Accounting for Macro-Finance Trends: Market power, Intangibles, and Risk premia

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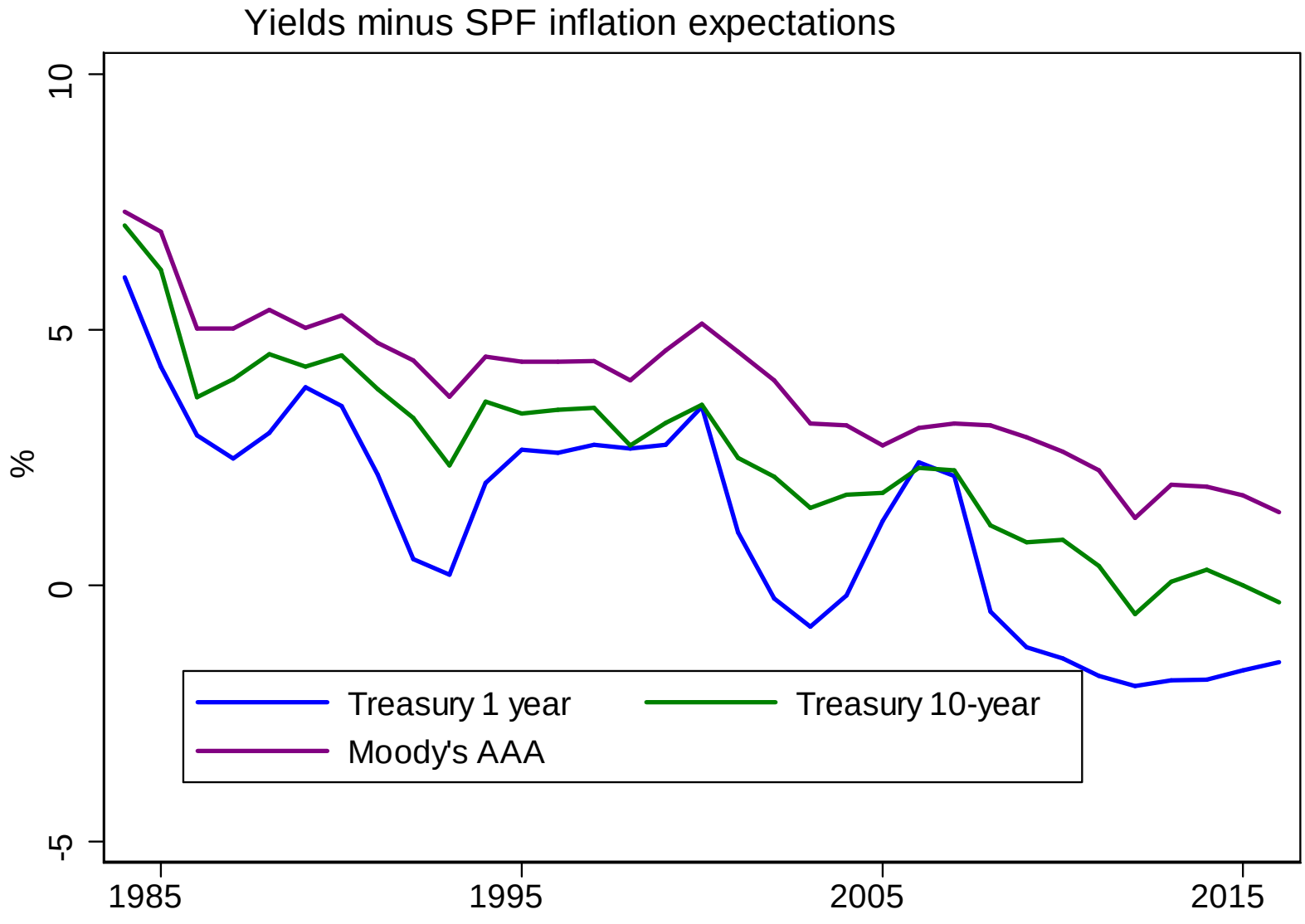
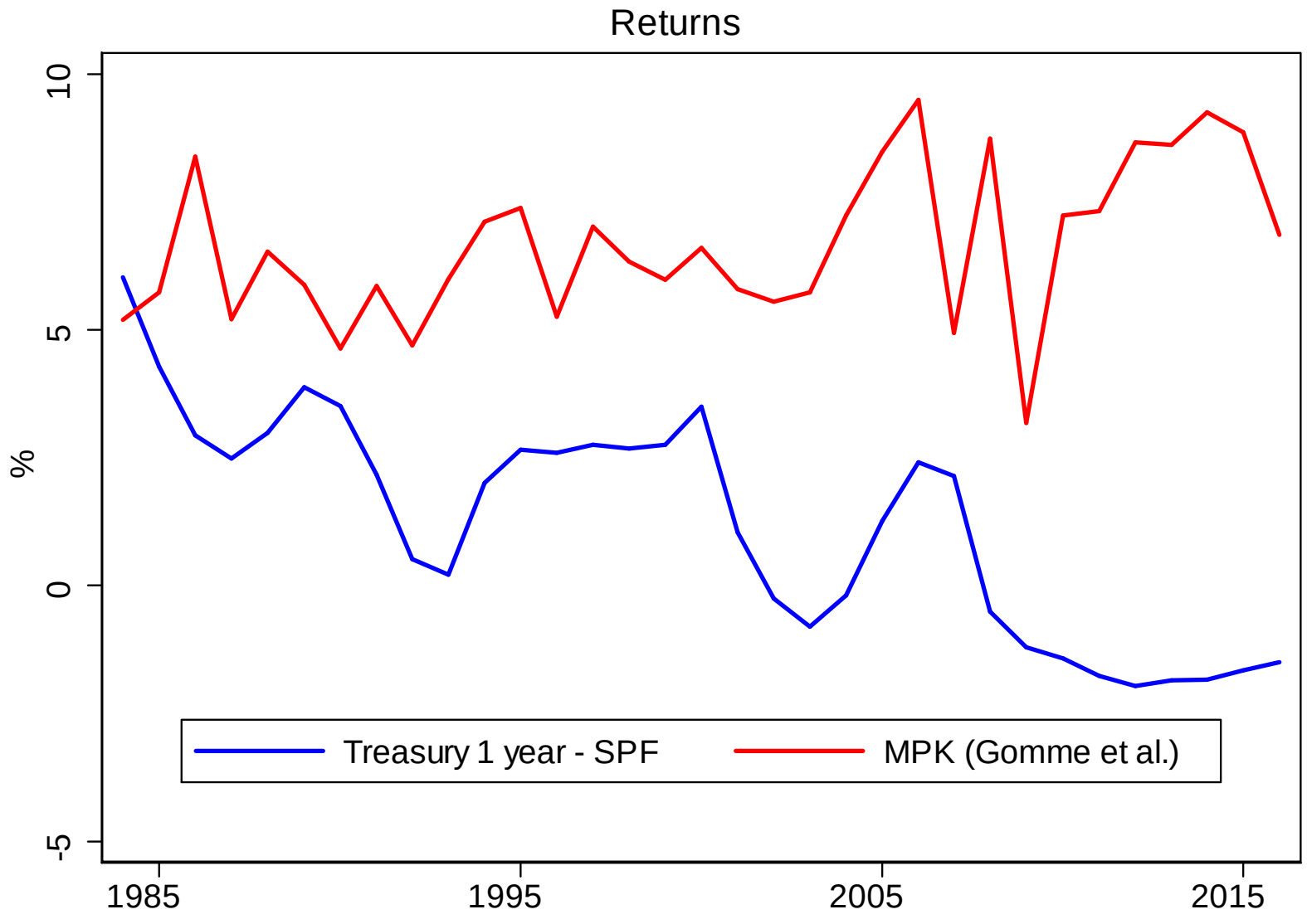
2019

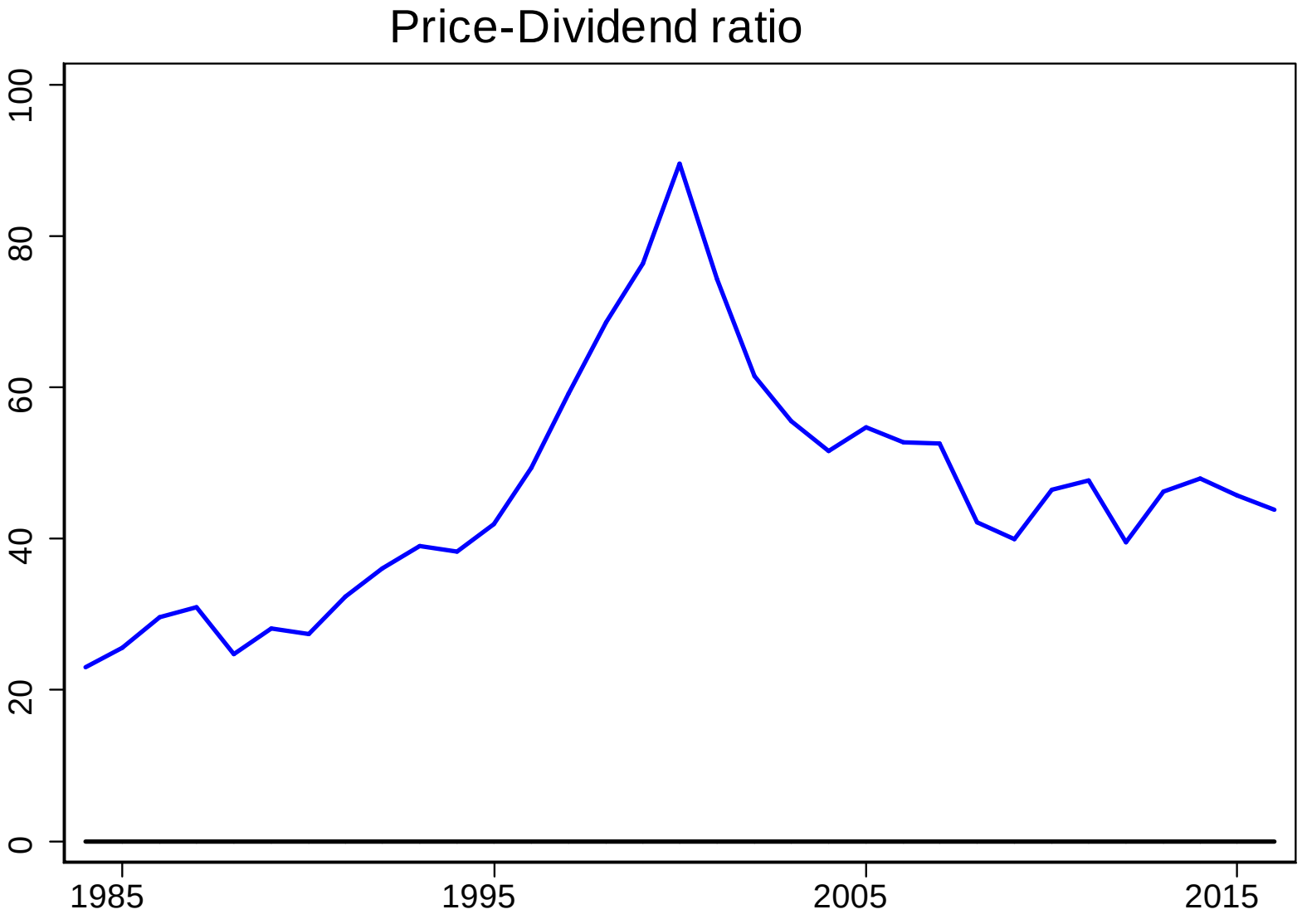
Real interest rates on safe assets trend down...



