Securities Transaction Taxes: Macroeconomic Implications in a General-Equilibrium Model

Julia Lendvai Rafal Raciborski Lukas Vogel

DG ECFIN, European Commission

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Debate

Improve resilience of financial sector and of real sector to financial shocks

Contribution of financial sector to crisis-related costs

European Commission (2011) proposed EU-wide tax on broad set of secondary-market transactions

Experience with financial (transaction) taxes in several countries

This paper

(1) What is the long-term effect of a transaction tax on financing costs, investment and output (economic costs of taxation)?

(2) Does the tax reduce (non-fundamental) volatility of asset prices and real variables?

Address these questions in a general-equlibrium framework

Set aside issues of technical and political feasibility: closed-economy model ("world economy")

Literature

Partial-equilibrium models (e.g., Westerhoff and Dieci 2006):

- Impact on financial variables dependent on market structure
- Real effects discussed off-model

Empirical studies:

- Transaction taxes/costs reduce share prices (Bond et al. 2005, Hu 1998) - 1% tax reduces share prices by around 5% (Jackson and O'Donnell 1985, Umlauf 1993, Westerholm 2003)
- Transaction taxes/costs tend to increase asset price volatility (Baltagi et al. 2006, Hau 2006, Jones and Seguin 1997)

Xu (2010) analyses Tobin tax on Forex transactions in DSGE model, but no capital-cost channel

Outline

Model description:

