

ESTIMATING THE ELASTICITY OF INTERTEMPORAL SUBSTITUTION USING DIVIDEND TAX NEWS SHOCKS

Martin B. Holm, University of Oslo
Rustam Jamilov, All Souls College
Marek Jasinski, University of Oslo
Plamen T. Nenov, Norges Bank

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The views expressed here do not necessarily reflect the views of Norges Bank.

MOTIVATION

1. What is the elasticity of intertemporal substitution (EIS)?

Key behavioral parameter in macro and finance

Big debate: EIS is small vs. EIS is large

Notoriously hard to estimate

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Dividend tax rate increased by 28 percentage points

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3. Compelling quasi-experiment to study the response to *news* about future capital tax changes

Anticipatory saving or dis-saving effect?

THIS PAPER

- | Norwegian administrative register on the quasi-universe of households
- | Rich household and firm balance sheet data due to wealth tax and third-party reporting
- | Dynamic diff-in-diff approach identifies (relative) spending response to the reform
- | Capitalist-worker model with dividend tax news shocks and flexible pass-through
- | Calibrate the model to empirical impulse response and back out the implied EIS (and pass-through)

PREVIEW OF MAIN RESULTS

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- | Anticipatory dis-saving implies an $EIS > 1$ for the treated group
- | EIS that matches this response in the data is around 2
 - Average EIS of capital owners – relevant for effects of capital taxation
 - Consistent with Jakobsen et al. (2020) and evidence from the 1989 Danish wealth tax reform

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 - Consistent with Jakobsen et al. (2020) and evidence from the 1989 Danish wealth tax reform
- | Low and heterogeneous reform pass-through

RELATED LITERATURE

1. Macro/empirical literature on the EIS:

Hall (1988), Hansen and Singleton (1983), Campbell and Mankiw (1989), Mankiw and Zeldes (1991), Attanasio and Weber (1993), Blundell et al. (1994), Attanasio and Browning (1995), Beaudry and Van Wincoop (1996), Vissing-Jørgensen (2002), Vissing-Jørgensen and Attanasio (2003), Gruber (2013), Jacob et al. (2015), Cashin and Unayama (2016), Best et al. (2020), Jakobsen et al. (2020), Ring (2020), Calvet et al. (2021), Crump et al. (2022), Flynn et al. (2022)

2. Real effects of capital income/dividend taxation:

Harberger (1962), Hall and Jorgenson (1967), Feldstein (1970), Auerbach (1979), Bradford (1981), Poterba and Summers (1983), Cummins et al. (1994), Chetty and Saez (2005), Auerbach and Hassett (2007), House and Shapiro (2008), Yagan (2015), Alstadsæter et al. (2017), Zwick and Mahon (2017), Barro and Furman (2018), Straub and Werning (2020), Boissel and Matray (2022), Furno (2022), Chodorow-Reich et al. (2024)

3. Models with limited participation, heterogeneity, news shocks

Campbell and Mankiw (1989), Galí et al. (2007), Bilbiie (2008), Bilbiie (2018), Debortoli and Galí (2017), Beaudry and Portier (2004), Beaudry and Portier (2006), Barsky and Sims (2011), Beaudry and Lucke (2010), Beaudry and Portier (2014).

OUTLINE

SIMPLE MODEL

INSTITUTIONAL DETAIL

HOUSEHOLD DATA AND EMPIRICAL METHODOLOGY

EMPIRICAL RESULTS

STRUCTURAL MODEL

IDENTIFYING EIS

AN ILLUSTRATIVE MODEL

| Three period-lived agent, $t = 0, 1, 2$ (no discounting)

| CRRA preferences:

$$u'(C) = C^{-1/\psi},$$

where $\psi > 0$ is the elasticity of intertemporal substitution (EIS)