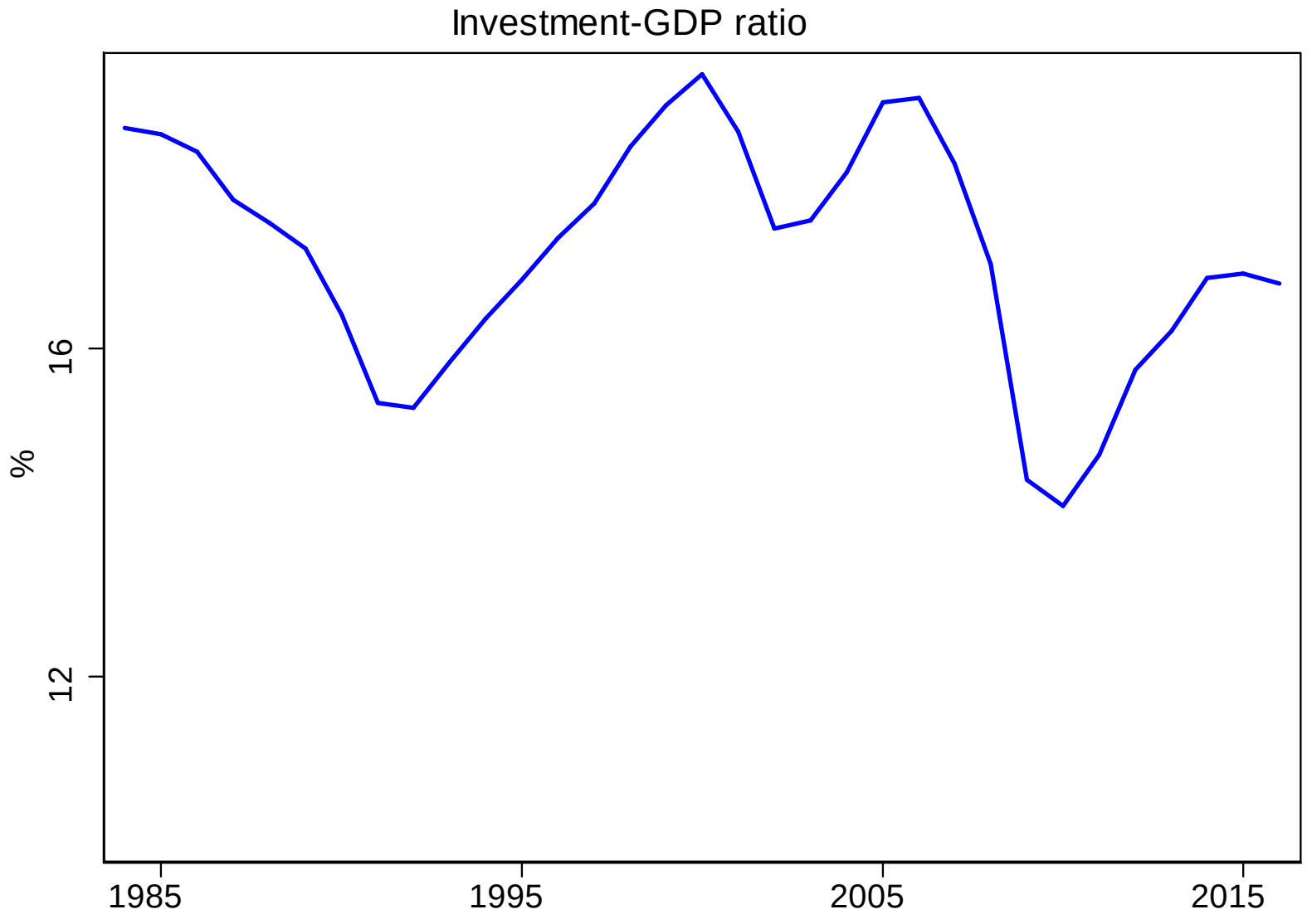
... but return on capital (MPK) stable...



... and stocks' valuation ratios rise moderately...



... while investment remains lackluster



Potential explanations

- Savings glut

  Bernanke (2005), Caballero et al. (2008), Carvalho et al. (2016), ...

- Lower productivity growth

  Fernald (2015), Gordon (2012), Hamilton et al. (2015)...

- Rising market power (and monoposony)

  Barkai (2016), De Loecker & Eeckhout (2016), Eggertsson et al. (2018), Gutierrez & Philippon (2016), CEA (2016), Furman (2015), ...

- Technical change

  Acemoglu & Restreppo (2017), Autor et al. (2017), Karabarbounis & Neiman (2013), Kehrig & Vincent (2017), Van Reenen (2018), ...

- Intangibles / mismeasurement

  Bhandari & McGrattan (2018), Caggese & Perez (2017), Corrado et al. (2018), Crouzet & Eberly (2018), Rognlie (2015), ...

- Rising liquidity or **risk premia**

  Caballero et al. (2017), Del Negro et al. (2017), Marx et al. (2017), ...

What we do

1. Document macro-finance trends
2. Neoclassical growth model as accounting framework
3. Baseline results and counterfactuals
4. Adding intangibles
5. Comparison with macro estimation

In paper: robustness, transitional dynamics, related evidence

1. Macro-finance trends

Macro-finance trends

	Average		Change
	1984-2000	2001-2016	
1. Interest rate (real 1Y)	2.79	-.35	-3.14***
2. Gross Profitability	14.01	14.9	.88
3. Price-dividend	42.3	50.1	7.78
4. Investment-capital	8.10	7.23	-.88**
5. Labor share (nonfin corps.)	70.1	66.0	-4.1***
6. TFP growth	1.10	.76	-.34
7. Investment price growth	-1.77	-1.13	.64**
8. Population growth	1.17	1.10	-.07
9. Employment-population	62.34	60.84	-1.51

2. Model

Accounting framework

- Neoclassical growth model extended for
  - Monopolistic competition
  - Risk: productivity + capital quality shocks
- Can characterize in closed form
  - big "ratios" of macro & asset prices

Model 1/2

- Utility:

$$V_t = \left((1-\beta) L_t c_t^{1-\sigma} + \beta E_t \left(V_{t+1}^{1-\theta} \right)^{\frac{1-\sigma}{1-\theta}} \right)^{\frac{1}{1-\sigma}}$$

- L_t population; c_t per capita consumption
- Inelastic labor supply $N_t = \overline{N} L_t$
- Production: differentiated goods, elasticity ε
- CRS production function, no frictions:

$$y_{it} = Z_t k_{it}^{\alpha} (S_t n_{it})^{1-\alpha}$$

$$S_{t+1} = S_t e^{\chi_{t+1}}$$

- Can aggregate:

$$Y_t = Z_t K_t^{\alpha} (S_t N_t)^{1-\alpha}$$

Model 2/2

- Capital accumulation:

$$K_{t+1} = \left(\left(1 - \delta \right) K_t + Q_t X_t \right) e^{\chi_{t+1}}.$$

- Q_t investment-specific technical progress
- Euler equation

$$E_t \left[M_{t+1} R_{t+1}^K \right] = 1$$

$$R_{t+1}^K = \left(\frac{\alpha}{\mu} \frac{Y_{t+1}}{K_{t+1}} + \frac{1 - \delta}{Q_{t+1}} \right) Q_t e^{\chi_{t+1}}$$

- Resource constraint

$$L_t c_t + X_t = Y_t$$

Big ratios 1/3

- Define composite parameter r^*:

$$r^* = \rho + \sigma g_{PC} + \sigma \frac{1 - 1/\sigma}{1 - \theta} \log E\left(e^{(1-\theta)\chi_{t+1}}\right)$$

- User cost of capital (Euler equation):

$$\frac{\alpha Y_t}{\mu K_t / Q_t} = r^* + \delta + g_Q$$

- Spread between measured profitability and risk-free rate:

$$\frac{\Pi_t}{K_t / Q_t} - r_f = \underbrace{\delta + g_Q}_{\text{depreciation}} + \underbrace{\frac{\mu - 1}{\alpha}\left(r^* + \delta + g_Q\right)}_{\text{rents}} + \underbrace{r^* - r_f}_{\text{risk}}.$$

Big ratios 2/3

- Price-dividend ratio:

$$\frac{P_t}{D_t} \approx \frac{1}{r^* - g_T}$$

- Equity premium:

$$ERP = r^* - r_f = \log E\left(e^{-\theta \chi_{t+1}}\right) - \log E\left(e^{(1-\theta)\chi_{t+1}}\right)$$

- Risk-free rate:

$$r_f = r^* + \log E\left(e^{(1-\theta)\chi_{t+1}}\right) - \log E\left(e^{-\theta \chi_{t+1}}\right)$$

Big ratios 3/3

- Labor, capital and profit shares:

$$s_L = \frac{1-\alpha}{\mu}, \quad s_C = \frac{\alpha}{\mu}, \quad s_\pi = \frac{\mu - 1}{\mu}$$

- Investment-output ratio:

$$\frac{X_t}{Y_t} = \frac{\alpha}{\mu} \frac{g_T + \delta + g_Q}{r^* + \delta + g_Q}$$

- Tobin's Q :

$$\frac{P_t}{E_t\left(K_{t+1}/Q_{t+1}\right)} \approx 1 + \frac{\mu - 1}{\alpha} \frac{r^* + \delta + g_Q}{r^* - g_T}$$

3. Empirical implementation, baseline results, and counterfactuals

Moment-matching

- Fit model to each subsample
- Parameters to estimate

	parameter	interpretation
β	discount factor	savings supply
σ	1/IES	–
θ	risk aversion	risk premia
χ	risk	"
μ	markup	market power
g_Z	TFP growth	technology slowdown
g_Q	invt-specific technical change	"
g_N	population growth	demographics
N	labor supply	"
α	Cobb-Douglas	technical change
δ	depreciation	"

Identification is (almost) recursive

1. Match growth rates of pop, invt prices, TFP , and emp-pop ratio, & infer δ from I/K
2. Infer r^* from P/D ratio using Gordon formula:

$$r^* = g_T + D/P$$

3. Infer α, μ from labor share LS and measured MPK :

$$\mu = \frac{MPK}{s_L MPK + (1 - s_L)uc},$$

$$\alpha = \frac{uc(1 - s_L)}{s_L MPK + (1 - s_L)uc}.$$

4. Infer ERP from r_f:

$$ERP = r^* - r_f = \log E\left(e^{-\theta \chi_{t+1}}\right) - \log E\left(e^{(1-\theta)\chi_{t+1}}\right)$$

Identification

- How to go from $r^*$and ERP to structural $\beta, \theta, \sigma, \chi$?
- σ not identified
- Need additional assumptions:

$$r^* = \rho + \sigma g_{PC} + \sigma \frac{1 - 1/\sigma}{1 - \theta} \log E\left(e^{(1-\theta)\chi_{t+1}}\right)$$

$$ERP = \log E\left(e^{-\theta\chi_{t+1}}\right) - \log E\left(e^{(1-\theta)\chi_{t+1}}\right)$$

- Baseline assumes rare disaster for χ and recovers β, p given

risk aversion	θ	12
IES	$1/\sigma$	2
macro shock size	b	0.15

Estimated parameters

Parameter name	Symbol	Estimates		
		1984-2000	2001-2016	Difference
Discount factor	β	0.961	0.972	0.012
Markup	μ	1.079	1.146	0.067
Disaster prob.	p	0.034	0.065	0.031
Depreciation	δ	2.778	3.243	0.465
Cobb-Douglas	α	0.244	0.243	-0.000
Population growth	g_N	1.171	1.101	-0.069
TFP growth	g_Z	1.298	1.012	-0.286
Invt technical growth	g_Q	1.769	1.127	-0.643
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Decomposing the MPK-RF spread

- Spread between *MPK* and risk-free rate:

$$MPK - r_f = \underbrace{\delta + g_Q}_{\text{depreciation}} + \underbrace{\frac{\mu - 1}{\alpha}\left(r^* + \delta + g_Q\right)}_{\text{rents}} + \underbrace{r^* - r_f}_{\text{risk}}.$$

