

The Intended and Unintended Consequences of Financial-Market Regulations

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Motivation

- ▶ The recent financial crisis, has highlighted the **negative feedback** from financial markets to the real sector.
- ▶ Debate about ability of financial-market regulations to
 - **stabilize financial markets**, and
 - **improve macroeconomic outcomes**.

Objective

- ▶ Study the **intended** and **unintended** consequences of three regulatory measures which have been proposed by regulators:
 - ① **Financial-transactions tax**
 - 0.20% tax, by France in 2012
 - ② **Portfolio constraints** (short-sale constraints)
 - Spain and Italy, 2012, and
 - ③ **Borrowing constraints** (leverage constraints)
 - advocated in 2008 by European commissioner.

Questions we wish to answer

- ▶ Of the three regulatory measures, **which is most effective** in stabilizing financial markets and increasing welfare?
- ▶ What is the **channel** through which each measure works?
- ▶ What is the impact, **intended** or **unintended** on
 - **financial variables**: the risk-free interest rate, the cost of capital?
 - what are the spillover effects on **real variables**?
- ▶ Are more tightly regulated markets
 - more **stable**?
 - increase output growth or **welfare**?

Setting

- ▶ Consider a world where financial markets influence real sector.
- ▶ Investors trade for **two** reasons:
 - ① **Risk-sharing**: hedge shocks to labor income
 - ② **Speculation**: disagree about the state of the economy
- ▶ Trading in financial markets has **positive** and **negative** effects
 - Trading to share risk **improves** welfare
 - Trading to speculate generate **excess volatility** in financial and real markets, and **reduces** welfare.

Preview of results:

Effects on financial and macro variables

- ▶ All three regulatory measures have **similar effects** on financial and macroeconomic variables:
 - reduce stock and bond turnovers,
 - reduce the risk-free rate
 - increase the equity risk premium and stock-return volatility,
 - change capital investment and output growth.

Preview of results: Effects on welfare

Effect on welfare depends on how regulatory policy influences

- Speculative trading—financed using the bond
- Risk-sharing—executed through trading stocks

① **Borrowing constraint improves welfare**

- because bond used mostly to finance speculative trading

② **Small transaction tax improves welfare**

- because it allows for small trades to hedge labor income but makes large and erratic speculative trades less profitable.

③ **Limit on stock holdings, such as short-sale ban, reduces welfare**

- because it limits risk sharing severely, while reducing only partially speculative trading.

Outline

- ① Motivation and objective
- ② The model
- ③ Effects of disagreement
- ④ Benefits of risk sharing
- ⑤ Effects of regulatory measures
- ⑥ Conclusion

Key features of our model

- ▶ **Endogenous growth:** by means of an “AK”-production model differences in beliefs and regulation can affect long-run growth
- ▶ **Differences in beliefs with persistent disagreement:** differences in learning—effects do not ‘die out’
- ▶ **Risk resides internally in the financial system:** speculators gives rise to motive for financial regulation
- ▶ **Market incompleteness:** because of differences in beliefs, labor-income shocks, regulation

Production

- ▶ **Representative firm** producing and paying out a single consumption good.
- ▶ **Stochastic technology** (productivity shocks, “AK” model)
- ▶ **Quadratic adjustment costs** to change capital stock
- ▶ **Firm chooses investment and dividends** to maximize its value, which depends on ownership-weighted state prices of investors.

Investors

- ▶ Two groups of investors that derive utility from consumption
 - Utility function is of the Epstein-Zin-Weil type.
- ▶ Investors receive **stochastic wages** by supplying labor.
- ▶ Investors can invest in **two financial assets**:
 - stock, which represents a claim to the dividends of the firm;
 - one-period risk-free bond.

Uncertainty

- ▶ **Hidden Markov Model** for describing uncertainty in the economy.
- ▶ **Hidden Part**
 - Two unobservable fundamental states:
'Expansion' or 'Recession'
 - **Markov process** describes transition between these states.

Disagreement between investors

▶ Observables

- While state of economy is unobservable, investors do observe
 - ① productivity realization: 'high' or 'low'
 - ② a public signal: 'positive' or 'negative'

- ▶ Investors use these observables to form conditional state probabilities using a **nonlinear analog** of the **Kalman filter**.
- ▶ **Investors disagree** about the information contained in the signal, so they **agree to disagree**.
- ▶ Results in **persistent stochastic disagreement** between investors.

