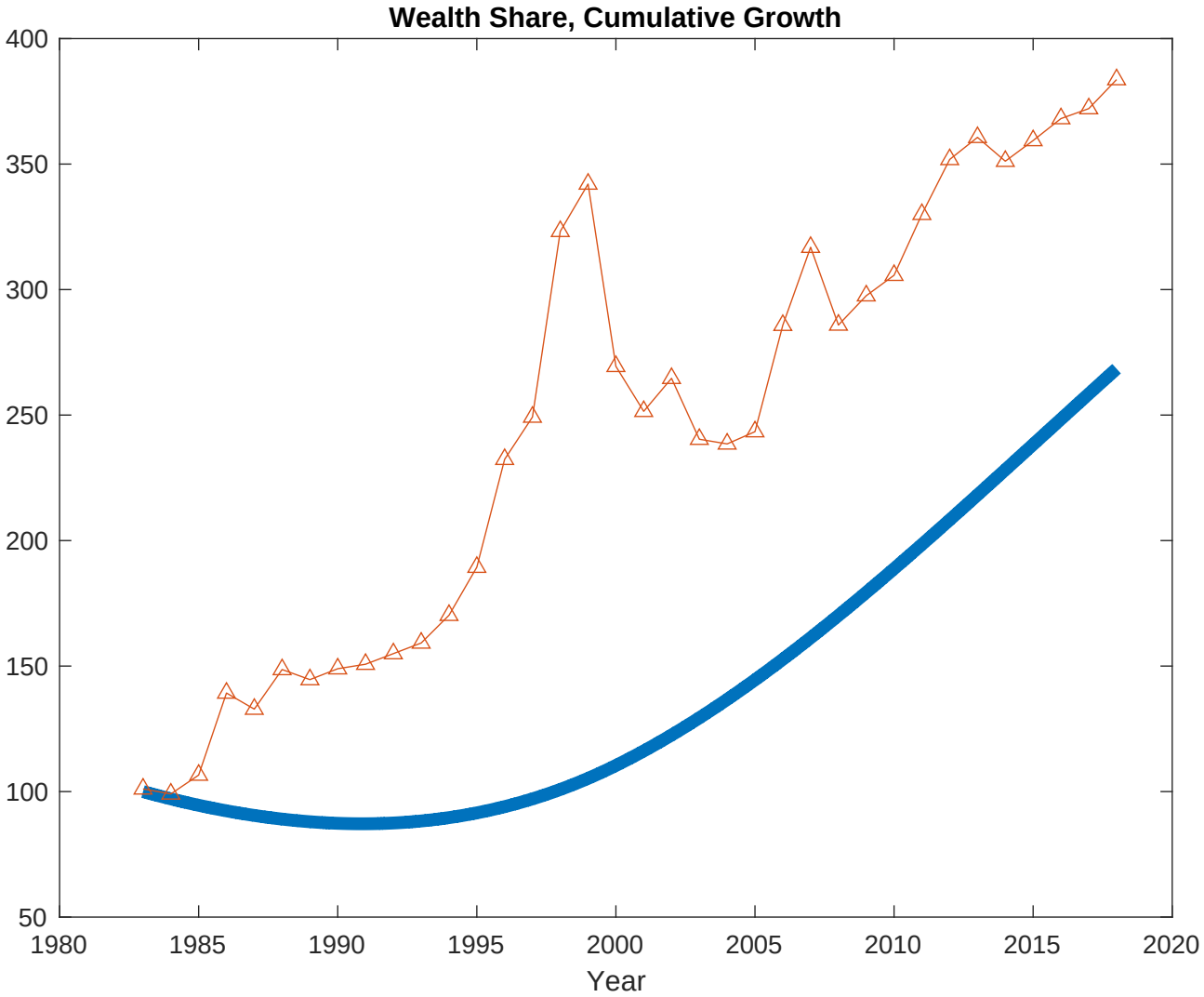
Model implied very top wealth shares

Still a bit slow.