	1984–2000	2001-2016	Change
Total spread $MPK - RF$	11.22	15.24	4.02
rents	3.39	5.55	2.17
risk premium	3.15	5.23	2.08
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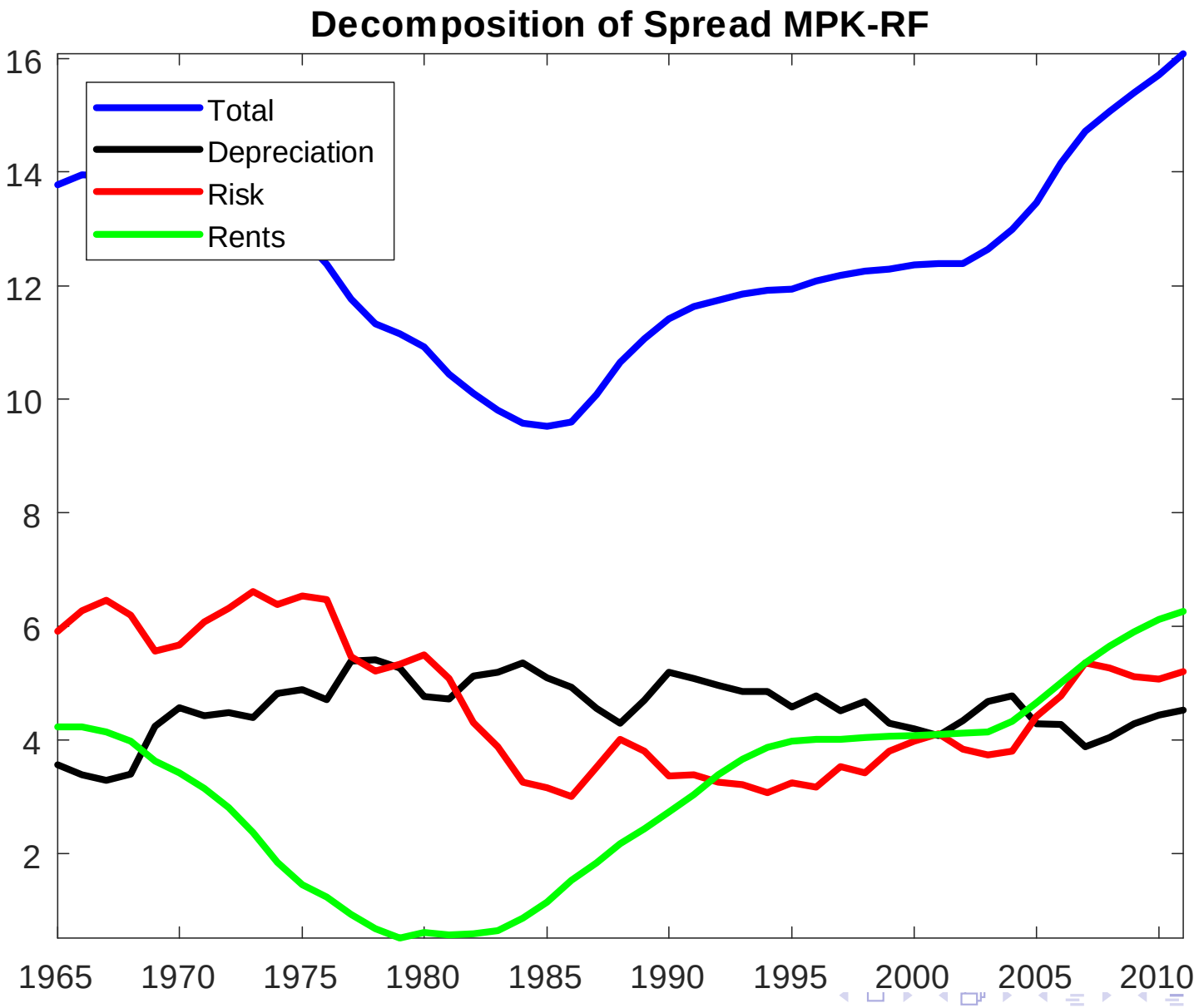
Income distribution

	1984–2000	2001-2016	Change
Labor share	70.11	66.01	-4.10
True capital share	22.59	21.24	-1.35
Pure profits share	7.30	12.76	5.46

Decomposing the MPK-RF spread



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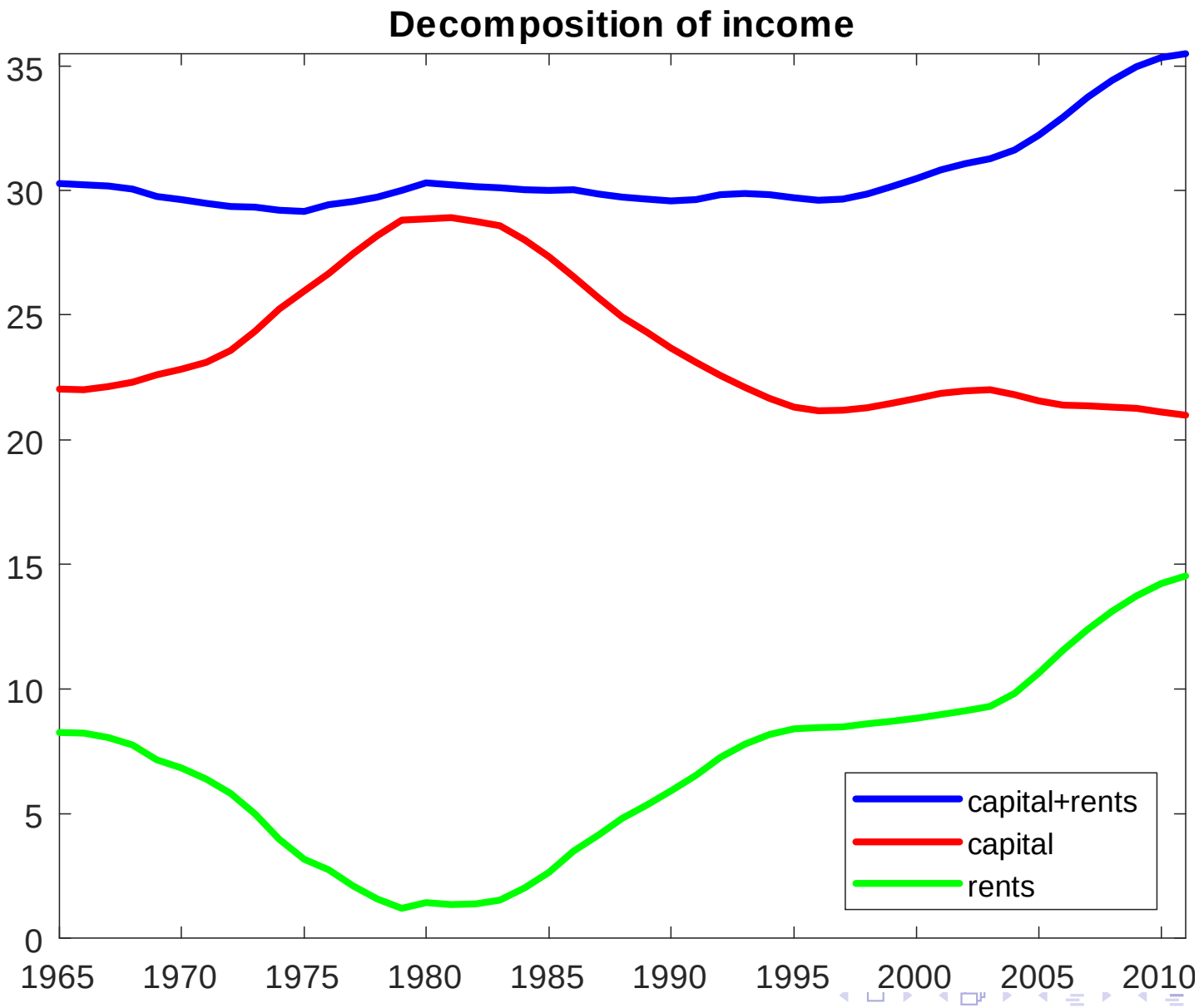
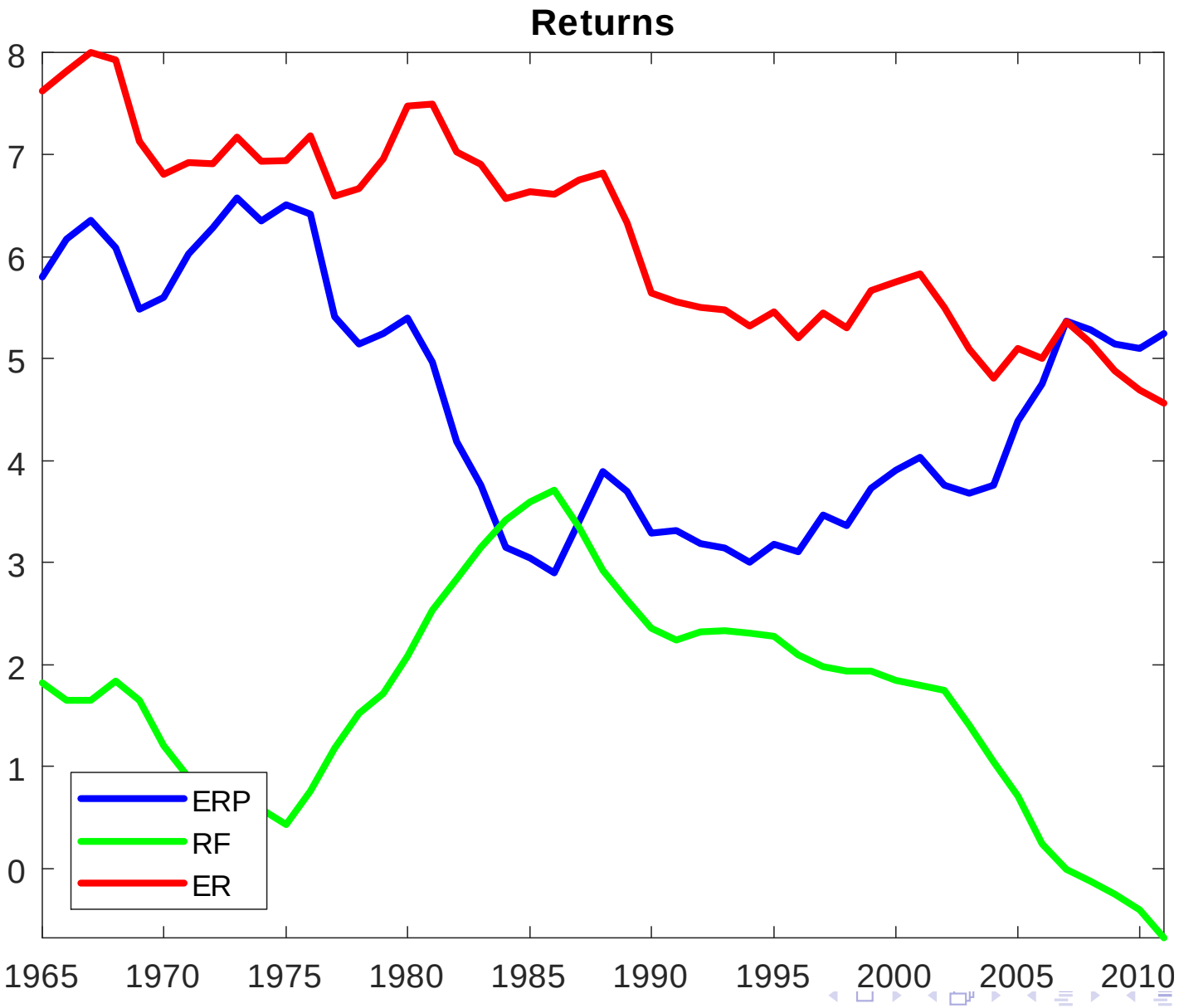


Expected returns



Counterfactuals

	Total change	Contribution β	μ	p	others
Output (%)	-0.30	4.30	-1.95	-1.70	-0.95
Investment (%)	-4.95	17.67	-8.02	-6.98	-7.62
Equity premium	2.18	0.00	0.00	2.18	0.00
Risk-free rate	-3.14	-1.25	0.00	-1.62	-0.27
Equity return	-0.96	-1.25	0.00	0.56	-0.27
Π/K	0.88	-1.94	2.76	0.76	-0.70
Tobin's Q	1.34	1.09	1.35	-0.48	-0.62
P/D	7.78	31.89	0.00	-13.34	-10.77

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5. Adding intangibles

Intangibles

- Basic idea: rising undermeasurement of K leads to rising overestimate of $MPK = \Pi / K$
- Suppose BEA measures a share $0 \leq \lambda \leq 1$ of investment and capital:
  - measured investment $x^m = \lambda x$
  - measured cap $k^m = \lambda k$
  - measured GDP: $y^m = y - (1 - \lambda)x$
  - measured profits $\pi^m = \pi - (1 - \lambda)x$
- Wedge MPK-RF:

$$MPK - r_f = \delta + g_Q + \frac{\mu - 1}{\alpha}(r^* + \delta + g_Q) + r^* - r_f + \frac{\mathbf{1} - \boldsymbol{\lambda}}{\boldsymbol{\lambda}} \frac{\boldsymbol{\pi} - \mathbf{x}}{\mathbf{k}}$$

A quantitative illustration

- Suppose unmeasured K grows from 10% to 20% of K.
  - Note: measured IPP K is 6% of total K today

	1984–00	2001-16	Change	No Intang.
Total spread:	11.22	15.24	4.02	4.02
components:				
depreciation	4.55	4.37	-0.18	-0.18
rents	2.80	4.03	1.23	2.17
risk premium	3.15	5.23	2.08	2.08
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6. Comparison with macro estimation

Comparison with macro-estimation

- Most macro estimations abstract from risk premia
- What if we do the same?