Regulatory measures

- ① **Portfolio constraint** puts lower limit on investors' stock holdings
 - Short-sale constraint implies a lower limit of zero.
- ② **Borrowing constraint** limits the maximum amount of borrowing
- ③ **Transaction tax**: proportional transaction tax on value of stock traded
 - Tax is redistributed back as a lump-sum to investors after they have made their optimization decisions for that date.

Equilibrium

Equilibrium in this economy is defined as

- ▶ **consumption policies** that maximize lifetime expected utility
- ▶ **portfolio policies** that finance the optimal portfolio policy
- ▶ **investment policy** that maximizes the value of the firm
- ▶ **price processes** for the financial assets such that markets clear.
- ▶ **regulatory constraint** is satisfied.

Solving for equilibrium

- ▶ We solve for the equilibrium in the economy
 - by extending the algorithm in Dumas and Lyasoff (2012),
 - who show how one can identify the equilibrium
 - in a **recursive** fashion (for a frictionless exchange economy)
 - even with **incomplete** financial markets.

Calibration of the model

- ▶ For the quantitative analysis we calibrate our model to match several **stylized facts** of the U.S. **macroeconomy** and **financial markets**.
 - For example, output and investment volatility as well as the levered equity risk premium and its volatility.
- ▶ We solve model for 200 years, and **study results for last 50 years** in order to draw from a stationary distribution.
- ▶ All statistics are based on averages over 25,000 simulated paths.

Model parameters

Variable	Description	Value
Production		
Capital share in output	α	0.50
Avg. productivity	\bar{Z}	0.325
Avg. productivity growth	$\bar{u} = -\bar{d}$	0.041
Mean-reversion productivity growth	ν	0.667
Depreciation	δ	0.045
Adjustment costs	ξ	7.25
Investors		
Rate of time preference	β	0.96
Risk aversion	γ	8.50
Elasticity of intertemporal substitution	ψ	$1/\gamma$
Degree of disagreement	w	0.60
Persistence labor shocks	$E_{1,1} = E_{2,2}$	0.75
High individual labor supply	$e_{1,u} = e_{2,u}$	0.77
Low individual labor supply	$e_{1,d} = e_{2,d}$	0.23
Uncertainty: Hidden Markov model		
Persistence of hidden states	$A_{1,1} = A_{2,2}$	0.90
Precision of productivity shocks	ρ	0.80
Initial probability hidden state 1	π	0.50

Financial and Business Cycle Statistics

Description	Variable	U.S. Data	Model
Financial markets			
Interest rate	r_f	1.94%	2.31%
Interest rate volatility	$\sigma(r_f)$	5.44%	4.89%
Levered equity premium	$\mathbb{E}[R^{ep}]$	6.17%	6.97%
Levered stock return volatility	$\sigma(R)$	19.30%	17.19%
Log price-dividend ratio	$\log(S/D)$	3.10	3.06
Volatility price-dividend ratio	$\sigma(\log(S/D))$	26.30%	19.60%
Real economy			
Output growth	$E[Y]$	1.60%	0.91%
Output growth volatility	$\sigma(Y)$	3.78%	3.93%
Norm. investment growth volatility	$\sigma(I)/\sigma(Y)$	2.39	2.04
Norm. consumption growth volatility	$\sigma(C)/\sigma(Y)$	0.40	0.71

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Effects of disagreement

- ▶ Disagreement is stochastic, with stochastic volatility.
- ▶ Thus, disagreement is an **additional source of risk**.
 - Often referred to as “**sentiment risk**.”
- ▶ This extra risk affects both the financial and real sectors.

Effects of disagreement on financial sector

- ▶ Increased demand for precautionary saving, reduces interest rate.
- ▶ Interest rate volatility and stock return volatility increase.
- ▶ Per annum turnover increases
 - for the bond by 15 times; for the stock by 5 times
 - **thus, bond important to finance speculation**
(no change in labor income, so need bond to fund speculation)
- ▶ Equity risk premium increases.
- ▶ Cost of capital increases.

Effects of disagreement on real sector and welfare

- ▶ Higher cost of capital leads to:
 - Lower rate of investment
 - Lower growth rate
 - Higher volatility of investment growth
- ▶ **Welfare is reduced** by about 4% of initial capital.