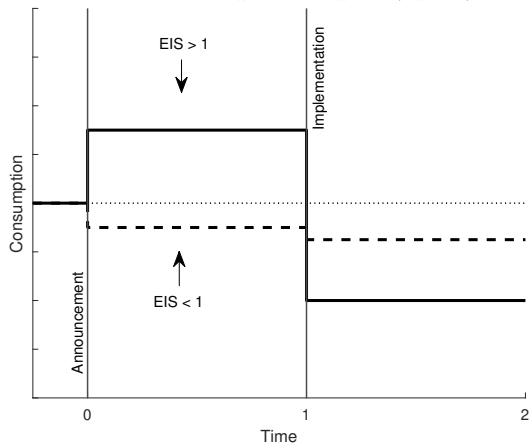
| Allocates initial financial wealth A_0 between consumption over $t = 0, 1, 2$.

| No labor endowment (no wealth effects from re-valuation of labor endowment)

| Can save in a portfolio of financial assets with after-tax return of R_t , for $t = 1, 2$

AN ILLUSTRATIVE MODEL

CHANGE FROM $R_2 = 1$ TO $R_2 < 1$ ($R_1 = 1$)



- | Holds more generally: See Flynn et al. (2022).
- | Provides a lower bound when wealth effects are also present.

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INSTITUTIONAL BACKGROUND

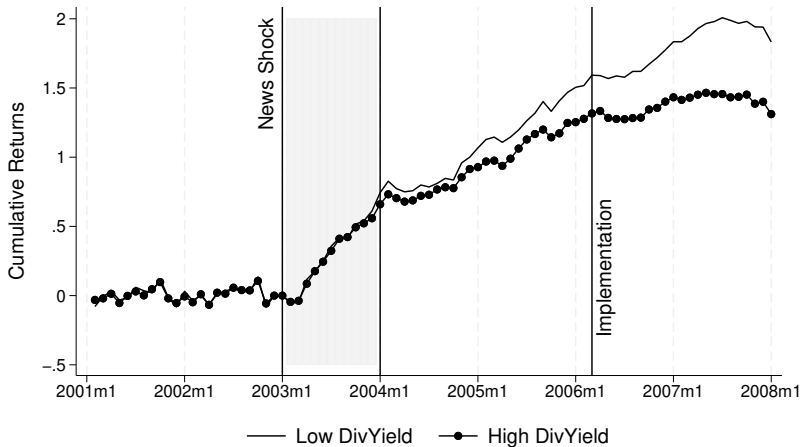
- | Main goal: reduce difference in tax rates on labor and capital income
- | 2001: Temporary dividend tax of 11%
- | January 2002: Expert commission appointment
- | February 2003: Commission published findings and submits recommendation
- | March 2004: Policy announcement (mostly in line with commission recommendations)
- | January 2006: Policy implementation

- | Feature 1: 28% tax on dividends and capital gains in excess of riskless return allowance
- | Feature 2: top marginal tax on labor income falls from 64.7% to 54.3%

- | Sum of taxes paid by the firm and investor on dividends and capital gains increased to 48.2 %

