Fiscal Multipliers in the 21st Century

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Renewed Interest in Fiscal Multipliers and inequality...

- Great Recession lead to a renewed interest in fiscal shocks

Ramey, JEL 2011

Before 2008, the topic of stimulus effects was a backwater compared to research in monetary policy. One reason for the lack of interest was the belief that the lags in implementing fiscal policy were typically too long to be useful for combating recessions. Perhaps another reason was that central banks sponsored way more conferences than government treasury departments.

- Inequality has been quite a hot topic too recently - Piketty, Capital in the Twenty-First Century

- Though its macro implications have been the focus of attention for quite some time:

Plutarch, 46 - 120 AD

An imbalance between rich and poor is the oldest and most fatal ailment of all republics.

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Do differences in cross-country wealth heterogeneity lead to different fiscal multipliers?

- Highly skewed wealth distributions - Inequality is very high, possibly rising and unlike to come down any time soon.
- Macroeconomics needs to factor this in, and it likely matters a lot for multipliers in particular.
- Significant differences in wealth inequality between countries and for given individual characteristics (age for example).
- In a standard dynamic setting, agents will use capital markets to smooth consumption in reaction to temporary fiscal shocks.
- However, liquidity constraints can prevent agents from doing so.

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Do differences in cross-country wealth heterogeneity lead to different fiscal multipliers?

- One would expect different responses depending on the proportion of liquidity constrained agents in a given economy.
- Anderson, Inoue, and Rossi (2012) find that (in the US), people respond to unanticipated fiscal shocks depending on:
  - age, income level and education.
  - the wealthiest individuals tend to behave according to the predictions of standard RBC models,
  - whereas the poorest individuals tend to exhibit non-Ricardian behavior.

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Literature: there is no such thing as **a** fiscal multiplier.

- Iltzeki et al. (2013) find that fiscal multipliers differ between:
  - high income (larger) vs developing countries
  - fixed (larger) vs flexible exchange rates (zero)
  - open (smaller) vs closed economies
  - negative for high debt countries
- Carrol et al. (2014) and Kaplan et al. (2014) focus on net wealth vs liquid wealth.
  - They find that a higher proportion of constrained agents can lead to much larger multipliers.

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Wealth inequality and fiscal responses

- We replicate Iltzeki, et al. (2013) adding data on wealth inequality.
- SVAR approach introduced by Blanchard and Perotti (2002).
- Panel regression with country fixed effects, quarterly data for 44 countries.
- Variables ordering: government consumption, output, current accounts balance and real effective exchange rate.
- Same methodology: divide the sample according to mean GINI and compare impulse responses
- Output response much stronger on countries with GINI above mean.

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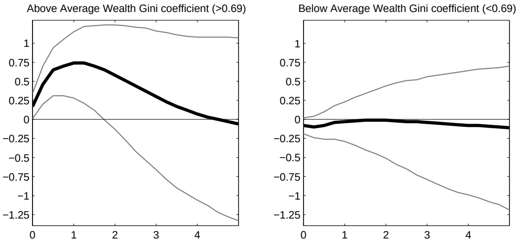
- Impulse responses of GDP to a S.D. shock to government consumption



- Fitting SVARs to individual countries show a strong and robust correlation between the GINI coefficient and the multiplier.

α	β_1	β_2
-8.398	0.132	
(13.593)	(0.003)	
-7.189	0.120	-0.023
(17.512)	(0.003)	(0.001)

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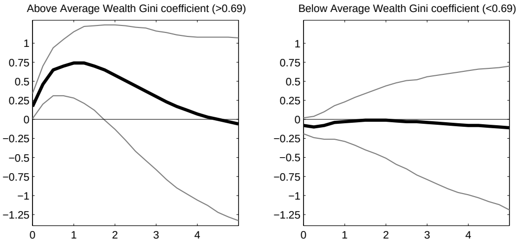

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Features of the model

- A model must generate the core element of the issue: wealth heterogeneity.
- Representative agent model not appropriate.
- Life-cycle economy with heterogeneous agents and incomplete markets
- Households start life-cycle with low income, but face a deterministic trend that sees their income grow over time.
- Both the age trend in earnings, and resulting age profile of wealth distribution are features of the data.
- Include features relevant to the wealth distribution: pension system, progressive taxation, capital and consumption taxation.

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Demographics

- Economy populated by J overlapping generations of finitely lived households, born at 20, retire at 65.
- Retired agents face age-dependent probability of dying $\pi(j)$.
- Retired agents receive a social security payment, Ψ_t. Unintended bequests are redistributed as a lump-sum Γ.
- At age 20, agents are assigned an idiosyncratic productivity level (ability) and then build their age profile of productivity.
- Standard additive-separable preferences in consumption and hours: $U(c,n) = \frac{c^{1-1/\sigma}}{1-1/\sigma} - \chi \frac{n^{1+1/\psi}}{1+1/\psi}$
- Each generation consists of three types of agents with equal mass, that differ w.r.t. the time preference parameter β.