Effects of disagreement

Description	Variable	Disagreement	
		Yes	No
Financial markets			
Interest rate	r_f	2.31%	3.36%
Interest rate volatility	$\sigma(r_f)$	4.89%	2.30%
Levered equity premium	$\mathbb{E}[R^{ep}]$	6.97%	4.50%
Levered stock return volatility	$\sigma(R)$	17.19%	13.29%
Log price-dividend ratio	$\log(S/D)$	3.06	3.11
Volatility price-dividend ratio	$\sigma(\log(S/D))$	19.60%	13.40%
Real economy			
Output growth	$E[Y]$	0.91%	1.08%
Output growth volatility	$\sigma(Y)$	3.93%	3.94%
Norm. investment growth volatility	$\sigma(I)/\sigma(Y)$	2.04	1.46
Norm. consumption growth volatility	$\sigma(C)/\sigma(Y)$	0.71	0.87
Turnover			
Bond market		0.203	0.013
Stock market		0.139	0.027
Welfare (certainty consumption)			
Econometrician's measure		0.1238	0.1289

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Benefits of risk sharing

- ▶ To study importance of risk-sharing, we **compare two economies**, both with labor-income risk but without disagreement:
 - ① first **with** bonds and stocks
 - ② second **without** bonds and/or stock

Benefits of risk sharing: Stock vs. Bonds

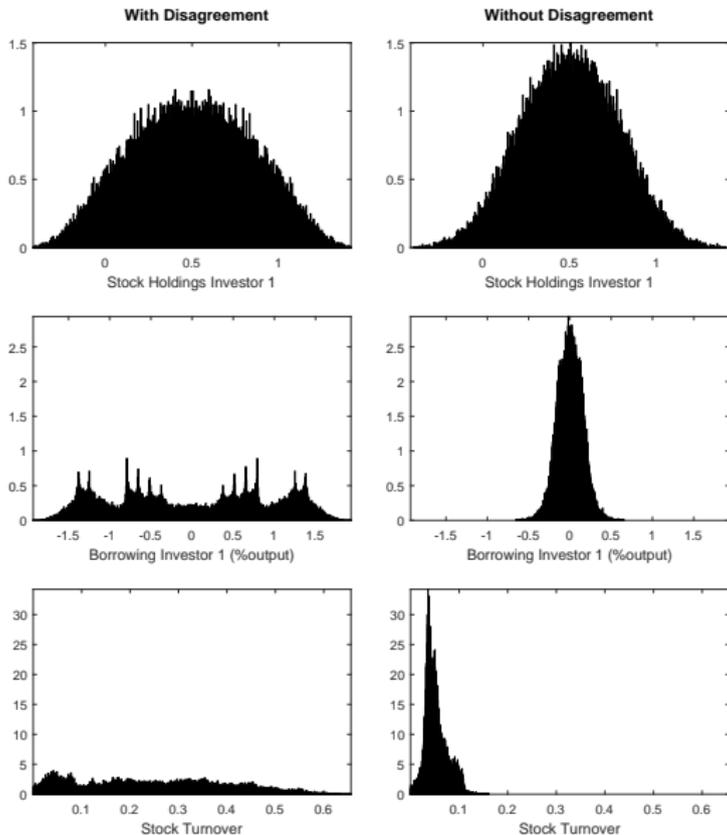
- a. If bond & stock unavailable for trading, then **large** welfare loss
 - Investors can hedge only by changing investment in the firm

- b. If only stock unavailable for trading, then **smaller** welfare loss

- c. If only bond unavailable for trading, then **even smaller** loss
 - 1/10th the loss from not being able to trade stock.

- ▶ **Thus, stock market much more important for risk sharing.**
(the next figure illustrates this point)

Histograms: Effective channels for regulation



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Effects of regulatory measures