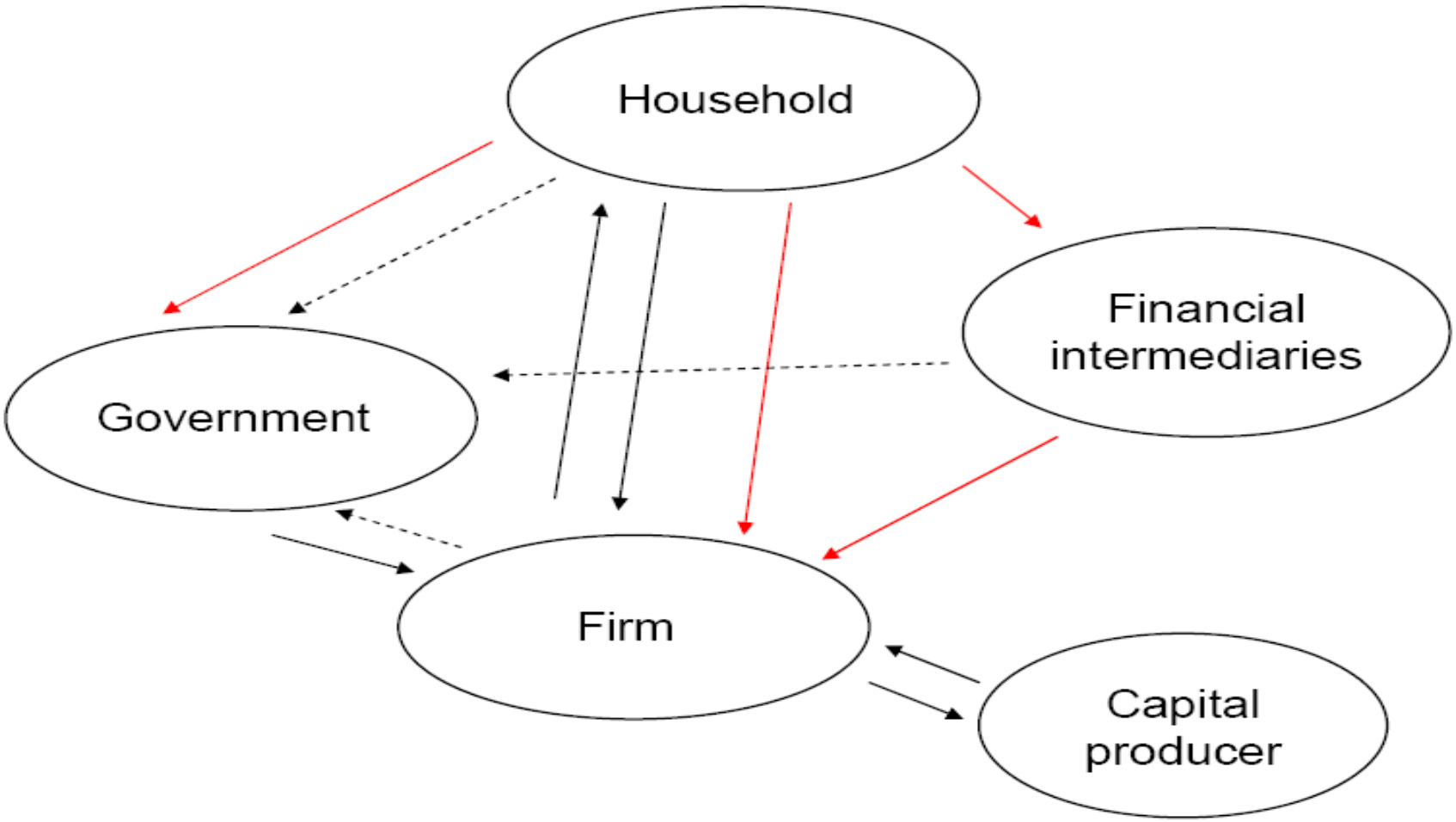
- Building blocks
- Parametrisation

Results:

- Transaction tax in benchmark model
- Comparison with corporate tax
- Sensitivity checks

Conclusions

Building blocks



Representative household

Consumes and works

Puts savings in deposits, loans to firms and public debt

Receives wage, interest and profit income

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t)^{1-\gamma}}{1-\gamma} - \frac{\omega}{1+\kappa} N_t^{1+\kappa} \right]$$

subject to:

$$C_t + B_t^G + B_t^C + F_t + NW_t + T_t^{ls} = \left(1 - \tau^l\right) W_t N_t$$
$$+ R_{t-1} B_{t-1}^G + R_{t-1} B_{t-1}^C + R_{t-1} F_{t-1} + \Pi_t^F + \Pi_t^K$$

Financial intermediaries (Gertler and Karadi 2011)

Intermediary lives 2 periods

Trader j born in t receives transfer from owner (NW_t^j) and collects deposits (F_t^j) from other households to invest in equity ($S_t^j P_t^S$):

$$S_t^j P_t^S = F_t^j + NW_t^j$$

In $t+1$ trader sells equity and transfers profits (=return minus loan repayment and tax) to owner

Profit maximisation makes intermediary in t buy equity if non-negative net expected return:

$$\beta E_t^j \left[\frac{\lambda_{t+1}^I}{\lambda_t^I} \left(R_{t+1}^S - R_t - \frac{T_t^{STT,j}}{P_t^S S_t^j} \right) \right] P_t^S S_t^j \geq 0$$

Financial intermediaries (cont'd)

GK (2011) introduce financial friction based on agency problem that trader may divert fraction $\chi < 1$ of deposits, in which case depositors recover remaining $1 - \chi$ of deposits.

Agency problem introduces leverage constraint for intermediary that links equity investment to initial transfers (NW_t^j).

In our scenarios the incentive constraint is always binding:

$$P_t^S S_t^j = \phi_t^j NW_t^j$$

with $\phi_t^j > 0$ as leverage ratio of intermediary j:

$$\phi_t^j \equiv \frac{1}{1 + \chi - \beta E_t^j \left[\frac{\lambda_{t+1}^I}{\lambda_t^I} R_{t+1}^S - \frac{T_t^{STT,j}}{P_t^S S_t^j} \right]}$$

Financial intermediaries (cont'd)

NEW: Share s_n of "noise traders" (DSSW 1990) with expectations about future return to equity deviating from rational expectations by shock ν_t:

$$E_t^N \beta \frac{\lambda_{t+1}^I}{\lambda_t^I} \left[R_{t+1}^S \right] = E_t \beta \frac{\lambda_{t+1}^I}{\lambda_t^I} \left[R_{t+1}^S e^{\nu_t} \right]$$

Timing of the investment decision:

- Intermediary born at t receives the same initial transfer from owner (NW_t) and have initially identical return expectations
- Purchase initially the same amount of equity from firms
- Then sentiment of share s_n changes and they adjust positions by buying/selling assets from/to informed traders