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Firm's problem

- Representative firm combines capital and labor in a Cobb-Douglas production function

$$Y_t(K_t, L_t) = K_t^{\alpha} \left[L_t\right]^{1-\alpha}$$

- Capital evolves as:

$$K_{t+1} = (1-\delta)K_t + I_t$$

- Firm chooses inputs to maximize profit:

$$\Pi_t = Y_t - w_t L_t - (r_t + \delta)K_t$$

- Competitive equilibrium yields factor prices:

$$w_t = \partial Y_t / \partial L_t = (1-\alpha)\left(\frac{K_t}{L_t}\right)^{\alpha}$$

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Labor income

- An agent's wage depends on the wage per efficiency unit of labour, w, and the number of efficiency units the agent is endowed with.
- This endowment depends on agent $i's$ age (j), the realization of an idiosyncratic shock (u) and the realization of ability (a) at the beginning of the life cycle.

$$w_i(j, u, a) = we^{\gamma_1 j + \gamma_2 j^2 + \gamma_3 j^3 + u + a}$$

  - γ_1, γ_2 and γ_3 capture the age profile of wages.
  - Shock follows simple AR process: $u' = \rho u + \epsilon, \epsilon \sim N(0, \sigma_\epsilon^2)$
  - Ability is realized (at age 20) from $N(0, \sigma_a^2)$

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$$w_i(j,u,a) = we^{\gamma_1 j + \gamma_2 j^2 + \gamma_3 j^3 + u + a}$$

  - γ_1, γ_2 and γ_3 capture the age profile of wages.
  - Shock follows simple AR process: $u' = \rho u + \epsilon, \epsilon \sim N(0, \sigma_\epsilon^2)$
  - Ability is realized (at age 20) from $N(0, \sigma_a^2)$

Government

- Government runs a balanced social security system by taxing employers and employees, τ_{ss} and $\tilde{\tau}_{ss}$, and paying benefits, Ψ_t, to retired agents:
  - $\Psi(\sum_{j\geq 65}\Omega_j) = R^{ss}$
- Government also taxes consumption, labor and capital income to finance public consumption, G_t, interest on the national debt, $r_t B_t$, and lump sum transfers, g_t.
  - Consumption and capital income are taxed at rates τ_c, and τ_k.
  - Progressive labor income taxes.
  - Lump-sum transfers financed by government surplus:
    - $g(45+\sum_{j\geq 65}\Omega_j) = R - G - rB$

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Recursive formulation of the Agent's problem

- Agent characterized by (k, u, a, j), wealth, persistent and transitory components of income shock, age and ability.

Agent's problem

$$V(k,u,a,j) = \max_{c,k',n} \left[U\left(c,n\right) + \beta E_{u'} \left[V(k',u',a,j+1) \right] \right]$$

s.t.:

$$c(1+\tau_c) + k' = \begin{cases} (k+\Gamma)\left(1 + r(1-\tau_k)\right) + g + Y^L, & \text{if } j < 65 \\ (k+\Gamma)\left(1 + r(1-\tau_k)\right) + g + \Psi^z, & \text{if } j \geq 65 \end{cases}$$

$$Y^L = \frac{nw\left(j,u,a\right)}{1+\tilde{\tau}_{ss}} \left(1 - \tau_{ss} - \tau_l \left(\frac{nw\left(j,u,a\right)}{1+\tilde{\tau}_{ss}} \right) \right)$$

$$n \in [0,1], \quad k' \geq -b, \quad c > 0, \quad n = 0 \text{ if } j \geq 65 \tag{1}$$

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Stationary Recursive Competitive Equilibrium

- Let $\Phi(k, u, a, j)$ be the measure of households with the corresponding characteristics.

Equilibrium definition

1. Value function $V(k, u, a, j)$ and policy functions, $c(k, u, a, j)$, $k'(k, u, a, j)$, and $n(k, u, a, j)$, solve the consumers' optimization problem given the factor prices and initial conditions.
2. Markets clear:

$$K + B = \int k d\Phi$$

$$L = \int (n(k, u, a, j))\, d\Phi$$

$$\int c d\Phi + \delta K + G = K^{\alpha} L^{1-\alpha}$$

3. The factor prices satisfy:

$$\begin{aligned} w &= (1-\alpha)\left(\frac{K}{L}\right)^{\alpha} \\ r &= \alpha\left(\frac{K}{L}\right)^{\alpha-1} - \delta \end{aligned}$$