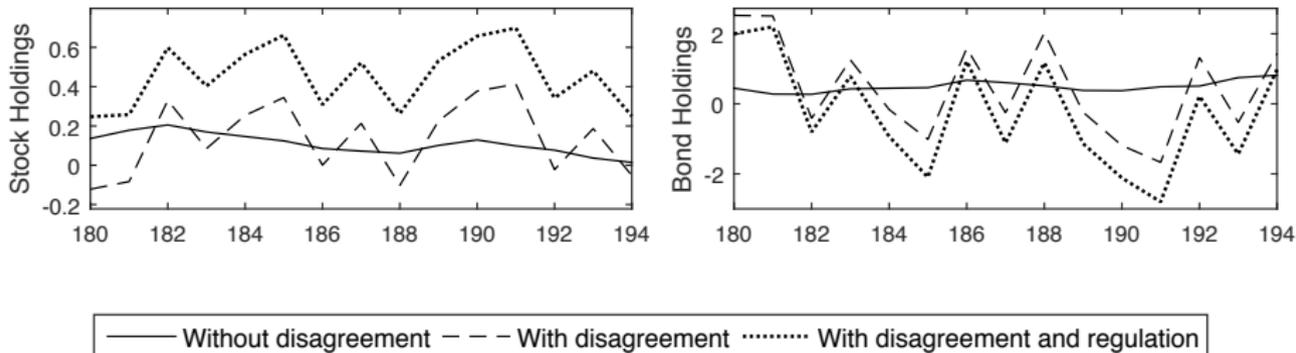
- ▶ We now look at the effects of the three regulatory measures:
 - ① Portfolio constraint
 - ② Borrowing constraint
 - ③ Financial-transaction tax

- ▶ Results explained using **two** kinds of pictures:
 - Plot of **individual paths**
 - Plot of **changes** (averaged across 25,000 paths) as we change magnitude of regulatory measure

1. Portfolio constraint

Portfolio constraint: One simulated path

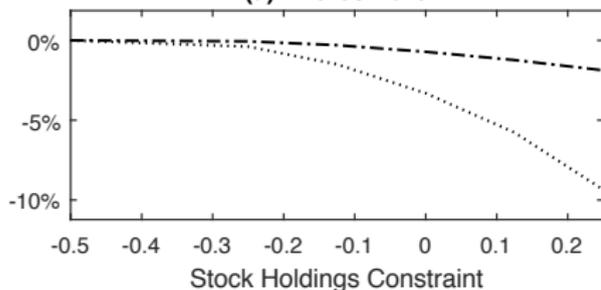
Stock portfolio constraint $\rho = 0.25$



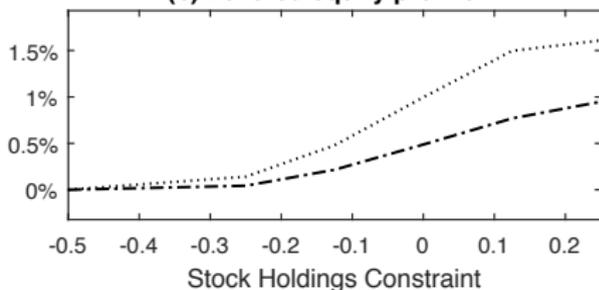
Effects of portfolio constraint on financial sector

Change in ...