Financial intermediaries (cont'd)

Secondary-market transactions in the model as noise-driven trade *between* financial intermediaries

Final asset positions of informed and noise traders are governed by ϕ_t^I and ϕ_t^N:

$$\phi_t^I = \frac{1}{1+\chi-\beta E_t\left[\frac{\lambda_{t+1}^I}{\lambda_t^I}R_{t+1}^S-\frac{T_t^{STT,I}}{P_t^S S_t^I}\right]}$$

$$\phi_t^N = \frac{1}{1+\chi-\beta E_t\left[\frac{\lambda_{t+1}^I}{\lambda_t^I}R_{t+1}^S e^{\nu_t}-\frac{T_t^{STT,N}}{P_t^S S_t^N}\right]}$$

Financial intermediaries (cont'd)

Transaction tax on secondary-market transactions:

$$T_t^{STT,j} = \tau^{STT} \left(P_t^S S_t^j - P_t^S S_t \right)^2$$

Quadratic tax-base term standard in modelling transaction taxes (e.g., Subrahmanyam 1998, Xu 2010); it avoids that traders are subsidised for selling assets

Taxing deviations from average holding taxes only noise-driven secondary-market transactions = **idealistic** assumption: dampen non-fundamental fluctuations, but allow fundamental adjustment

Final goods producers

Production:

$$Y_t = A_t \left(N_t\right)^{\alpha} \left(K_{t-1}\right)^{1-\alpha}$$

with exogenous law of motion for TFP:

$$\log\left(A_t\right) = \left(1-\rho_a\right)\log\left(\bar{A}\right) + \rho_a \log\left(A_{t-1}\right) + \varepsilon_t^a$$

and shock $\varepsilon_t^a \sim N\left(0, \sigma_a\right)$.

Final good for private consumption, investment and government purchases

Final goods producers (cont'd)

Firms maximize present value of future dividends discounted at stochastic discount factor of owners:

$$\max_{K_{t+i},N_{t+i}} E_t \sum_{i=0}^{\infty} \beta^i \frac{\lambda^I_{t+1+i}}{\lambda^I_t} \left[DIV_{t+i}(K_{t+i-1}, N_{t+i}) \right]$$

$$\begin{aligned} DIV_t \equiv & \left(1-\tau^c\right)\left(Y_t - W_t N_t\right) + \tau^c \delta K_{t-1} \\ & + P^K_t \left(1-\delta\right) K_{t-1} - P^K_t K_t + B^C_t - R^B_{t-1} B^C_{t-1} \end{aligned}$$

Capital installment financed by loans B^C_t or equity issuance $P^S_t S_t$:

$$B^C_t + P^S_t S_t \geq P^K_t K^d_t$$

$$B^C_t = \theta P^K_t K^d_t$$

with $0 \leq \theta < 1$ exogenous (agency problem)

Summary of transmission mechanism

Financial intermediaries:

- Noise shock generates affects intermediaries demand for equity $\longrightarrow$ share price
- Agency problem rules out infinite trade without tax (if $\chi \longrightarrow 0$ implies $\phi_t^j \longrightarrow \infty$)
- Quadratic transaction tax reduces profitability of trading in either direction:
  - Positive noise (demand $\uparrow \longrightarrow P_t^S \uparrow$): tax reduces expected profitability $\longrightarrow$ higher pre-tax return required $\longrightarrow P_t^S \downarrow$ compared to zero tax
  - Negative noise (demand $\downarrow \longrightarrow P_t^S \downarrow$): tax reduces expected profitability and demand further $\longrightarrow P_t^S \downarrow$ compared to zero tax

Balance sheet constraint of firms:

- Makes share price matter for firms

Capital producers (CMR 2010, GK 2011)

Take investment decision: buy capital K_t^{bought} that final goods firm used for production in t, refurbish the capital with additional investment I_t and sell new capital K_t^{sold} to final goods producers for use in production in $t+1$