	Macro approach			Baseline
	1984-00	2001-2016	Diff.	Diff.
β	0.984	1.012	0.028	0.012
μ	1.165	1.330	0.166	0.067
p	0	0	0	0.031
δ	2.778	3.243	0.465	0.465
α	0.183	0.122	-0.061	-0.000
g_P	1.171	1.101	-0.069	-0.069
g_Z	1.544	1.358	-0.187	-0.286
g_Q	1.769	1.127	-0.643	-0.643
N	0.623	0.608	-0.015	-0.015

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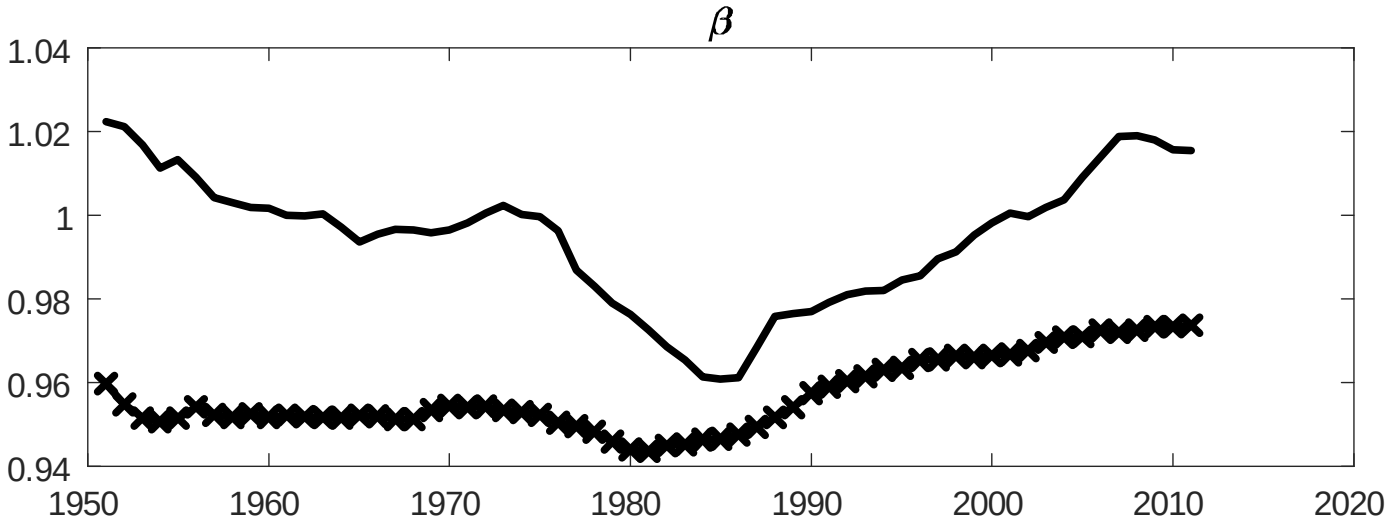
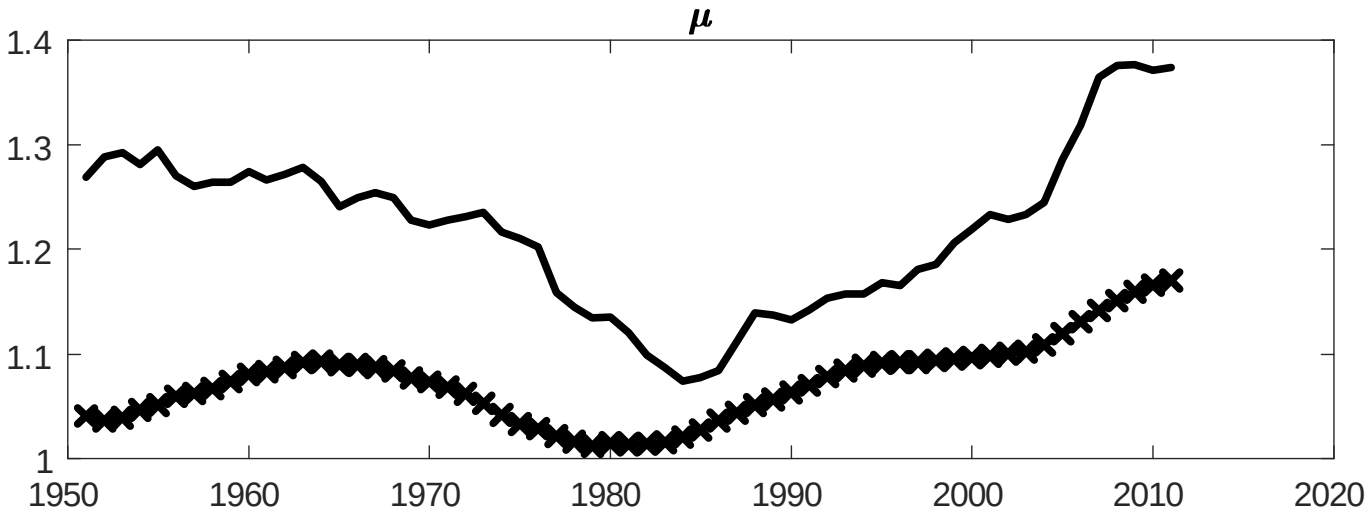
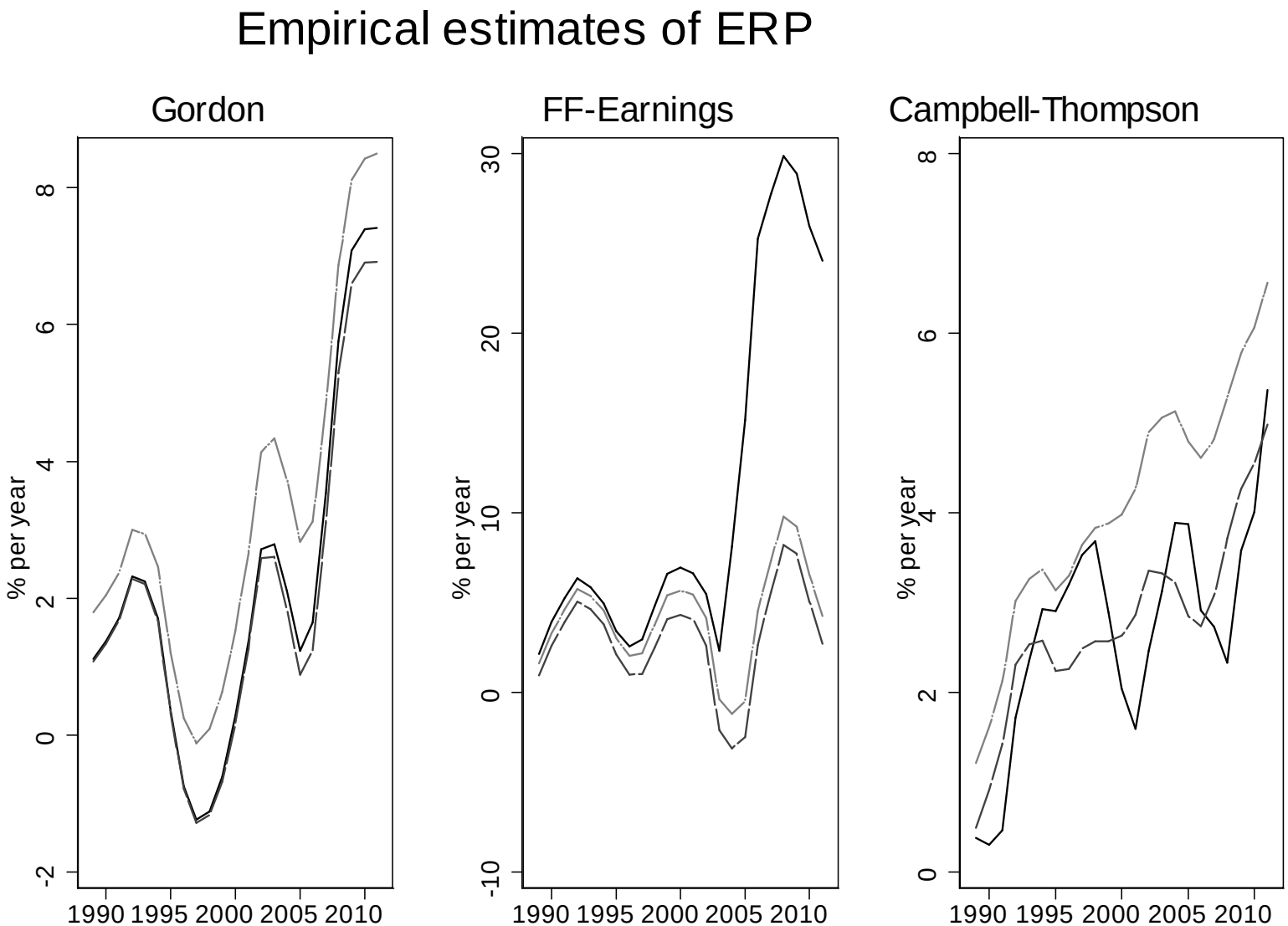
Macro estimation: unstable parameters?





7. Related Empirical Evidence

Other estimates of equity risk premium



Other estimates of equity risk premium

	1984–'00	2001-'16	Change
1. *Arithmetic*			
1a. Gordon	.87	5.56	**4.69**
1b. Fama-French Earnings	2.43	4.78	**2.35**
1c. Campbell-Thompson	1.47	4.11	**2.64**
2. *Geometric*			
2a. Gordon	1.91	9.16	**7.25**
2b.Fama-French Earnings	4.61	8.66	**4.05**
2c. Campbell-Thompson	1.84	3.65	**1.81**
3. *Geometric: w. variance ajd*			
3a. Gordon	2.43	8.26	**5.83**
3b. Fama-French Earnings	4.81	10.3	**5.49**
3c. Campbell-Thompson	2.31	5.56	**3.25**

Other estimates of risk

	Mean			Change	
	1984-00	2001-16			
		w GFC	wo GFC	w GFC	wo GFC
	(1)	(2)	(3)	(2)-(1)	(2)-(1)
spread GZ	1.5	2.54	2.31	1.04	.81
spread BAA	1.94	2.74	2.61	.80	.67
spread AAA	1.01	1.64	1.61	.63	.60
VIX	18.92	20.22	18.62	1.3	-.3
Realized vol	13.36	17.43	15.34	4.07	1.98

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Conclusion

- An **accounting** exercise...
- Disciplined by standard **neoclassical** framework
- To study **jointly** key trends
- Substantive conclusion: **rising macro risk**
  - plays a role as important as market power
  - market power overestimated by macro approaches
  - market power smaller if we account for intangibles
- Can extend to incorporate other explanations & target
  - taxes, corporate governance, idiosyncratic risk, etc.