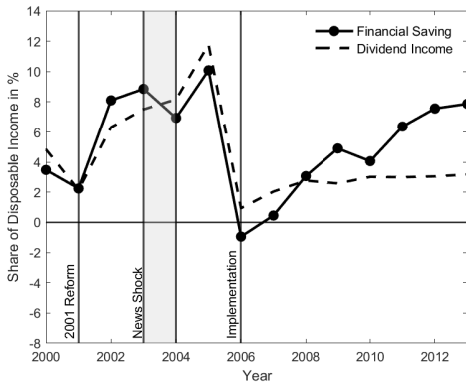
STOCK MARKET IMPACT

THE REFORM ANNOUNCEMENT WAS UNANTICIPATED

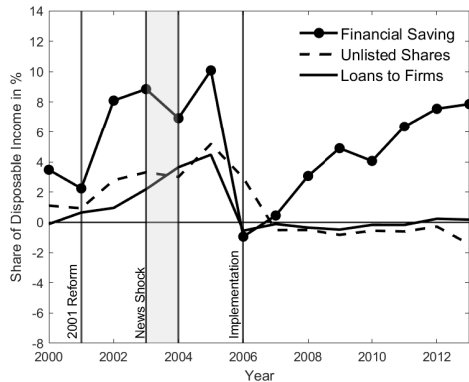


AGGREGATE IMPACT

PASS-THROUGH OF THE REFORM WAS LIKELY LOW



(A) Saving and Dividend Income



(B) Saving in Unlisted Shares and Loans to Firms

Notes: Figure (a) shows households' financial saving and dividend income as a share of disposable income. Figure (b) shows households' saving in unlisted shares and loans to non-financial firms as a share of disposable income. All numbers are from the national accounts.

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DATA

| The Norwegian registry data:

Household balance sheets and income statements from Norwegian tax registers; Data on family status, demographics, education, employment status, etc.; Employer-employee matched data; Housing transaction data; Business ownership data; Firm income statements and balance sheets

Deflated to real 2011 US dollars

| Sample:

Sample period 2000-2013

Individuals between 25 and 65 years in 2000

Exclude household with disposable income and spending below 1G (\$10,000)

Above median within-cohort wealth in 2000

Exclude households with very large annual changes in imputed spending

IMPUTED SPENDING

Imputed spending: difference between disposable income and (imputed) active saving

| For everyone but incorporated business owners:

we follow the literature: Fagereng-Halvorsen (2015) and Eika-Mogstad-Vestad (2020) for Norway

Disposable income: labor income + transfers + business income + capital income + other income - taxes

(Imputed) saving: change in net worth from depositing/withdrawing resources from asset classes

IMPUTED SPENDING

- | For incorporated business owners:

 - Focus on business owners with $> 50\%$ + stable ownership

 - Integrate the private and business accounts

IMPUTED SPENDING

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Focus on business owners with > 50% + stable ownership

Integrate the private and business accounts

$$\text{spending}_{i,t} = \text{spending}_{i,t}^{\text{npbo}} + \underbrace{\text{profits}_{i,t}}_{\text{income within the firm}} - \overbrace{(\Delta \text{ book value}_{i,t} - \text{capital gains}_{i,t})}^{\text{saving within the firm}} \quad (1)$$

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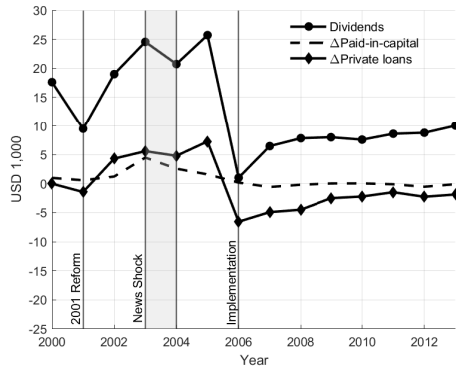
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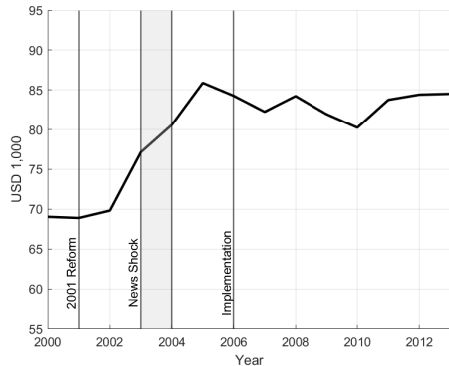
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$$\text{spending}_{i,t} = \text{spending}_{i,t}^{\text{npbo}} + \text{dividends from the firm}_{i,t} - \Delta \text{ paid-in capital in firm}_{i,t}. \quad (3)$$

SPENDING, DIVIDENDS AND PAID-IN CAPITAL



(A) Average dividends, paid-in-capital and private loans in the treatment group.



(B) Average spending in the treatment group.