Stationary Recursive Competitive Equilibrium

Equilibrium definition continued

4 The government budget balances:

$$g \int d\Phi + G + rB = \int \left(\tau_k r(k+\Gamma) + \tau_c c + \tau_l \left(\frac{nw(u,\nu,j)}{1+\tilde{\tau}_{ss}} \right) \right) d\Phi$$

5 The social security system balances:

$$\Psi \int_{j \geq 65} d\Phi = \frac{\tilde{\tau}_{ss} + \tau_{ss}}{1+\tilde{\tau}_{ss}} \left(\int_{j<65} nw d\Phi \right)$$

6 The assets of the deceased are uniformly distributed among the living:

$$\Gamma \int \omega(j) d\Phi = \int (1-\omega(j))\, k d\Phi$$

Recursive Competitive Equilibrium for the transition

Transition Recursive Competitive Equilibrium

Given the initial capital stock, K_0, and initial distribution, Φ_0, and taxes $\{\tau_l, \tau_c, \tau_k, \tau_{ss}, \tilde{\tau}_{ss}\}_{t=1}^{t=\infty}$ a competitive equilibrium is a sequence of individual functions for the household, $\{V_t, c_t, k_t', n_t\}_{t=1}^{t=\infty}$, sequences of production plans for the firm, $\{K_t, L_t\}_{t=1}^{t=\infty}$, factor prices, $\{r_t, w_t\}_{t=1}^{t=\infty}$, government transfers $\{g_t, \Psi_t, G_t\}_{t=1}^{t=\infty}$, government debt, $\{B_t\}_{t=1}^{t=\infty}$, inheritance from the dead, $\{\Gamma_t\}_{t=1}^{t=\infty}$, and a sequence of measures $\{\Phi_t\}_{t=1}^{t=\infty}$, such that for all t:

1. The value functions $V_t(k, \beta, a, u, j)$ and policy functions, $c_t(k, \beta, a, u, j)$, $k_t'(k, \beta, a, u, j)$, and $n_t(k, \beta, a, u, j)$, solve the consumers' optimization problem given factor prices and initial conditions.
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Solution method - solving for the steady state

1. Discretize u and a - Tauchen (1986) - and guess K/L.
2. Guess ψ^z, g, average earnings and Γ.
3. Start at $t = 100$ and given that $k^*_{100} = 0$, solve for k^*_{99} for each β type.
4. Repeat until $t = 65$
5. From $t = 65$ to $t = 20$, repeat (3)-(4) for each u, a and β type.
6. Draw 40000 life-cycle paths wages for all a and β types.
7. Use $V(k, u, a, \beta, j) \to (c, n, k')$ to simulate the economy.
8. Aggregate labor and asset positions, weighted by $\Omega(j)$.
9. Check if guesses for ψ^z, g, average earnings and Γ were correct. If not, go to (2).
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Solution method - solving for the transition

1 Assume economy at t=0 is at the steady state and goes back to SS after T periods.

2 Define the policy experiment example: $\Delta G_1, \nabla g_1$.

2 Guess a sequence of $\{K_t/L_t\}_{t=1}^{t=T-1}$.

3 Since we know V_T and $\{K_t/L_t\}_{t=1}^{t=T-1}$, start at $T-1$ and solve for $V_{T-1}(k, \beta, a, u, j)$.

4 Solve recursively until we have all $\{V_t\}_{t=1}^{t=T-1}$.

5 Use $\{V_t\}_{t=0}^{t=T}$ to simulate the model forward and collect $\{K_t/L_t\}_{t=1}^{t=T-1}$.

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* More complex policy experiments may imply extra loops. Example: Check in the mail, financed by debt, to be paid in T periods with temporary increase in labor taxation.

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6 Check if guessed $\{K_t/L_t\}_{t=1}^{t=T-1}$ are correct. If not, update each K_t/L_t and go to (3).

* More complex policy experiments may imply extra loops. Example: Check in the mail, financed by debt, to be paid in T periods with temporary increase in labor taxation.

Calibration strategy - Simulated method of moments

- Choose β_1, β_2, β_3, b, χ and σ_a in order to minimize the loss function below:

$$L(\beta_1, \beta_2, \beta_3, b, \chi, \sigma_a) = ||M_m - M_d||$$

M_m and M_d are moments of the model and the data. We match:

  - capital-output ratio and fraction of hours worked
  - variance of log wages
  - Q_1, Q_2 and Q_3, the three quartiles of the wealth distribution.

- We use 6 instruments to calibrate the model to match 6 moments and thus have an exactly identified system.