Model implied very top wealth shares

Timing is a bit off.
Less than 10% stay in Forbes 400 for whole 30 years (compare to Gomez)



Summary of family firm model

1. The very rich have a lot of money ($\zeta_{ss} = 1.5$) ✓
2. Lots of wealth mobility
   - Many at the top got rich quickly ✓
3. Top wealth shares have changed rapidly and by large amounts over last 100 years ✓
4. Innovations to top wealth are volatile ✓

Our top share dynamics are a little slow.
One might go to three or more types to refine model or consider jumps
Key is to get fast mobility from the bottom

Wealth Mobility: you don't stay on top for long

List of Wealthy American Families 1924 (Lundberg 1937)

	FAMILY AND NUMBER OF TAX RETURNS	PRIMARY SOURCE OF WEALTH	AGGREGATE 1924 TAX	APPROXIMATE NET AGGREGATE INCOME TAXED	NET AGGREGATE FORTUNE TAXED	GROSS ADJUSTED FORTUNE AFTER MULTIPLYING BY 3	MAXIMUM ESTIMATED FORTUNE
1.	21 Rockefellers	Standard Oil	$7,309,989	$17,955,000	$359,100,000	$1,077,300,000	$2,500,000,000
2.	34 Morgan Inner Group	J. P. Morgan & Co.	4,796,263	12,620,000	276,000,000‡	728,000,000‡	.....
	(Including Morgan partners and families and eight leading Morgan corporation executives)						
3.	2 Fords	Ford Motor Co.	4,766,863	11,000,000	220,000,000	660,000,000	1,000,000,000
4.	5 Harknesses	Standard Oil	2,776,735	7,550,000	150,200,000	450,600,000	800,000,000
5.	3 Mellons	Aluminum Company	3,237,876	7,500,000	150,000,000	450,000,000	1,000,000,000
6.	22 Vanderbilts	N. Y. Central R. R.	2,148,892	6,005,000	120,100,000	360,300,000	800,000,000
7.	4 Whitneys	Standard Oil	2,143,992	5,375,000	107,500,000	322,000,000	750,000,000
8.	28 Standard Oil Group	Standard Oil	1,737,857	5,435,000	118,700,000	356,000,000	.....
	(Including Archbolds, Rogerses, Bedfords, Cutlers, Flaglers, Pratts and Benjamins, but excepting others)						
9.	20 Du Ponts	E. I. du Pont de Nemours	1,294,651	3,925,000	79,500,000	238,500,000	1,000,000,000
10.	8 McCormicks	Int. Harvester and Chi. Tribune	1,332,517	3,520,000	70,400,000	211,200,000	.....
11.	2 Bakers	1st National Bank	1,575,482	3,500,000	70,000,000	210,000,000	500,000,000
12.	5 Fishers	General Motors	1,424,583	3,225,000	64,500,000	193,500,000	500,000,000
13.	6 Guggenheims	Amer. Smelting & Rfg. Co.	817,836	2,185,000	63,700,000	190,100,000	.....
14.	6 Fields	Marshall Field & Co.	1,197,605	3,000,000	60,000,000	180,000,000	.....
15.	5 Curtis-Boks	Curtis Pub. Co.	1,303,228	2,900,000	58,000,000	174,000,000	.....
16.	3 Dukes	Am. Tobacco Co.	1,045,544	2,600,000	52,000,000	156,000,000	.....
17.	3 Berwinds	Berwind-White Coal Co.	906,495	2,500,000	50,000,000	150,000,000	.....
18.	17 Lehmans	Lehman Brothers	672,897	2,150,000	43,000,000	129,000,000‡	.....
19.	3 Wideners	Am. Tob. & Pub. Utilities	772,720	1,975,000	39,500,000	118,500,000	.....
20.	7 Reynolds	R. J. Reynolds Tobacco Co.	652,824	1,950,000	39,000,000	117,000,000	.....
21.	3 Astors	Real Estate	783,002	1,900,000	38,000,000	114,000,000	300,000,000
22.	6 Winthrops	Miscellaneous	651,188	1,735,000	34,700,000	104,100,000	.....
23.	3 Stillmans	National City Bank	623,614	1,700,000	34,000,000	102,000,000	500,000,000
24.	3 Timkens	Timken Roller Bearing Co.	781,435	1,850,000	37,000,000	111,000,000	.....
25.	4 Pitcairns	Pittsburgh Plate Glass Co.	752,545	1,660,000	33,200,000	99,600,000	.....
26.	8 Warburgs	Kuhn, Loeb & Co.	598,246	1,620,000	32,400,000	97,200,000‡	.....
27.	4 Metcalfs	Rhode Island textile mills	623,817	1,510,000	30,200,000	90,600,000	.....