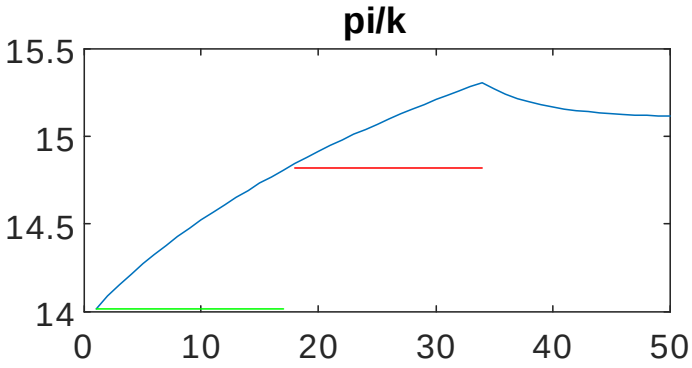
BACKUP

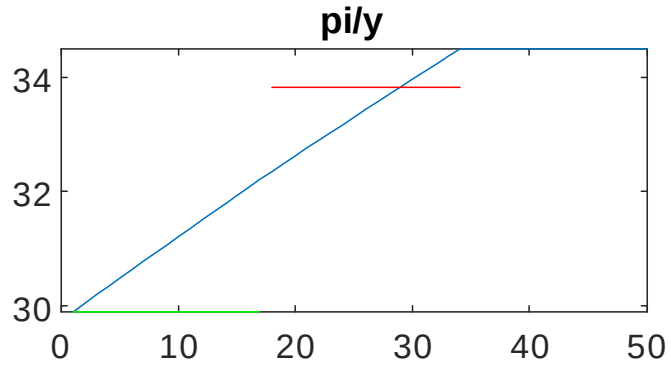
Transitional Dynamics

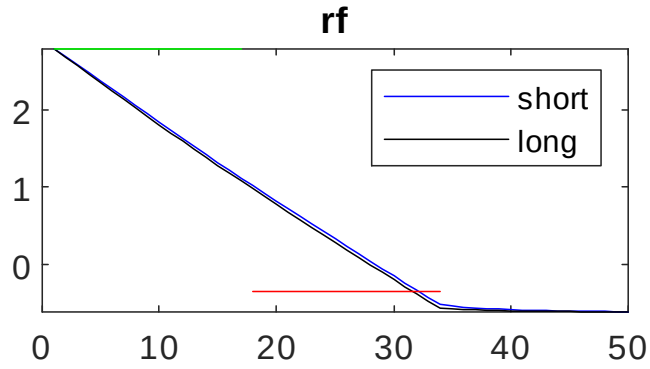
Transitional Dynamics

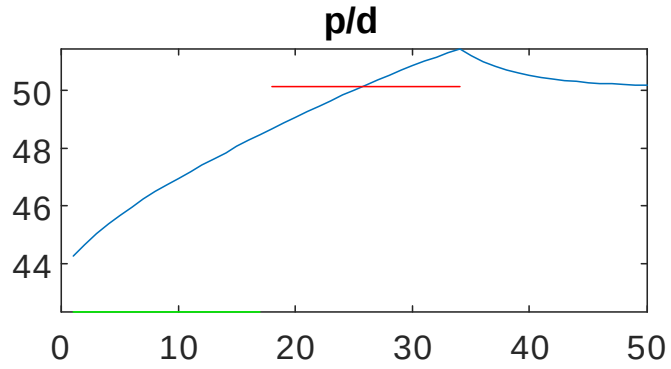
- Changes in parameter induce some transitional dynamics
- Does this affect our estimation?
- Suppose we calculate transition as parameters evolve linearly from value estimated in 1st sample to a final value
- Choose final value such that moments calculated during transition path match data
- Do we get similar parameters?
- Important: we assume "myopic" expectations (Otherwise cannot match data)