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Environment

The environment is thus defined by:

1. A set of calibrated parameters: $\beta_1, \beta_2, \beta_3, b, \chi, \sigma_a$.
2. An age profile for wages: γ_1,γ_2, γ_3.
3. A labor income tax function $\tau_l(\theta_1, \theta_2)$, where θ_1 and θ_2 capture the level and progressivity of the tax scheduled respectively.
4. A vector of country specific parameters: $\tau_c, \tilde{\tau}_{ss}, \tau_{ss}, \tau_k, B/Y$.
5. A vector of parameters held constant in all models: $\eta, \sigma, \alpha, \delta, \sigma_u, \rho_u$.
6. A set of functional forms for preferences, production and survival probabilities.

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Benchmark Model

Our benchmark consists of a model calibrated to the US economy:

Parameter	Value	Description	Source
Preferences			
η	1	Inverse Frisch Elasticity	Trabandt & Uhlig (2011)
σ	1.2	Risk aversion parameter	Literature
Technology			
α	0.33	Capital share of output	Literature
δ	0.06	Capital depreciation rate	Literature
$\gamma_1, \gamma_2, \gamma_3$	0.265, -0.005, 0.000	$w = \bar{w}e^{\gamma_1 j + \gamma_2 j^2 + \gamma_3 j^3}$	LIS
ρ, σ_ϵ^2	0.335, 0.307	$u' = \rho u + \epsilon, \quad \epsilon \sim N(0, \sigma_\epsilon^2)$	PSID 1968-1997
Taxes			
τ_c	0.047	Consumption Tax	Trabandt & Uhlig (2011)
$\tilde{\tau}_{ss}$	0.078	S.S. tax on the employer	OECD Tax data
τ_{ss}	0.077	S.S. tax on the employee	OECD Tax data
τ_k	0.364	Capital gains tax rate	Trabandt & Uhlig (2011)
θ_1, θ_2	0.888, 0.137	Labor income tax	OECD Tax data
B/Y	0.428	Debt to GDP ratio	IMF

Country-specific calibration targets

	Macro ratios		Labour targets			Taxes			
	K/Y	B/Y	$\bar{n}$	$\mathrm{Var}(\ln w)$	$\gamma_1, \gamma_2, \gamma_3$	θ_1, θ_2	$\tilde{\tau}_{ss}, \tau_{ss}$	τ_k	τ_c
Austria	3.359	0.432	0.226	0.199	0.155, -0.004, $3.0 * 10^{-5}$	0.939, 0.187	0.217, 0.181	0.240	0.196
Canada	2.435	0.343	0.236	0.272	0.222, -0.005, $3.0 * 10^{-5}$	0.900, 0.193	0.117, 0.069	0.427	0.118
Finland	4.402	-0.482	0.222	0.168	0.183, -0.004, $2.8 * 10^{-5}$	0.854, 0.237	0.243, 0.064	0.313	0.271
France	3.392	0.559	0.184	0.478	0.384, -0.008, $6.0 * 10^{-5}$	0.915, 0.142	0.434, 0.135	0.355	0.183
Germany	3.013	0.489	0.189	0.354	0.176, -0.003, $2.3 * 10^{-5}$	0.881, 0.221	0.206, 0.210	0.233	0.155
Greece	3.262	1.038	0.230	0.220	0.120, -0.002, $1.3 * 10^{-5}$	1.062, 0.201	0.280, 0.160	0.160	0.154
Italy	3.943	0.893	0.200	0.225	0.114, -0.002, $1.4 * 10^{-5}$	0.897, 0.180	0.329, 0.092	0.340	0.145
Japan	4.033	0.799	0.265	0.386	0.039, $-2.0 * 10^{-4}$, $-1.8 * 10^{-6}$	0.948, 0.101	0.128, 0.119	0.374	0.066
Netherlands	2.830	0.232	0.200	0.282	0.307, -0.007, $4.9 * 10^{-5}$	0.938, 0.254	0.102, 0.200	0.293	0.194
Portugal	3.229	0.557	0.249	0.298	0.172, -0.004, $2.6 * 10^{-5}$	0.937, 0.136	0.238, 0.110	0.234	0.208
Spain	3.378	0.368	0.183	0.225	0.144, -0.002, $1.4 * 10^{-5}$	0.904, 0.148	0.305, 0.064	0.296	0.144
Sweden	2.155	-0.034	0.233	0.315	-0.021, 0.001, $-1.2 * 10^{-5}$	0.796, 0.223	0.326, 0.070	0.409	0.255
Switzerland	2.923	0.395	0.263	0.299	0.248, -0.005, $3.3 * 10^{-5}$	0.929, 0.133	0.062, 0.062	0.296	0.087
UK	2.315	0.371	0.231	0.302	0.183, -0.004, $2.2 * 10^{-5}$	0.920, 0.200	0.105, 0.090	0.456	0.163
USA	3.074	0.428	0.248	0.509	0.265, -0.005, $3.6 * 10^{-5}$	0.888, 0.137	0.078, 0.077	0.364	0.047