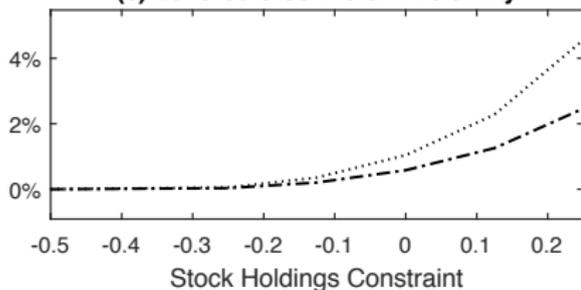
(a) Interest rate



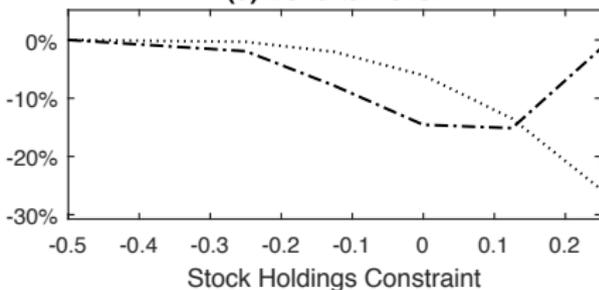
(b) Levered equity premium



(c) Levered stock return volatility



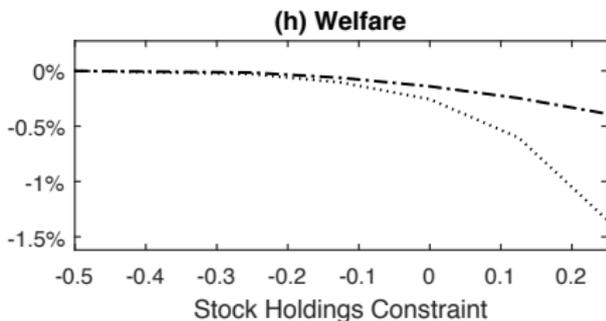
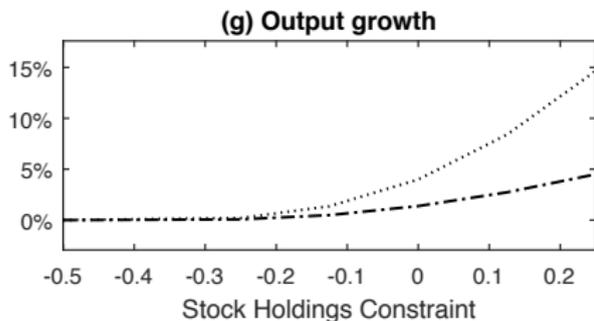
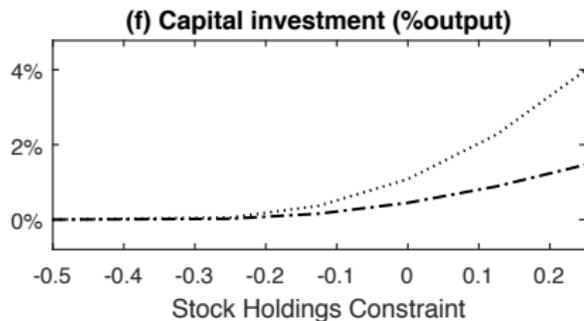
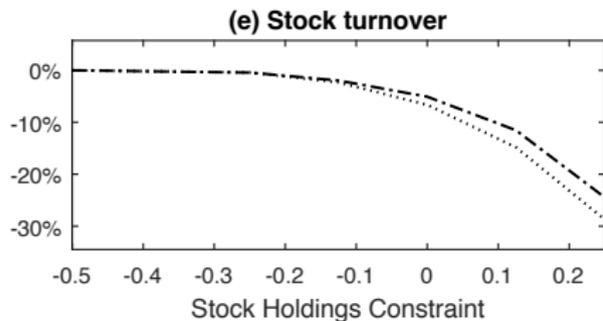
(d) Bond turnover



..... With Disagreement - · - · - Without Disagreement

Effects of portfolio constraint on welfare

Change in ...

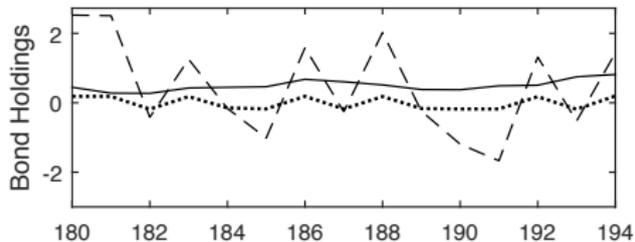
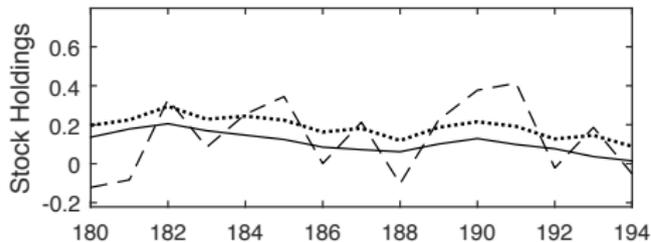