EMPIRICAL FRAMEWORK

I Dynamic difference-in-differences:

$$C_{i,2000+h} - C_{i,2000} = \alpha + \sum_{h=\underline{h}}^H \beta_h (D_{i,2000} \times \omega_{2000+h}) + \sum_{h=\underline{h}}^H \Gamma'_h (\mathbf{X}_{i,2000} \times \omega_{2000+h}) + \varepsilon_{i,h} \quad (4)$$

for $h = \{0, 1, 2, \dots, 13\}$,

$C_{i,2000+h}$ – log imputed spending in year 2000 + h

$D_{i,2000}$ – treatment variable

ω_t – dummy variable for year t

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- | **Treatment variable:** Average dividend income > 20% of gross income for 2000 and 2002.
- | **Control group:** Relatively wealthy non-private business owners.
- | **Controls:** flexible non-financial income, 2-digit NACE employment fixed effects, age-fixed effects, municipality-fixed effects

IDENTIFICATION

- | Treatment (T) and control (C) groups' spending would have trended similarly without the tax reform

Not random assignment of households into T vs C

Examine the 2000-2002 pre-reform period

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Systematically different exposure to differential industry-specific or local shocks

Dividend share correlated with age

Systematically different exposure to the top marginal labor income tax

- | Motivate our baseline specification

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- | In robustness:

control for systematic differences in exposure to stock market

OUTLINE

SIMPLE MODEL

INSTITUTIONAL DETAIL

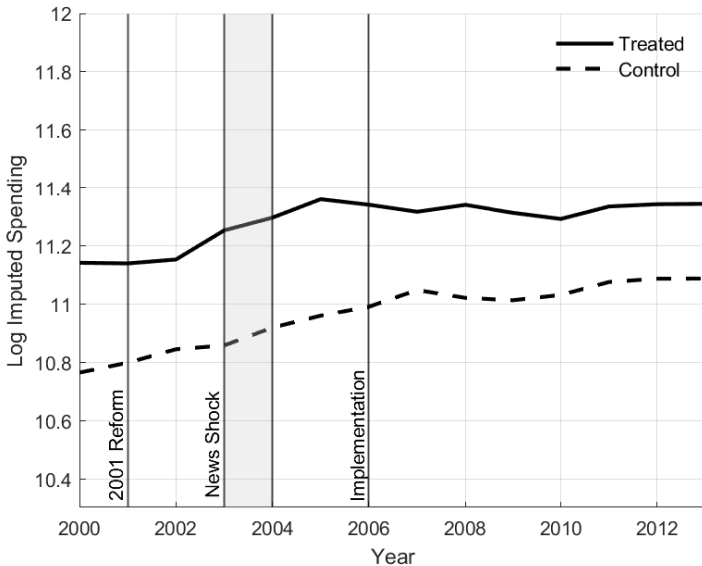
HOUSEHOLD DATA AND EMPIRICAL METHODOLOGY