[1] Macro ratios: K/Y is derived from Penn World Table 8.0, average from 1990-2011; B/Y is the average of net public debt from 2001-8 (IMF)
[2] Labour targets: $\bar{n}$ is hours worked per capita derived from OECD data, average from 1990-2011; $\mathrm{Var}(\ln w)$ and $\gamma_1, \gamma_2, \gamma_3$ are from the most recent LIS survey available before 2008. Data from Portugal comes from Quadros de Pessoal 2009 database.
[3] Taxes: θ_1, θ_2 are as discussed in Section 8.1; $\tilde{\tau}_{ss}, \tau_{ss}$ are the average social security withholdings faced by the average earner (OECD) from 2001-7; τ_k and τ_c are either taken from Trabandt and Uhlig (2011) or calculated using their approach, representing average effective tax rates from 95-07.

Wealth data

	10%	20%	30%	40%	50%	60%	70%	80%	90%	Gini
HFCS sample[a]										
Austria	-1.3	-1.1	-0.7	0.2	2.2	6.5	13.5	23.9	40.6	0.732
Finland	-1.2	-1.1	-0.7	1.1	5.2	11.9	21.5	35.1	55.0	0.646
France	-0.2	-0.1	0.4	1.8	5.4	11.6	20.4	32.3	49.7	0.655
Germany	-0.6	-0.5	-0.1	0.8	2.7	6.4	12.7	23.5	40.4	0.729
Greece	-0.2	0.3	2.4	6.5	12.5	20.3	30.4	43.6	61.6	0.545
Italy	0.0	0.4	1.7	4.9	10.2	17.4	26.7	38.5	55.2	0.590
Netherlands	-3.0	-2.8	-2.0	0.4	5.0	12.3	23.2	38.4	59.8	0.638
Portugal	-0.2	0.1	1.4	4.1	8.2	13.9	21.4	31.9	47.1	0.644
Spain	-0.3	0.6	3.3	7.3	12.9	19.9	28.7	40.1	56.6	0.562
Other sources										
Canada[b]	-1.8	-2.1	-2.1	-1.5	1.0	6.0	14.2	27.0	46.7	0.725
Japan[b]	-3.3	-3.3	-2.9	-1.1	2.9	9.4	19.1	33.1	53.8	0.685
Sweden[b]	-8.3	-9.8	-10.0	-9.7	-7.8	-3.2	5.2	19.0	41.7	0.866
Switzerland[c]	0.2	0.6	1.2	2.1	3.6	6.0	9.8	16.1	28.5	0.764
UK[b]	-0.8	-0.8	-0.5	1.2	5.4	11.7	21.0	34.0	54.3	0.649
US[b]	-1.2	-1.4	-1.4	-1.0	0.4	3.2	8.1	15.8	29.6	0.796

[a] Cumulative distribution of net wealth (survey variable designation: *DN3001*) for a selection of countries from the ECB's HFCS.
[b] Sourced from Luxembourg Wealth Study's most recent entry for each respective country (survey variable designation: *nw1*).
[c] Sourced from recent edition of wealth distributions calculated as in Davies, Sandström, Shorrocks, and Wolff (2011).

Fiscal policy scenarios

- What is the impact of a temporary increase in government purchases, G_1, financed by lump sum taxation (standard scenario in FM literature, e.g. Baxter and King (1993))

- We produce:
  1. responses from a model calibrated to US data vs model calibrated to Finnish data
  2. sensitivity analysis to exogenous parameters for the benchmark
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Why US v. Finland?

- US and Finland are at opposite ends of the wealth distribution, 79.57 and 64.64 respectively.
- Finland is an economy with less ex-ante income inequality and more redistributive policies, leading to smaller wealth and income inequality
- In addition, the US's steeper age profile of wages creates a stronger borrowing motive amongst younger agents which can lead to a greater proportion of financially constrained agents.