..... With Disagreement -.-.- Without Disagreement

2. Borrowing constraint

Borrowing constraint: One simulated path

Borrowing constraint $\kappa = 0.1$

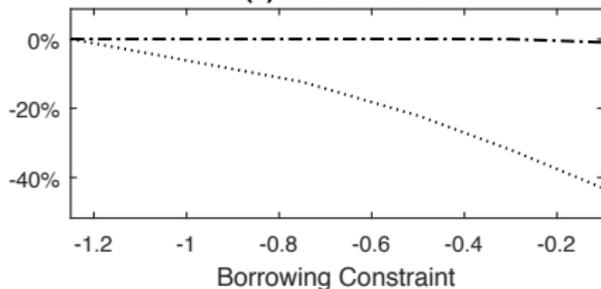


— Without disagreement - - - With disagreement With disagreement and regulation

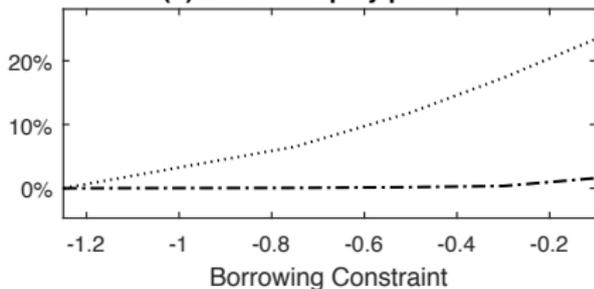
Effects of portfolio constraint on financial sector

Change in ...

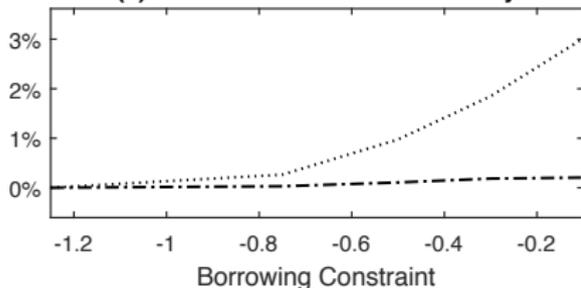
(a) Interest rate



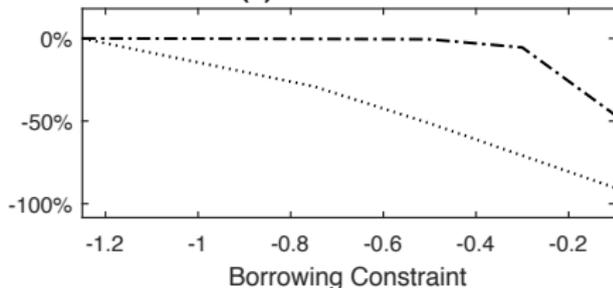
(b) Levered equity premium



(c) Levered stock return volatility



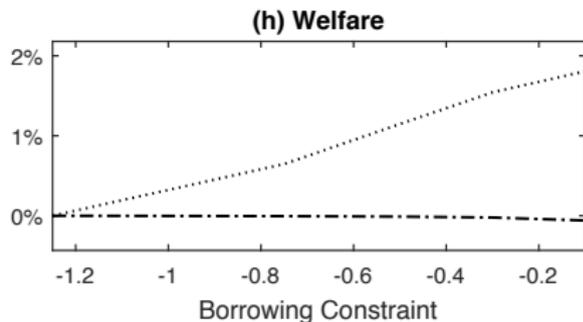
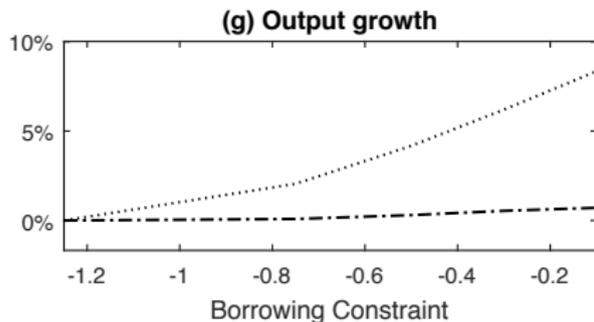
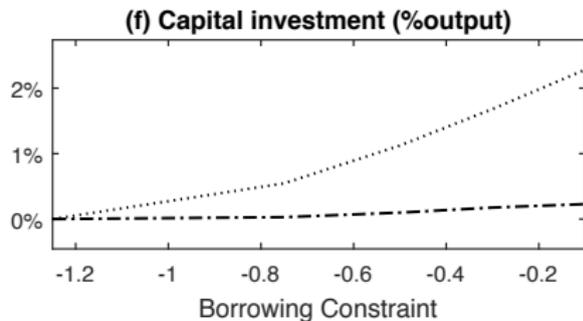
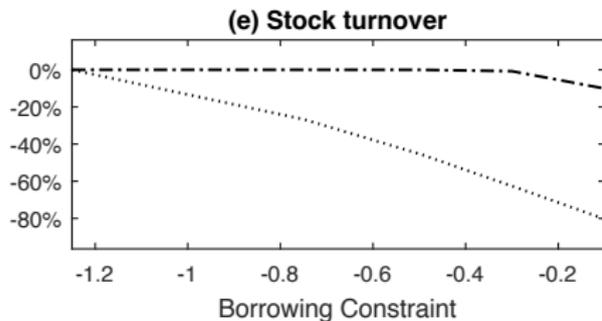
(d) Bond turnover