List of Wealthy American Families 2015 (Forbes)

Rank	Name	Net Worth	Origin of Wealth
1	Walton family	$130 billion	Wal-Mart
2	Koch family	$82 billion	diversified
3	Mars family	$78 billion	candy
4	Cargill-MacMillan family	$49 billion	Cargill Inc.
5	Cox family	$41 billion	media
6	S.C. Johnson family	$30 billion	cleaning products
7	Pritzker family	$29 billion	hotels, investments
8	(Edward) Johnson family	$28.5 billion	money management
9	Hearst family	$28 billion	Hearst Corp.
10	Duncan family	$21.5 billion	pipelines
11	Newhouse family	$18.5 billion	magazines, cable TV
12	Lauder family	$17.9 billion	Estee Lauder
13	Dorrance family	$17.1 billion	Campbell Soup Co.
14	Ziff family	$14.4 billion	publishing
15	Du Pont family	$14.3 billion	DuPont (chemicals)
16	Hunt family	$13.7 billion	oil
16	Goldman family	$13.7 billion	real estate
18	Busch family	$13.4 billion	Anheuser-Busch
19	Sackler family	$13 billion	pain medicines
20	Brown family	$12.3 billion	liquor
21	Marshall family	$12 billion	diversified
22	Mellon family	$11.5 billion	banking
23	Butt family	$11 billion	supermarkets
23	Rockefeller family	$11 billion	oil
25	Gallo family	$10.7 billion	wine, liquor

back

GLLM (2016) transition experiment

$$\begin{bmatrix} a_{F,t+1} \\ a_{D,t+1} \end{bmatrix} = \begin{bmatrix} \phi_F A_F & (1-\phi_F)A_D \\ (1-\phi_D)A_F & \phi_D A_D \end{bmatrix} \begin{bmatrix} a_{F,t} \\ a_{D,t} \end{bmatrix}$$

$$\begin{bmatrix} b_{F,t+1} \\ b_{D,t+1} \end{bmatrix} = \begin{bmatrix} \phi_F B_F & (1-\phi_F)B_D \\ (1-\phi_D)B_F & \phi_D B_D \end{bmatrix} \begin{bmatrix} b_{F,t} \\ b_{D,t} \end{bmatrix}$$

$$A_j = \left[1 + p_{u,j}\frac{1-\lambda_a}{\lambda_a} - p_{d,j}(1-\lambda_a)\right]$$

$$B_j = \left[1 + p_{u,j}\frac{1-\lambda_b}{\lambda_b} - p_{d,j}(1-\lambda_b)\right]$$