Profit maximisation:

$$\max_{K_t^{sold}, K_t^{bought}, I_t} \Pi_t^K = \left(P_t^K K_t^{sold} - P_t^K K_t^{bought} - I_t \right)$$

subject to the accumulation equation:

$$K_t^{sold} = K_t^{bought} + I_t$$

Government

Collects labour, corporate and transaction tax revenues

Government debt (B_t^G) evolves as:

$$B_t^G = R_{t-1} B_{t-1}^G + \overline{G} - \tau^l W_t L_t - \tau^c \left(Y_t - W_t L_t - \delta K_{t-1} \right) - T_{t-1}^{STT} - T_t^{ls}$$

$$T_t^{STT} = s_n T_t^{STT,N} + (1 - s_n) T_t^{STT,I}$$

Adjust lump-sum taxes (T_t^{ls}) to keep debt-to-GDP ratio constant: T_t^{ls} closure illustrates distortionary impact of transaction tax (but upper bound for associated inefficiencies)

Market clearing

In equilibrium, financial, facor and goods markets clear:

- Market for equity:

$$s_n S_t^N + (1 - s_n) S_t^I = S_t$$

- Market of physical capital:

$$\begin{aligned} K_t^{bought} &= (1 - \delta) K_{t-1} \\ K_t^{sold} &= K_t \end{aligned}$$

- Final goods market:

$$Y_t = C_t + G_t + I_t$$

Parametrisation

Real economy: standard values from RBC literature and real ratios

Financial sector parameters to match stylised facts:

- Firms' debt-to-equity ratio of 100% in line with empirical values for U.S. and Europe (Kalemli-Ozcan et al. 2011)
- Financial intermediaries debt-to-equity ratio of 4 (GK 2011); Kalemli-Ozcan et al. (2011) report ratios of up to 10 for financial institutions and 25 for investment banks
- Equity premium of 400 basis points p.a.
- Share of noise traders of 50% (survey evidence by Cheung et al. 2004, Menkhoff 2001, Menkhoff and Taylor 2007)
- Secondary-market turnover p.a. circa 100% of market value
- Transaction tax to generate revenue of 0.1% of GDP (European Commission)

Transaction tax in benchmark model

	Mean (%)	Std (%)	Std./mean (pp)
Output	**-0.20**	**-0.03**	**0.01**
Capital	-0.46	-0.04	0.01
Investment	-0.46	-0.18	0.04
Consumption	-0.16	-0.09	0.00
Employment	-0.02	-0.22	0.00
Real wage	-0.18	-0.02	0.01
Marginal product of capital	0.41	-0.04	-0.01
Financial trade	-0.46	-0.47	0.00
Share price	-0.46	-0.04	0.01
	Mean (pp)	Std (%)	Std./mean (pp)
Risk-free return	0.00	-0.27	-0.70
Return on share	**0.13**	**-0.21**	**-2.27**
ETT revenue to GDP	0.10		
Implicit ETT rate	0.11		

Corporate income tax in benchmark model

	Mean (%)	Std (%)	Std./mean (pp)
Output	**-0.20**	**-0.15**	**0.00**
Capital	-0.52	-0.34	0.01
Investment	-0.52	-0.26	0.04
Consumption	-0.15	-0.05	0.00
Employment	-0.03	-0.05	0.00
Real wage	-0.17	-0.06	0.00
Marginal product of capital	0.30	0.46	0.00
Financial trade	-0.51	-0.52	0.00
Share price	-0.52	-0.34	0.01
	Mean (pp)	Std (%)	Std./mean (pp)
Risk-free return	0.00	0.01	0.28
Return on share	**0.01**	**0.01**	**-0.08**
Corporate tax revenue to GDP	0.10		
Corporate tax rate	0.55		

Check 1: Transaction tax with higher equity premium (800bp p.a.)