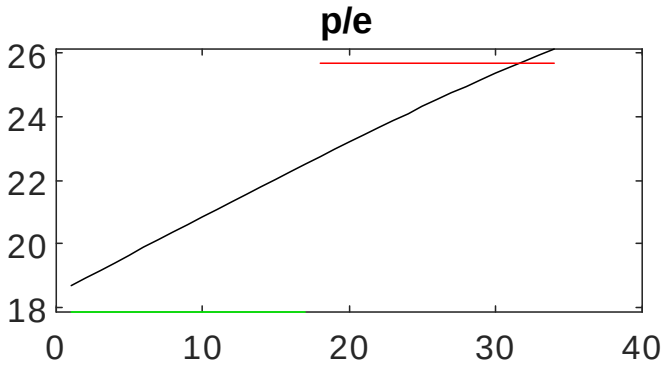
Transitional Dynamics

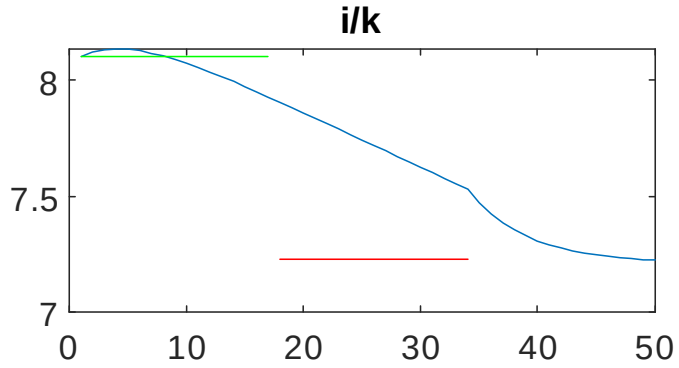




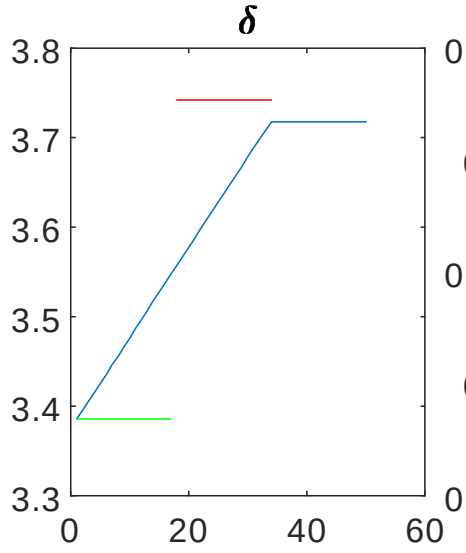


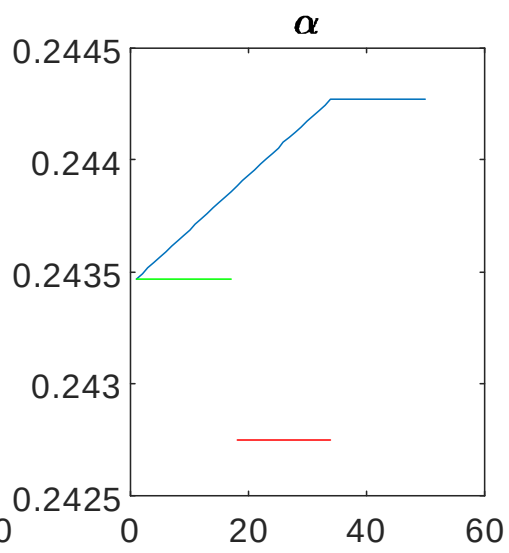


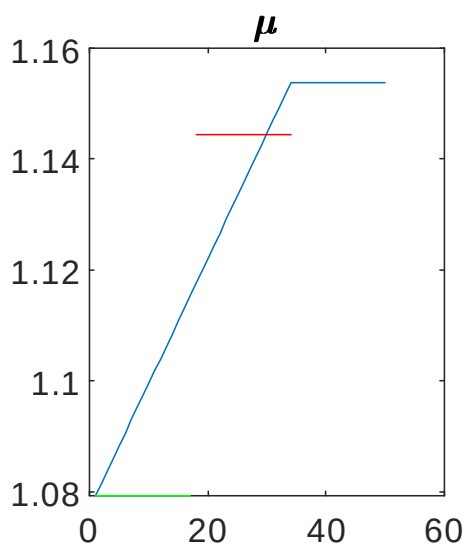


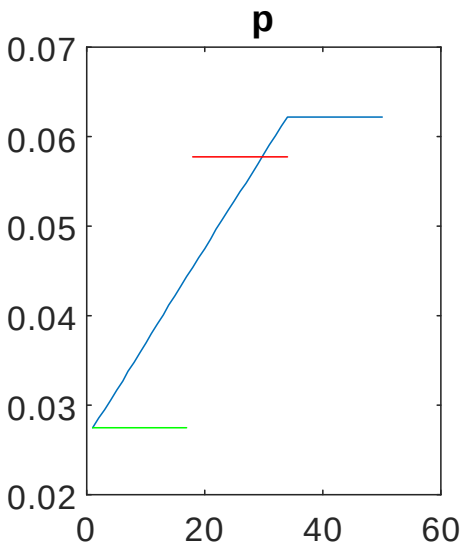


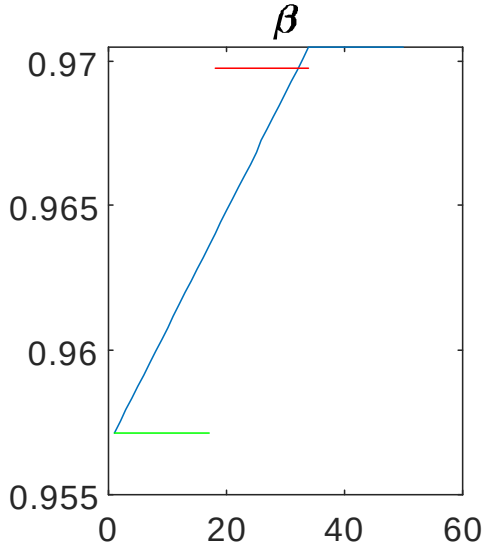
Transitional Dynamics





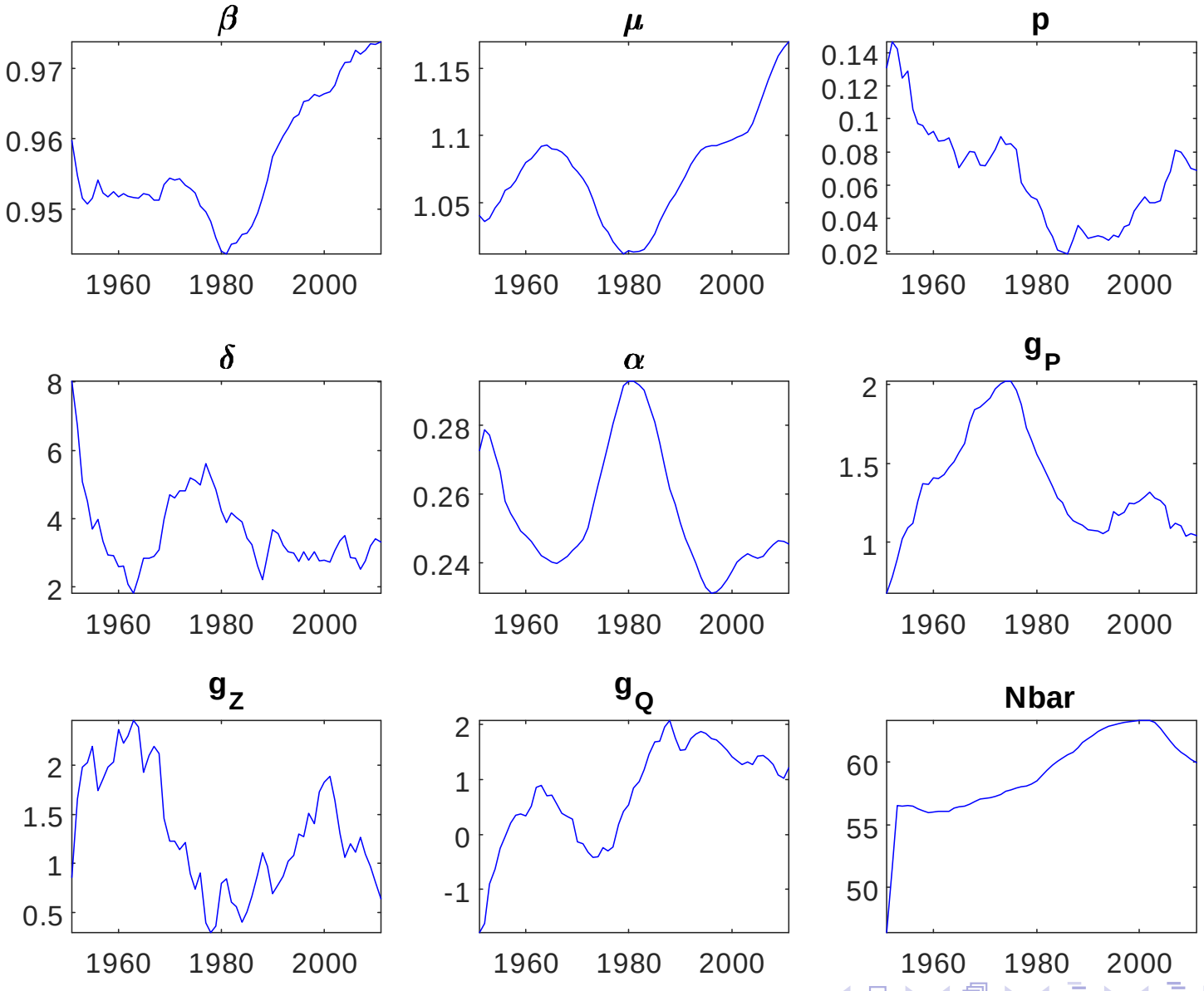




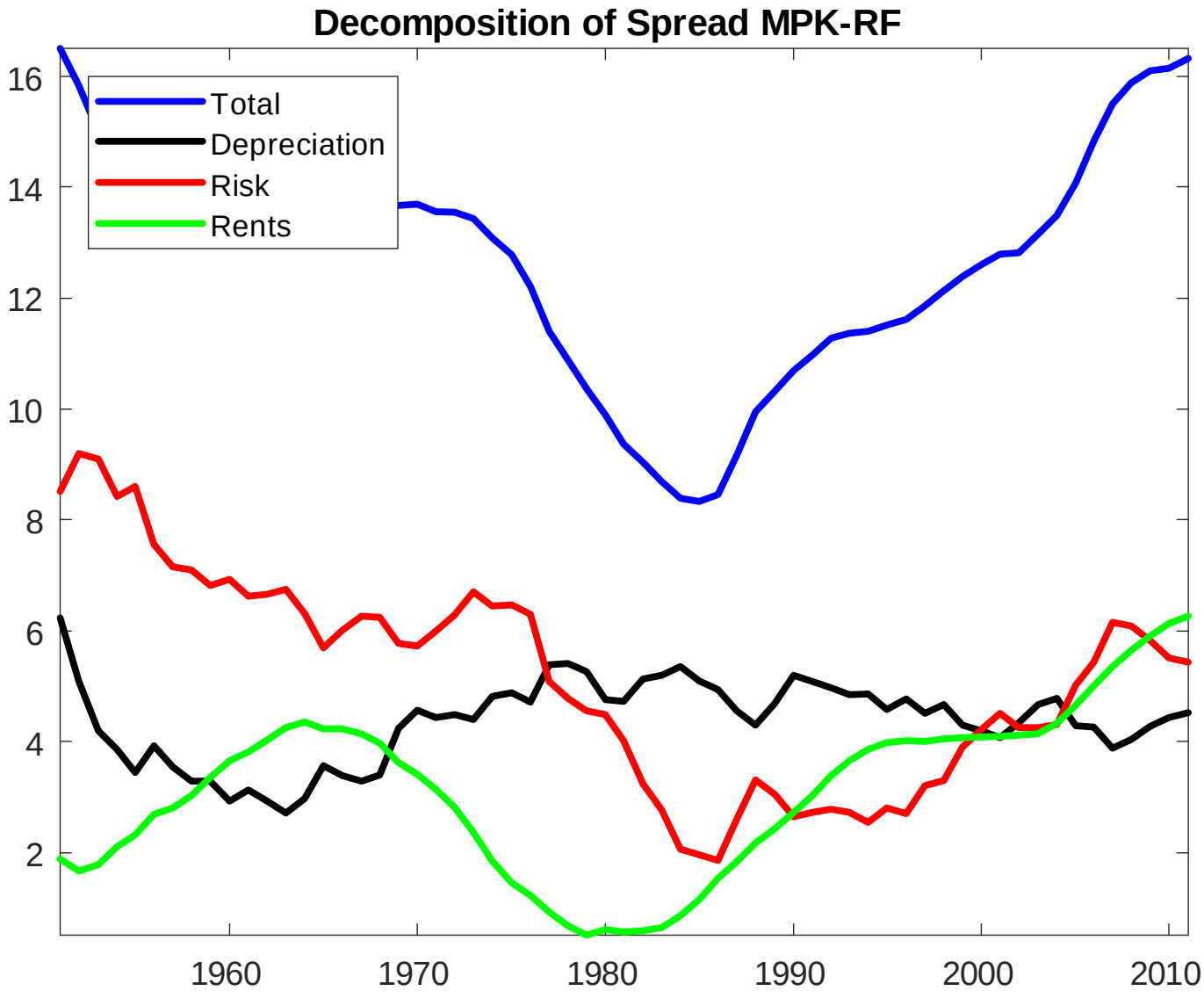


Long rolling estimation

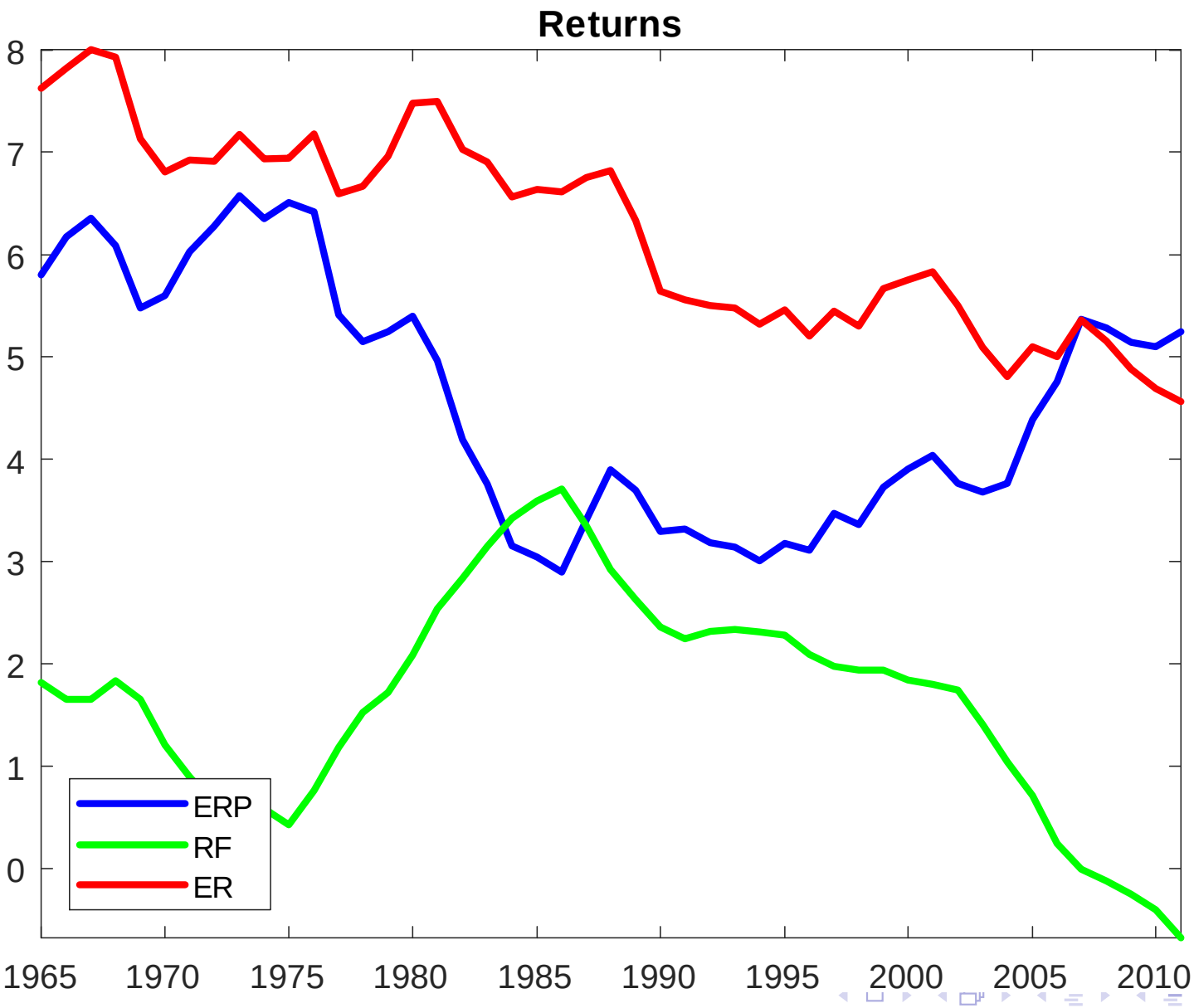
Rolling estimation



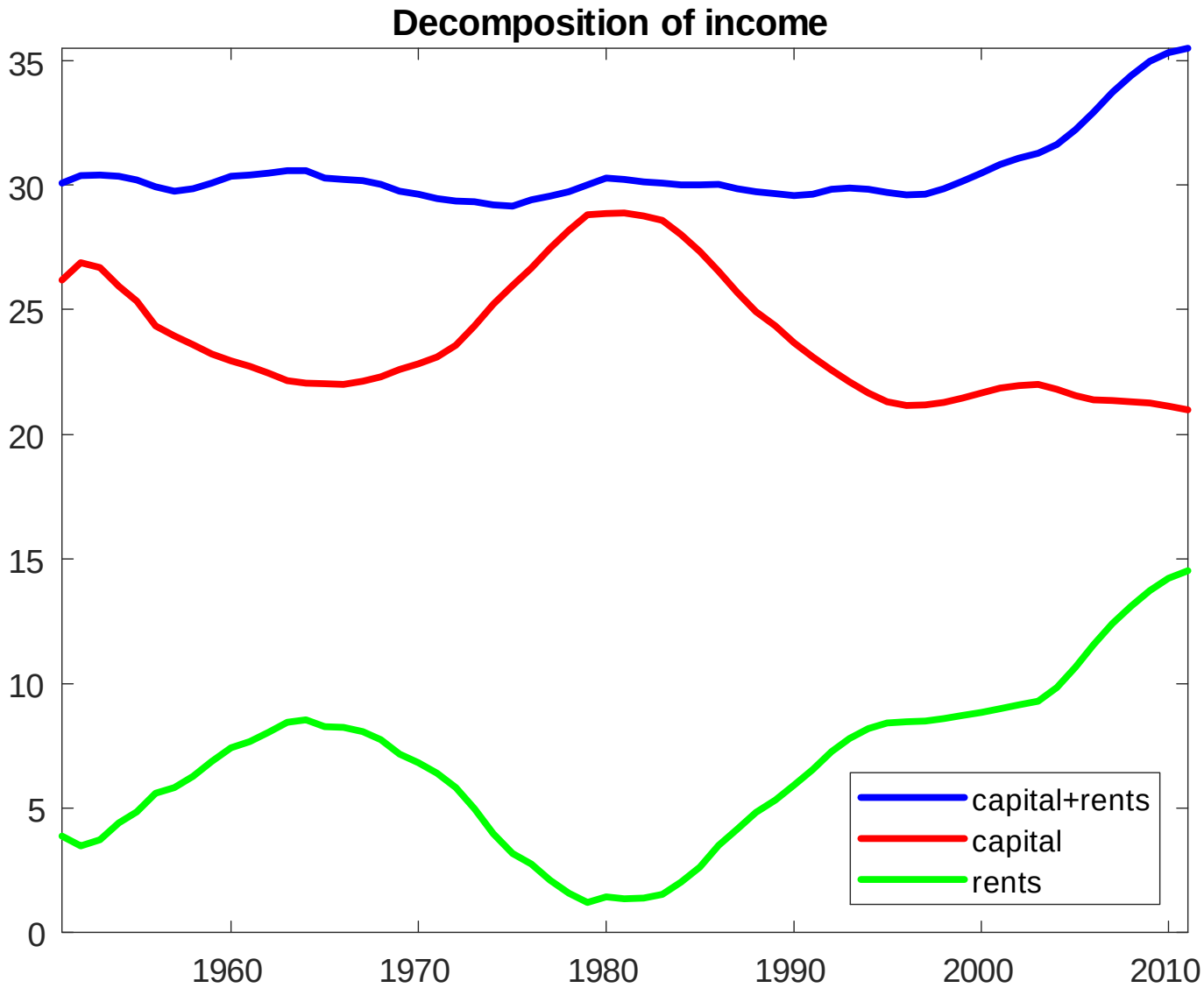
Evolution of MPK-RF spread since 1950



Expected returns since 1950



Income distribution since 1950



Robustness

Financial leverage

- Calculation assumes an all-equity financed firm
- But we use P/D only
- OK if yield on stocks = yield on debt
- Not quite true of course
- Feed leverage from data and assume interest rate = RF (for now) to correct PD