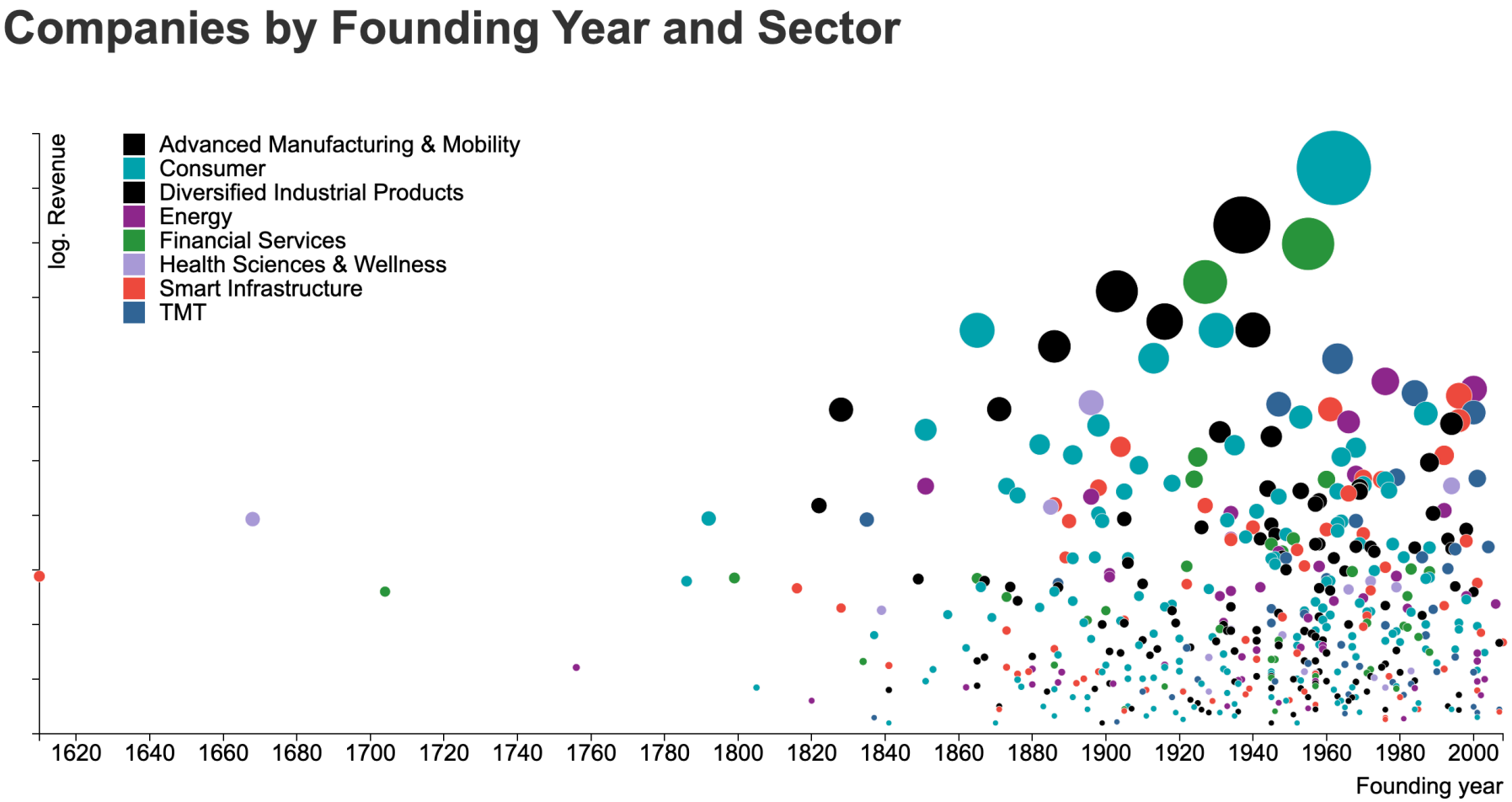
and $c_{F,0} = c_{D,0} = 0$ and

$$c_{F,t+1} = \phi_F(a_{F,t} + b_{F,t}) + (1-\phi_F)(a_{D,t} + b_{D,t}) - (a_{F,t+1} + b_{F,t+1})$$

$$c_{D,t+1} = \phi_D(a_{D,t} + b_{D,t}) + (1-\phi_D)(a_{F,t} + b_{F,t}) - (a_{D,t+1} + b_{D,t+1})$$

back

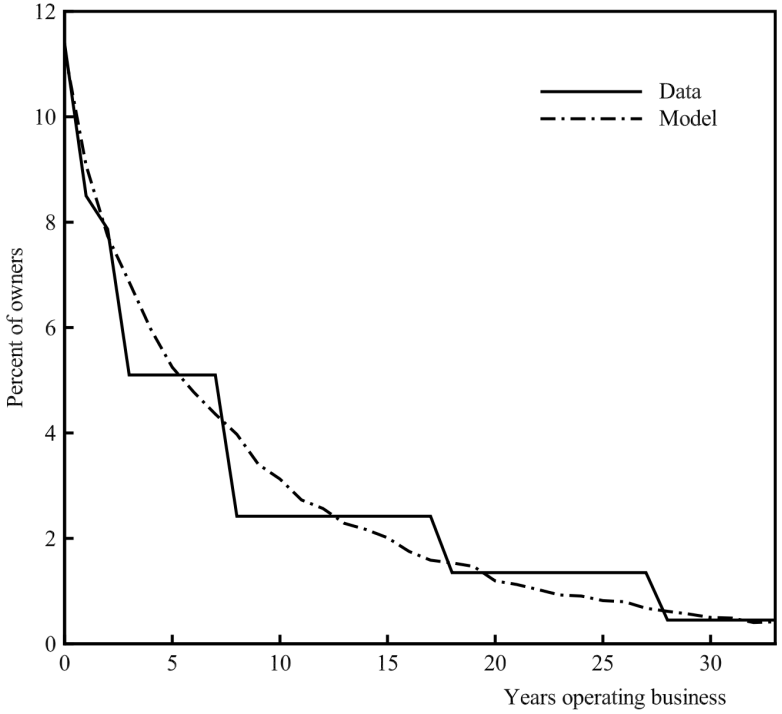
Some keep these concentrated portfolios for generations



from EY St Gallen Family Business Index follows family firms in 2nd generation or more

Census Data on Business Age

Figure 1. Business Age Profile



Notes. The U.S. estimates are based on the Survey of Business Owners microsample in 2007. The series is the fraction of owners reporting that they began operating their business in the current year, one year ago, two years ago, and so on. Individual information about how and when they acquired the businesses is included in the SBO for up to four owners. For acquisitions before 2004, the SBO uses intervals when reporting the data and we plot per-year averages. For the model, we compute the number of years in operation for all owners and record fractions separately for each year.

from Bhandari and McGrattan 2021

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