Variable	Description	Source	USA	FIN
K/Y	Capital-output ratio	PWT	3.074	4.402
B/Y	Debt-output ratio	IMF	0.428	-0.482
h	Fraction of hours worked	OECD	0.248	0.222
$\text{Var}(\ln w)$	Variance of log wages	LIS	0.509	0.168
$\bar{n}$	Fraction of hours worked	OECD	0.248	0.222
$\gamma_1, \gamma_2, \gamma_3$	Age profile of wages	LIS	0.265, -0.005, $3.6 * 10^{-5}$	0.183, -0.004, $2.8 * 10^{-5}$
Q_{25}, Q_{50}, Q_{75}	Wealth Quartiles	LWS	-0.014, -0.004, 0.120	-0.010, 0.052, 0.279
$\beta_1, \beta_2, \beta_3$	Subjective discount factor	calibrated	1.002, 0.961, 0.953	1.026, 1.004, 1.000
χ	Disutility of work	calibrated	13.3	15.1
b	Borrowing limit	calibrated	0.142	0.329
σ_a	Variance of ability	calibrated	0.667	0.281
$\tilde{\tau}_{ss}, \tau_{ss}$	Social Security	OECD	0.078, 0.077	0.313, 0.271
θ_1, θ_2	Level and progressivity of income tax	Holter et al. (2014)	0.888, 0.137	0.854, 0.237
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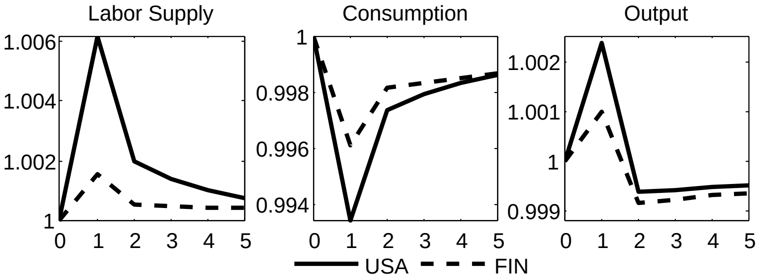
US v. Finland: $\Delta G_1, \nabla g_1$



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- Consumption and labor supply reactions also stronger for the US.
- % of agents constrained larger for US than Finland - 13.06% vs 6.31% respectively
- But of course US and Finland differ across many more dimensions than just the wealth distribution.

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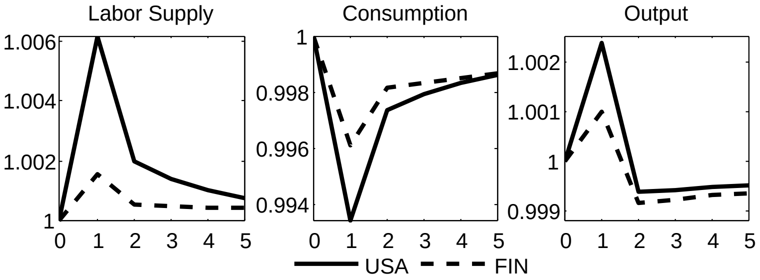

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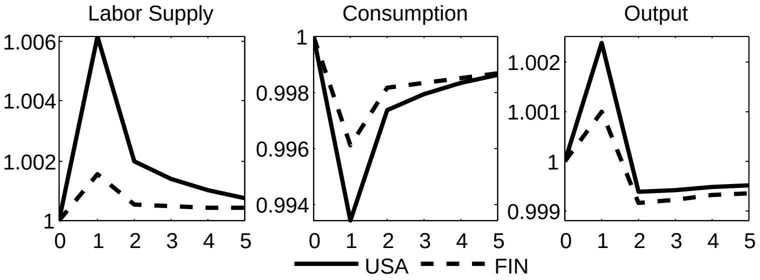

- $IM_{y,G} = 0.1192$ vs 0.050.
- Consumption and labor supply reactions also stronger for the US.
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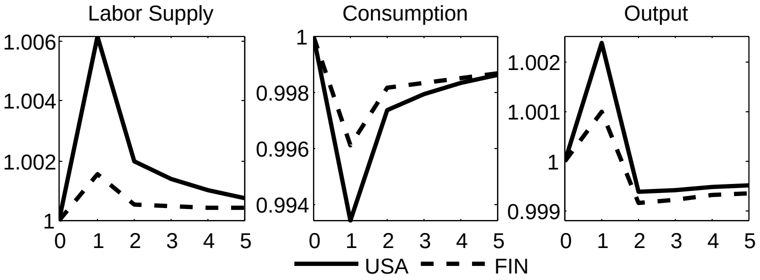

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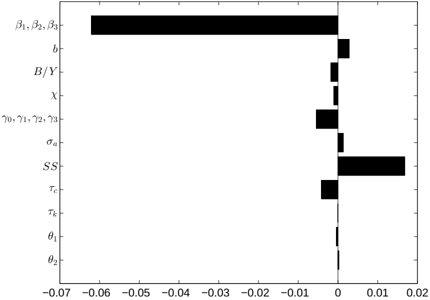
- We now feed, one at a time, Finnish parameters to our US benchmark model and repeat the experiment.



- Differences between discount factors account for most of the differences.
- Discount factors have the largest impact on k/y ratio and % of agents constrained.
- Similar exercise, where US benchmark economy is fed ± 1 std for each parameter yields similar results.