Financial leverage

	Leverage			Baseline
	1984-00	2001-16	Diff.	Diff.
β	1.002	0.995	-0.006	0.012
μ	1.106	1.191	0.084	0.067
p	0.021	0.044	0.023	0.031
δ	2.778	3.243	0.465	0.465
α	0.224	0.214	-0.010	-0.000
g_P	1.171	1.101	-0.069	-0.069
g_Z	1.378	1.096	-0.282	-0.286
g_Q	1.769	1.127	-0.643	-0.643
N	0.623	0.608	-0.015	-0.015

Financial Leverage

	Leverage 1984-00	2001-16	Diff.	Diff.
A. MPK-RF spread				
Total spread	11.22	15.24	4.02	4.02
– Depreciation	4.55	4.37	-0.18	-0.18
– Market power	4.47	6.99	2.52	2.17
– Risk premium	2.08	3.81	1.73	2.08
B. Rate of returns				
Equity return	5.77	4.84	-0.93	-0.96
Equity premium	2.99	5.19	2.20	2.18
Risk-free rate	2.79	-0.35	-3.14	-3.14

IES=0.5

	IES=0.5			Baseline
	1984-00	2001-16	Diff.	Diff.
β	0.987	0.976	-0.012	0.012
μ	1.079	1.146	0.067	0.067
p	0.034	0.065	0.031	0.031
δ	2.778	3.243	0.465	0.465
α	0.244	0.243	-0.000	-0.000
g_P	1.171	1.101	-0.069	-0.069
g_Z	1.298	1.012	-0.286	-0.286
g_Q	1.769	1.127	-0.643	-0.643
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A. MPK-RF spread				
Total spread	11.22	15.24	4.02	4.02
– Depreciation	4.55	4.37	-0.18	-0.18
– Market power	3.39	5.55	2.17	2.17
– Risk premium	3.15	5.23	2.08	2.08
B. Rate of returns				
Equity return	5.85	4.90	-0.96	-0.96
Equity premium	3.07	5.25	2.18	2.18
Risk-free rate	2.79	-0.35	-3.14	-3.14

Liquidity

	AA rate as RF			Baseline
	1984-00	2001-16	Diff.	Diff.
β	0.995	0.982	-0.013	0.012
μ	1.079	1.146	0.067	0.067
p	0.012	0.043	0.031	0.031
δ	2.778	3.243	0.465	0.465
α	0.244	0.243	-0.000	-0.000
g_P	1.171	1.101	-0.069	-0.069
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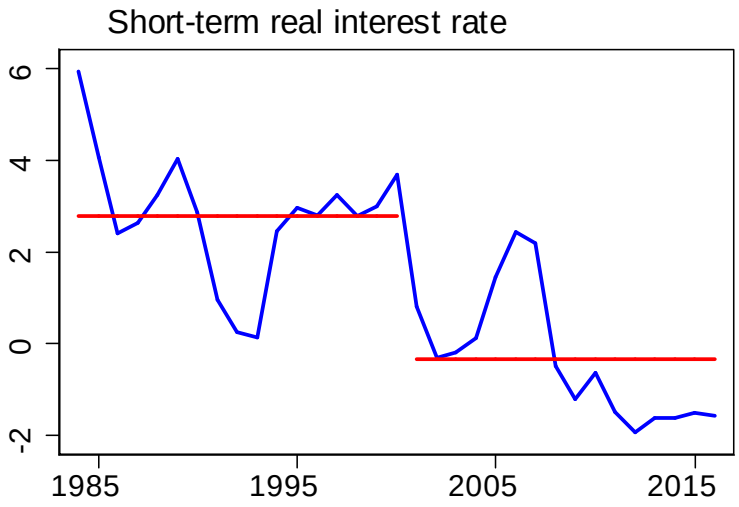
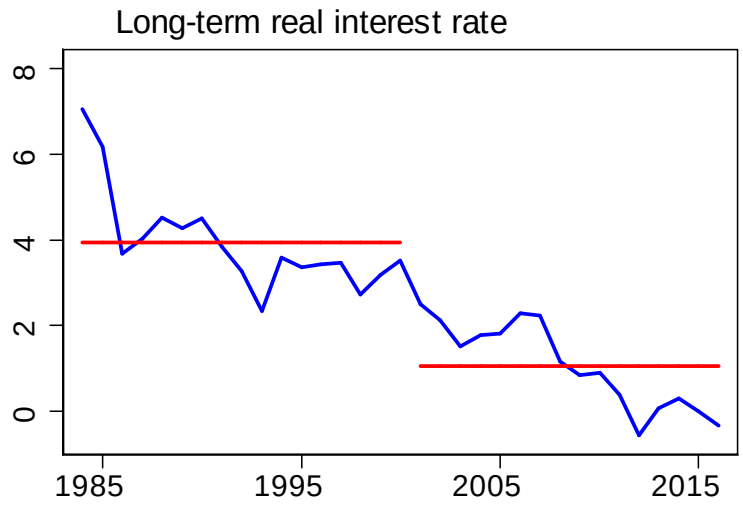
Liquidity

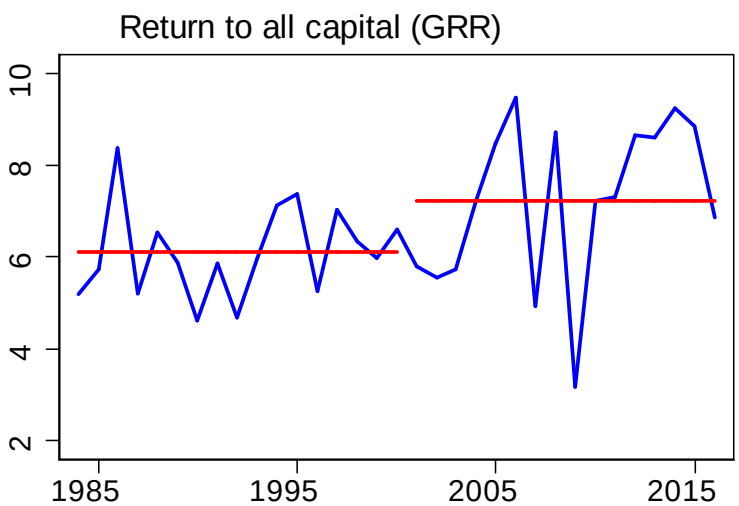
	AA rate as RF 1984-00	2001-16	Diff.	Baseline Diff.
A. MPK-RF spread				
Total spread	9.32	13.80	4.48	4.02
– Depreciation	4.55	4.37	-0.18	-0.18
– Market power	3.39	5.55	2.17	2.17
– Risk premium	1.25	3.79	2.54	2.08
B. Rate of returns				
Equity return	5.88	4.84	-1.05	-0.96
Equity premium	1.19	3.75	2.56	2.18
Risk-free rate	4.69	1.09	-3.60	-3.14