..... With Disagreement -.-.- Without Disagreement

Effects of portfolio constraint on welfare

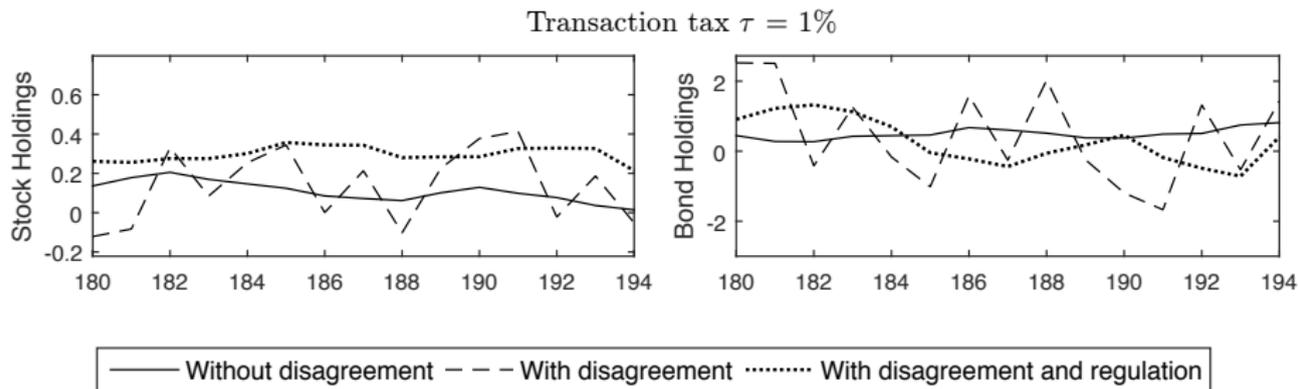
Change in ...