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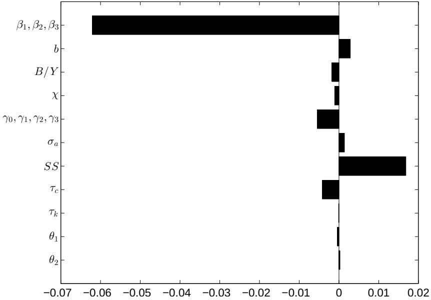

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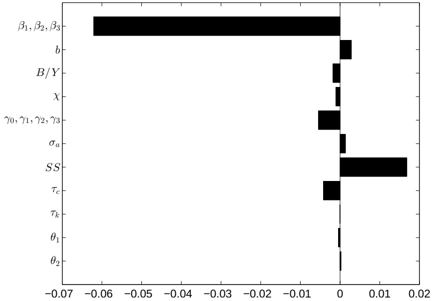

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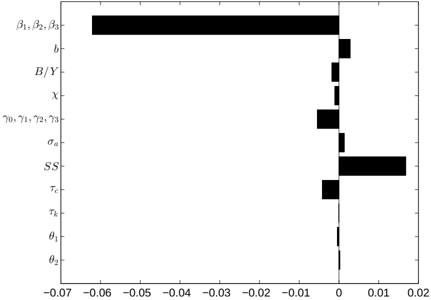

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$\Delta G_1, \nabla g_1$ - The role of wealth

- The US and Finnish economies had big differences in terms of k/y. How does that affect the multiplier?
- We study the effects of varying k_0 in the benchmark, holding everything else constant.

k_0	-0.14	0.00	1.00	2.00	3.00
Impact Multiplier	**0.124**	**0.119**	**0.107**	**0.101**	**0.097**
% Borrowing Constrained	16.24	13.03	11.67	11.42	11.40
K/Y	3.06	3.07	3.18	3.29	3.41
r	4.78%	4.73%	4.38%	4.03%	3.69%

- The interest rate, the proportion of agents constrained and the multiplier decrease as the capital-output ratio increases.
- Different mechanisms at play:

  - lower interest reduces the relative size of the fiscal shock to permanent income

  - lesser number of agents financially constrained, leads to lower marginal propensity to work

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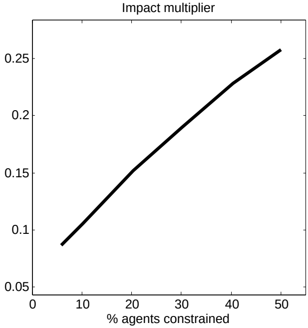

- We now keep K/Y constant and multiply β_1, β_2 by a constant ξ.
- We change ξ, β_3, χ and σ_a to match the same calibration targets, except wealth quartiles.
- The multiplier is very sensitive to the proportion of constrained agents.

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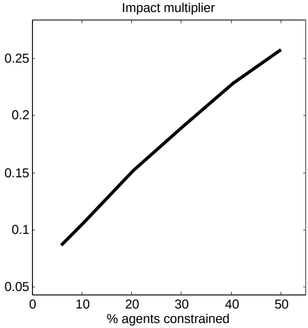

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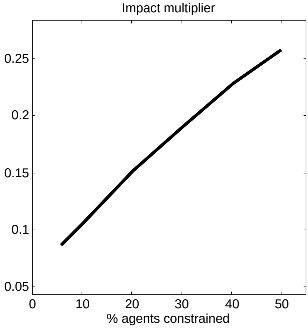

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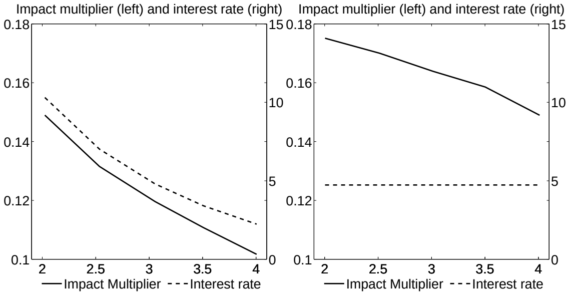
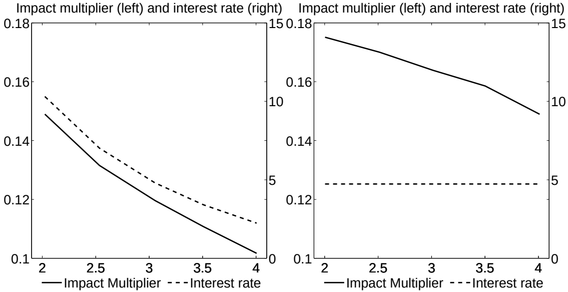
$\Delta G_1, \nabla g_1$ - The impact of K/Y and r_t



- We now keep the % of agents constrained constant, but change K/Y by scaling the discount factors and adjusting the borrowing limit.
- Interest rate is also very relevant for the multiplier.
- However, the K/Y in itself also matters.