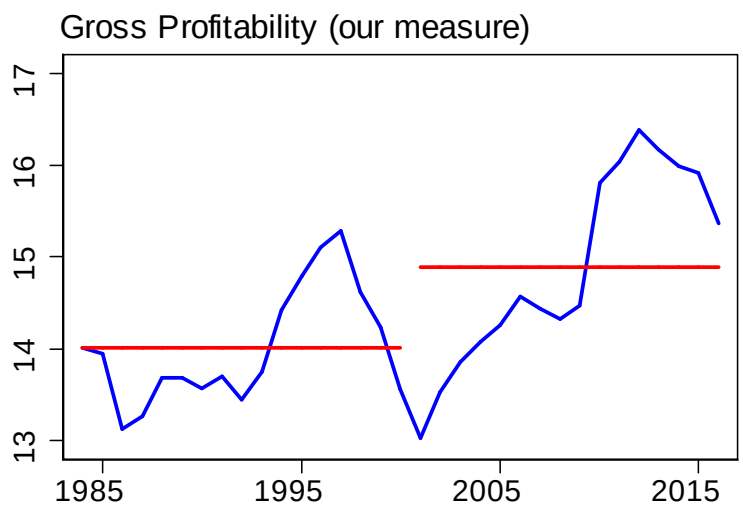
Macro-finance trends: graphs

Interest rate and MPK

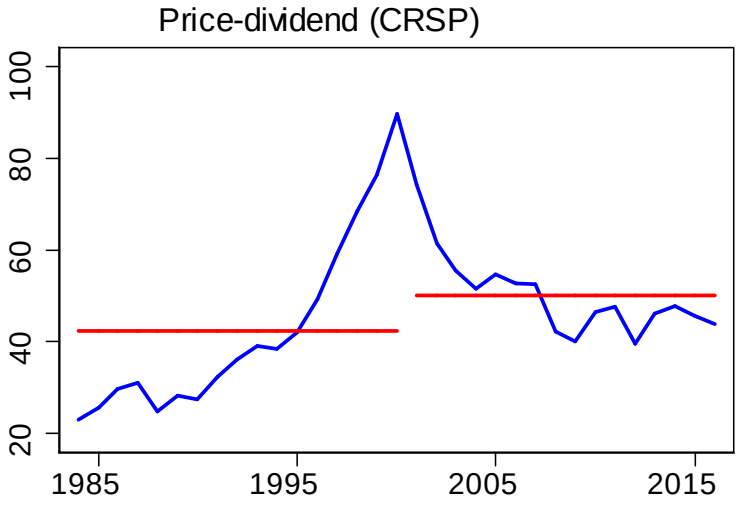


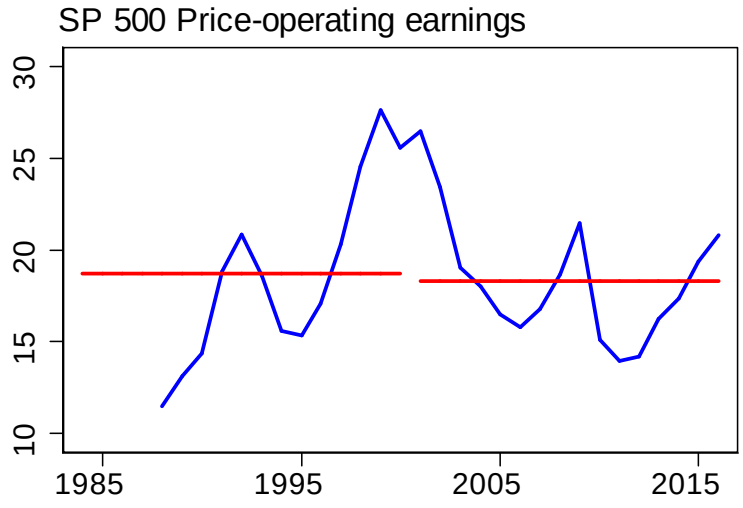


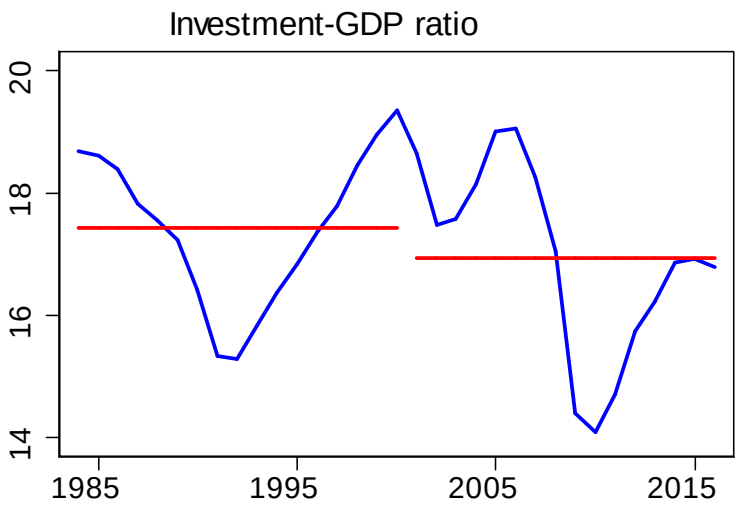


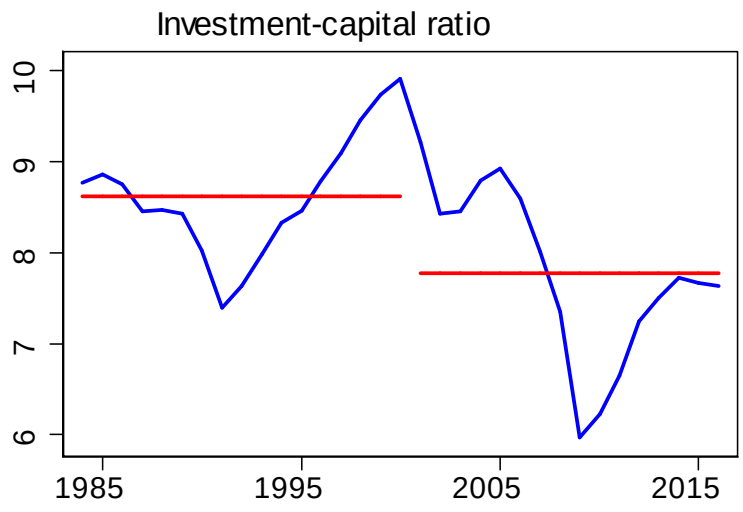


Valuation ratios and investment

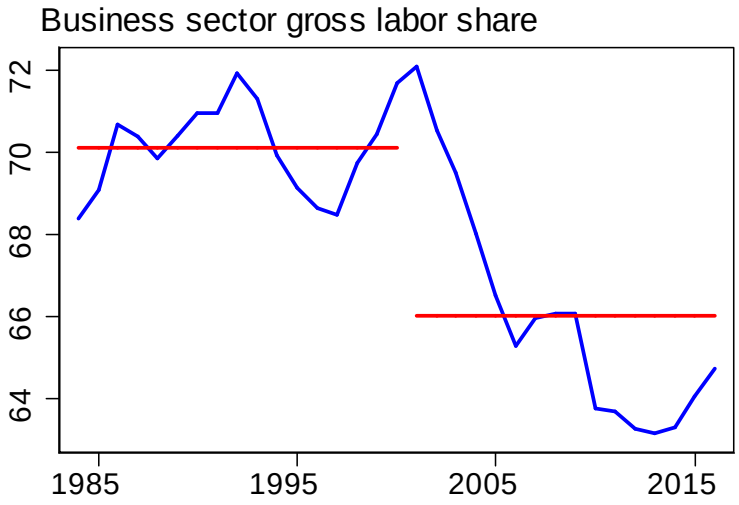


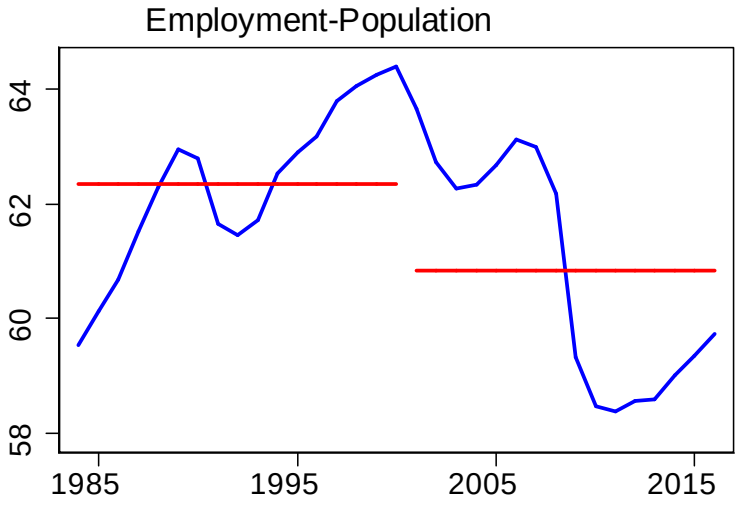


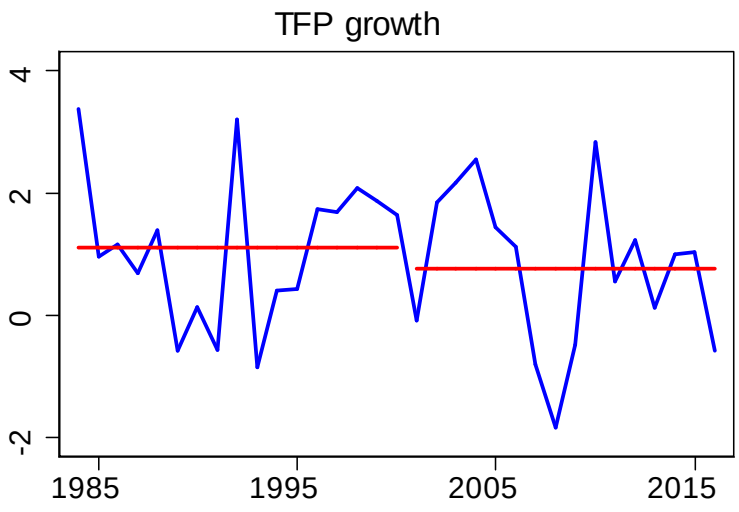


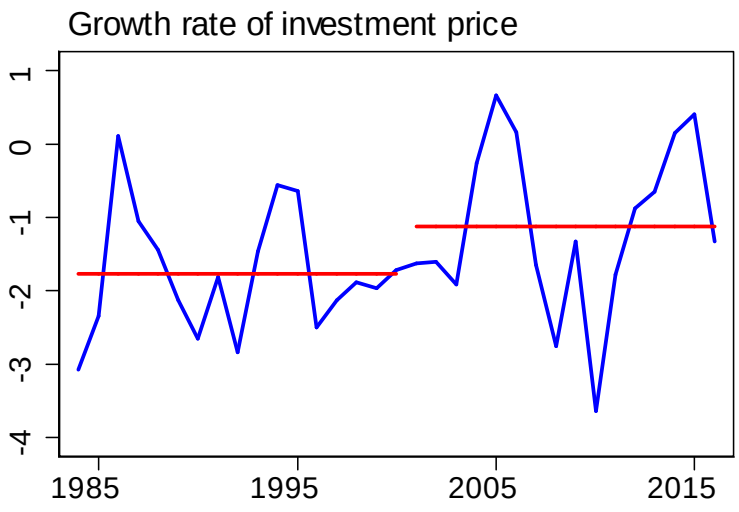


Labor share, Demographics, Productivity









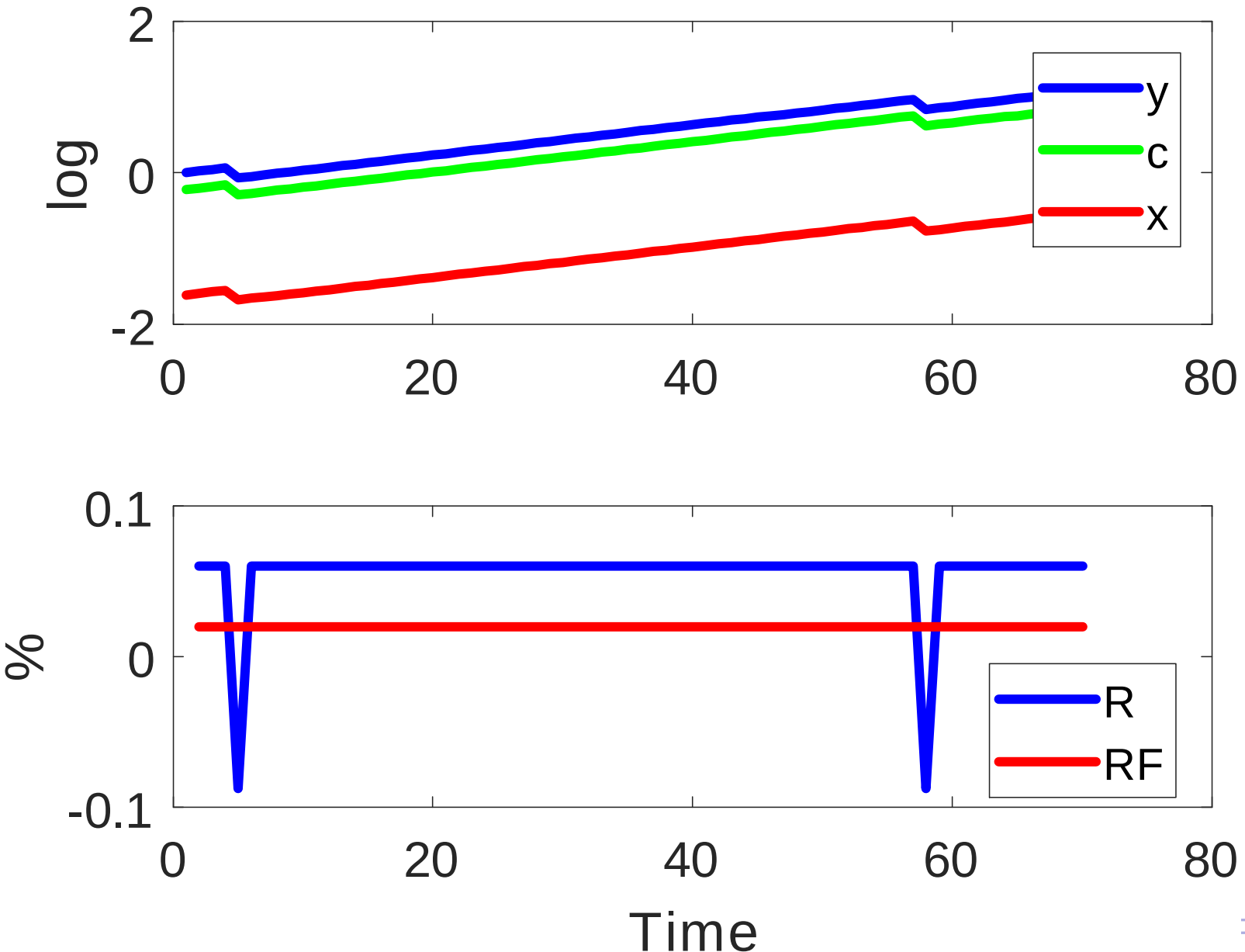
Risky balanced growth 1/2

- Assume Z_t, L_t, Q_t grow at constant rates:
  - $Z_{t+1}/Z_t = 1 + g_Z$, etc.
- Then equilibrium is a "risky balanced growth":

$$\begin{aligned} Y_t &= T_t S_t y^*, \\ X_t &= T_t S_t x^*, \text{ etc.} \end{aligned}$$

- S_t stochastic trend, $S_{t+1} = S_t e^{\chi_{t+1}}$
- $T_t = L_t Z_t^{\frac{1}{1-\alpha}} Q_t^{\frac{\alpha}{1-\alpha}}$ deterministic trend (of GDP)
- Uncertainty affects x^*, y^*
- Realizations of shocks affect X_t, Y_t, but not X_t/Y_t

Risky balanced growth 2/2



Counterfactuals

- What is the effect of these changes on the level of GDP or investment?
- Effect of markup on GDP:

$$\frac{\partial \log GDP}{\partial \log \mu} = -\frac{\alpha}{1-\alpha}$$

- Effect of r^* on GDP:

$$\frac{\partial \log GDP}{\partial r^*} = -\frac{\alpha}{1-\alpha}\frac{1}{r^* + g_Q + \delta}$$