	Mean (%)	Std (%)	Std./mean (pp)
Output	**-0.20**	**-0.04**	**0.01**
Capital	-0.47	-0.05	0.01
Investment	-0.47	-0.21	0.04
Consumption	-0.17	-0.10	0.00
Employment	-0.02	-0.26	0.00
Real wage	-0.19	-0.03	0.01
Marginal product of capital	0.41	-0.06	-0.01
Financial trade	-0.47	-0.47	0.00
Share price	-0.47	-0.05	0.01
	Mean (pp)	Std (%)	Std./mean (pp)
Risk-free return	0.00	-0.31	-0.79
Return on share	**0.15**	**-0.24**	**-1.27**
ETT revenues to GDP	0.10		
Implicit ETT rate	0.12		

Check 2: Transaction tax with higher share of debt finance (80%)

	Mean (%)	Std (%)	Std./mean (pp)
Output	**-0.22**	**-0.02**	**0.01**
Capital	-0.53	-0.03	0.02
Investment	-0.53	-0.14	0.04
Consumption	-0.16	-0.05	0.00
Employment	-0.03	-0.27	0.00
Real wage	-0.19	-0.01	0.01
Marginal product of capital	0.38	-0.01	-0.01
Financial trade	-0.53	-0.53	0.00
Share price	-0.53	-0.03	0.02
	Mean (pp)	Std (%)	Std./mean (pp)
Risk-free return	0.00	-0.51	-0.55
Return on share	**0.27**	**-0.37**	**-5.97**
ETT revenue to GDP	0.10		
Implicit ETT rate	0.21		

Check 3: Transaction tax with higher leverage of financial intermediaries (9)

	Mean (%)	Std (%)	Std./mean (pp)
Output	**-0.18**	**-0.07**	**0.00**
Capital	-0.40	-0.09	0.01
Investment	-0.40	-0.36	0.01
Consumption	-0.16	-0.19	0.00
Employment	-0.01	-0.41	-0.01
Real wage	-0.17	-0.05	0.00
Marginal product of capital	0.48	-0.12	-0.02
Financial trade	-0.40	-0.40	0.00
Share price	-0.40	-0.09	0.01
	Mean (pp)	Std (%)	Std./mean (pp)
Risk-free return	0.00	-0.44	-1.34
Return on share	**0.16**	**-0.42**	**-3.78**
ETT revenue to GDP	0.10		
Implicit ETT rate	0.07		

Check 4: Transaction tax with higher share of noise traders (0.75)

	Mean (%)	Std (%)	Std./mean (pp)
Output	**-0.21**	**-0.02**	**0.01**
Capital	-0.51	-0.03	0.02
Investment	-0.51	-0.05	0.10
Consumption	-0.17	-0.03	0.01
Employment	-0.02	-0.07	0.00
Real wage	-0.19	-0.02	0.01
Marginal product of capital	0.39	-0.02	-0.01
Financial trade	-0.53	-1.56	-1.06
Share price	-0.51	-0.03	0.02
	Mean (pp)	Std (%)	Std./mean (pp)
Risk-free return	0.00	-0.11	-0.38
Return on share	**0.13**	**-0.03**	**-1.74**
ETT revenue to GDP	0.10		
Implicit ETT rate	0.14		

Summary

Purpose: Analyse impact of STT on financial and real sectors in general equilibrium.

Framework: DSGE model with:

- Financial friction through incentive constraint (GK 2011) that puts upper bound on intermediaries' leverage to, i.e. cannot trade infinitely
- Noise traders in financial markets (DSSW 1990) to generate non-fundamental trading in secondary market
- "Idealistic" transaction tax that applies only to noise-driven secondary-market transactions
- Balance sheet constraint for firms

Summary (cont'd)

Transaction tax with 0.1% of GDP revenue:

- Investment and capital stock decline by 0.4% and real GDP by 0.2% in the long run
- Long-run effects very similar as for corporate income tax that raises identical revenue, despite the fact that transaction tax is imposed only on secondary market and non-fundamental transactions
- Volatility of financial trade and asset prices declines (0.2-0.5%), but very little impact on volatility of non-financial variables

Empirical research: negative long-term impact, but rather increase in asset price volatility

Outlook

Model makes simplifying assumptions that could be relaxed to study further aspects:

- Financial intermediation is costless: with production function or reasonable transaction costs in intermediation, resource savings from reduced non-fundamental trade (Stiglitz 1989, Summers and Summers 1989)
- Endogenising firms' financing mix to assess impact of taxation on the financing mix/leverage
- Representative household setting precludes analysis of distributional effects

Welfare analysis