$\Delta G_1, \nabla g_1$ - The impact of K/Y and r_t



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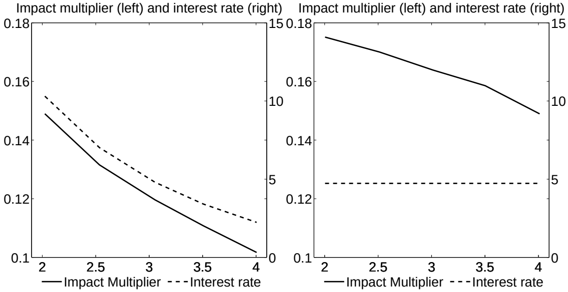

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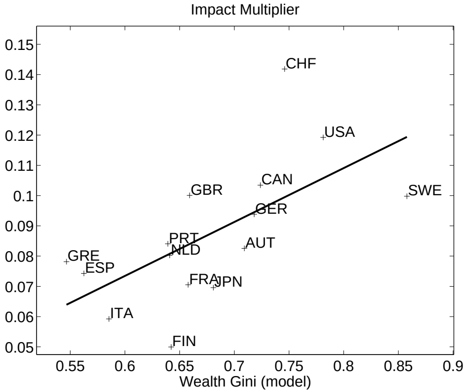
$\Delta G_1, \nabla g_1$ - Wealth GINI and the multiplier



- Strong and significant correlation between wealth GINI and multipliers, $\rho = 0.623$, $p-$val$= 0.012$.
- One s.d. increase in the GINI coefficient (0.083) leads to an increase of 17% of the average multiplier (0.0871) value.

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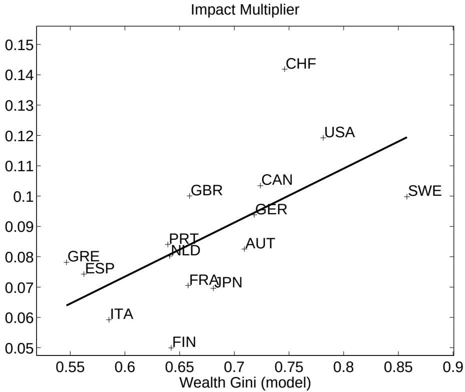

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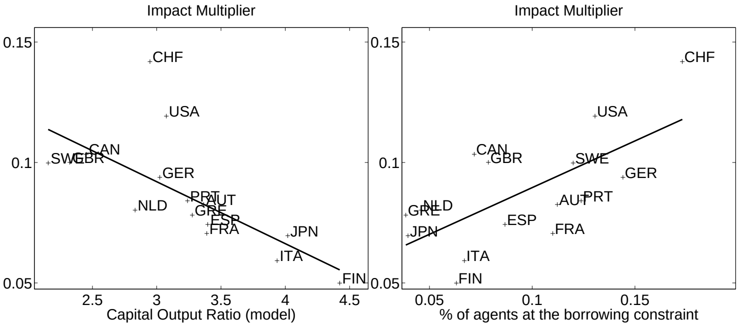
$\Delta G_1, \nabla g_1$ - K/Y and % constrained



- Both k/y and % of agents at the borrowing constraint strongly correlated with the multipliers.
- Correlation coefficients of -0.684 (p−val$= 0.005$) and 0.670 (p−val$= 0.006$)

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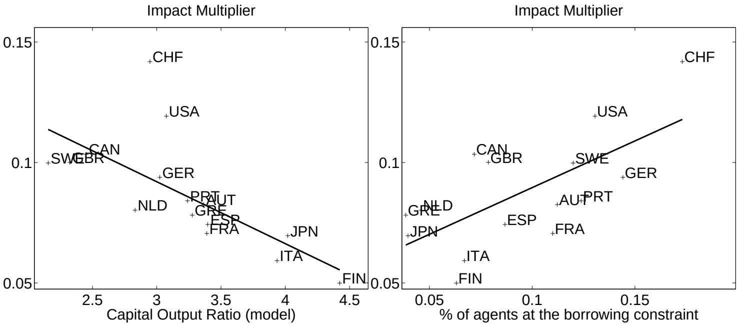

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Our results and future work

- Empirical exploration of the data shows that higher wealth inequality is associated with stronger fiscal responses.
- Analysis in the preceding experiments qualitatively aligns to the stylized fact that higher inequality is associated with higher impact multipliers.
- Capital-output ratio and % of agents at the borrowing constraint most relevant statistics.
- Fiscal policy transmission mechanism - demand side effects?
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