..... With Disagreement -.-.- Without Disagreement

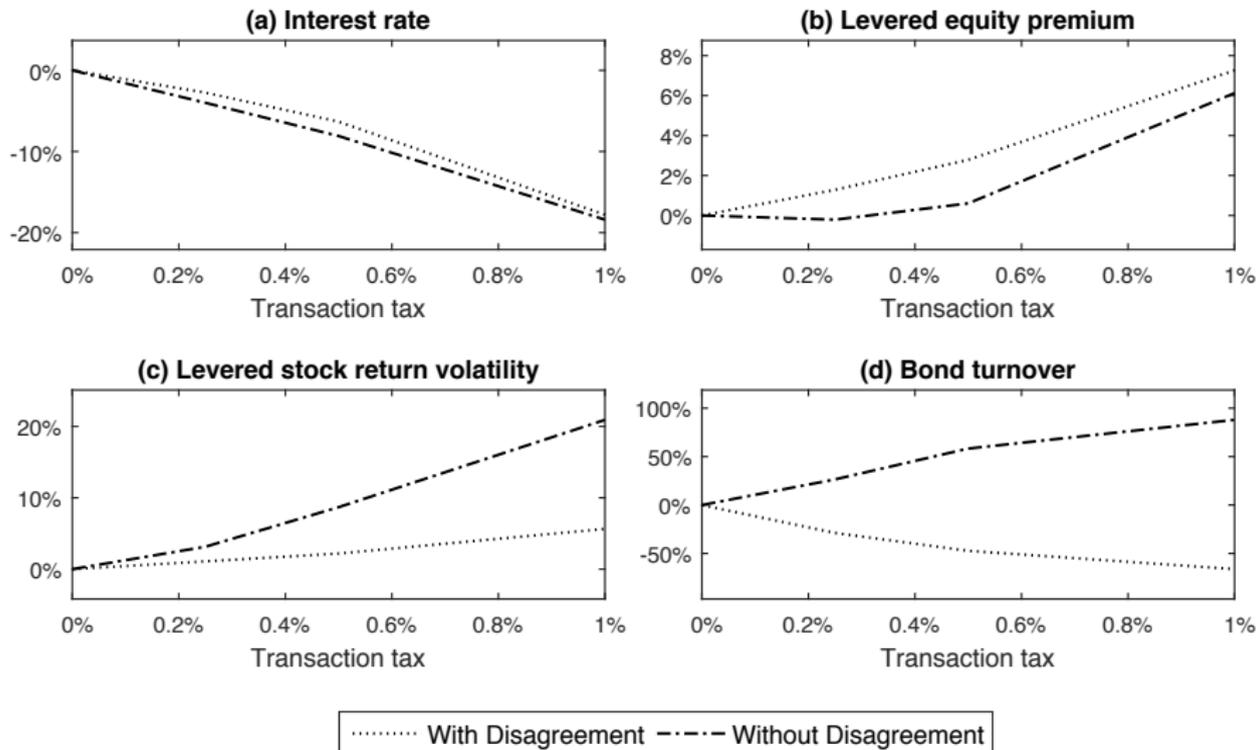
3. Financial-transaction tax

Financial-transaction tax: One simulated path



Effects of portfolio constraint on financial sector

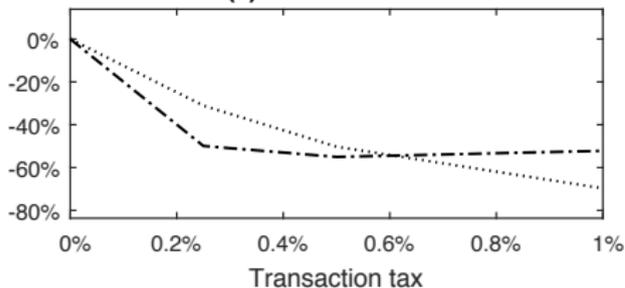
Change in ...



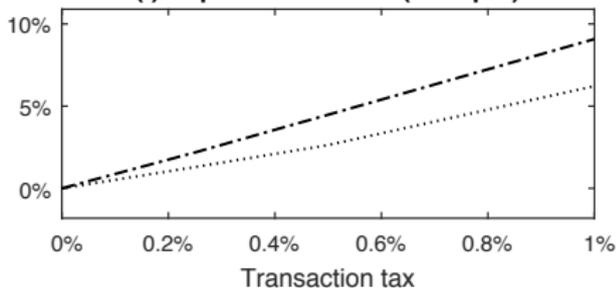
Effects of portfolio constraint on welfare

Change in ...

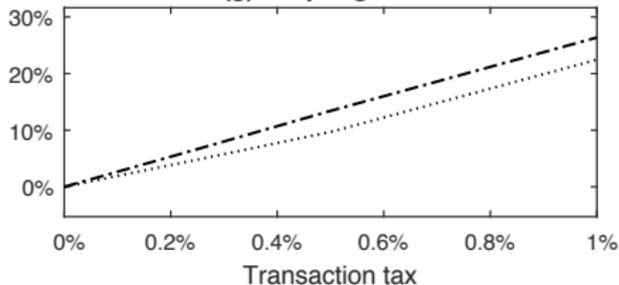
(e) Stock turnover



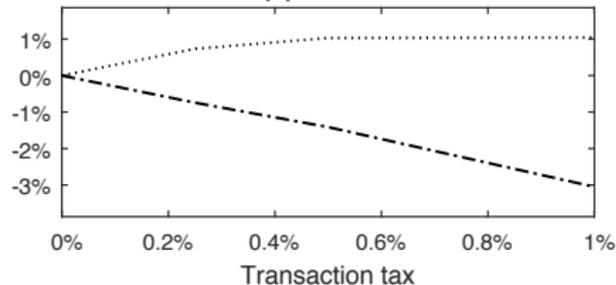
(f) Capital investment (%output)



(g) Output growth



(h) Welfare



..... With Disagreement -.-.- Without Disagreement

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Conclusion

- ▶ Study model where financial markets have real effects
 - Financial markets allow for **risk sharing**, which **increases** welfare
 - Financial markets allow for **speculation**, which **reduces** welfare
- ▶ **Quantitatively assess** the effectiveness of regulatory measures:
 1. Portfolio (short-sale) constraint: **Negative**
 2. Financial-transaction tax: **Positive but small**
 3. Borrowing constraint: **Positive and larger**
- ▶ **Intuition:** welfare improves only if regulatory measure reduces speculation without impairing substantially risk-sharing.

Thank you