EMPIRICAL RESULTS

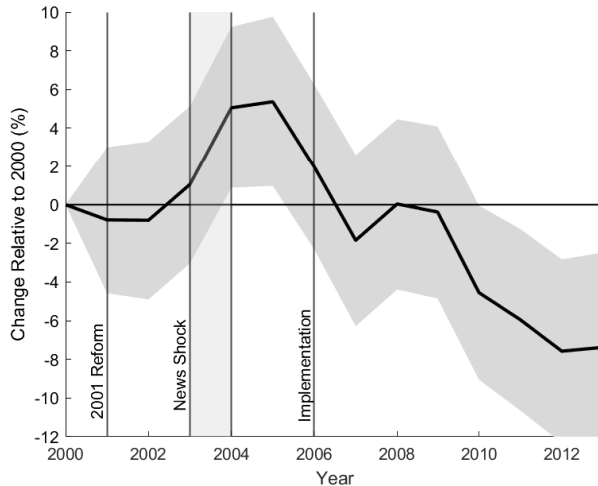
STRUCTURAL MODEL

IDENTIFYING EIS

RAW TRENDS

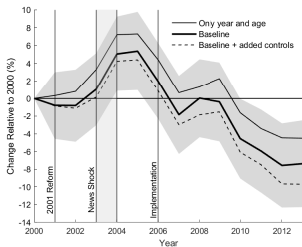


MAIN EMPIRICAL RESULT

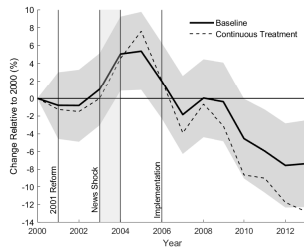


Notes: The figure displays the estimated coefficients of equation (4) with 95% confidence bands computed using standard errors clustered at the individual level.

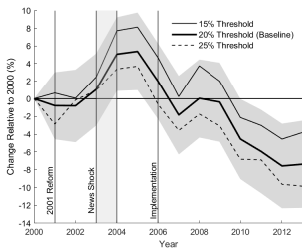
ROBUSTNESS



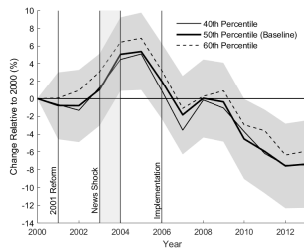
(A) Alternative sets of controls.



(B) Continuous treatment definition.



(C) Alternative treatment thresholds.



(D) Alternative sample restrictions.

TAKING STOCK

- | Anticipatory dis-saving effect of the reform
- | Relative spending rose by 5 % in 2004-2006
- | Fell gradually to around 8 in 2011-2013
- | Robust to alternative treatment thresholds or treatment definition
- | Consistent with $EIS > 1$
- | Next: back out a specific value of the EIS

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 2. Capitalists: save in claims on firms. Share = $1 - \lambda$

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- | Policy: news shocks about future dividend and labour income taxes [Beaudry and Portier (2004, 2006)]

HOUSEHOLDS

| Capitalists

$$\max_{\{C_{k,t}, S_{t+1}\}} E_0 \sum_{t=0}^{\infty} \beta^t \frac{C_{k,t}^{1-1/\psi} - 1}{1 - 1/\psi}$$

$$\text{s.t. } S_{t+1}P_t + C_{k,t} \leq (1 - \tau_{k,t})N_k + S_t(D_t + P_t), \forall t$$

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| Workers

$$\max_{\{C_{w,t}\}} E_0 \sum_{t=0}^{\infty} \beta^t \frac{C_{w,t}^{1-1/\psi} - 1}{1 - 1/\psi}$$

$$\text{s.t. } C_{w,t} + \frac{B_{w,t+1}}{R_t^B} = (1 - \tau_{w,t})N_w + B_{w,t} + T_{w,t}, \forall t$$

CLOSELY HELD FIRMS

$$V(K) = \max_{\{D, K'\}} [D + E m' V(K')]$$

s.t.

$$\varphi(D) + K' \leq (1 - \delta)K + F(A, K, N) - N,$$

where

$$\varphi(D_t) = D_t(1 + \tau_t)^\kappa \tag{5}$$

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- | Allow for slow adjustment to the dividend tax news.
- | Dividend tax impacts capitalists with probability $1 - \theta$
- | Over time the economy converges to the new tax regime

TAX POLICY

Tax processes:

$$\log \tau_t = \log \tau_{t-1} + \sigma_d \epsilon_{d,t-j},$$

$$\log \tau_{k,t} = \log \tau_{k,t-1} + \sigma_k \epsilon_{k,t-j},$$

$$\log \tau_{w,t} = \log \tau_{w,t-1} + \sigma_w \epsilon_{w,t-j},$$

News: $\epsilon_{d,t-j}$, $\epsilon_{k,t-j}$, $\epsilon_{w,t-j}$

In Norwegian context, $j = 3$

Numerically, assume a very persistent AR(1) process.

▶ Market clearing conditions

▶ Equilibrium definition

▶ Fixed parameters

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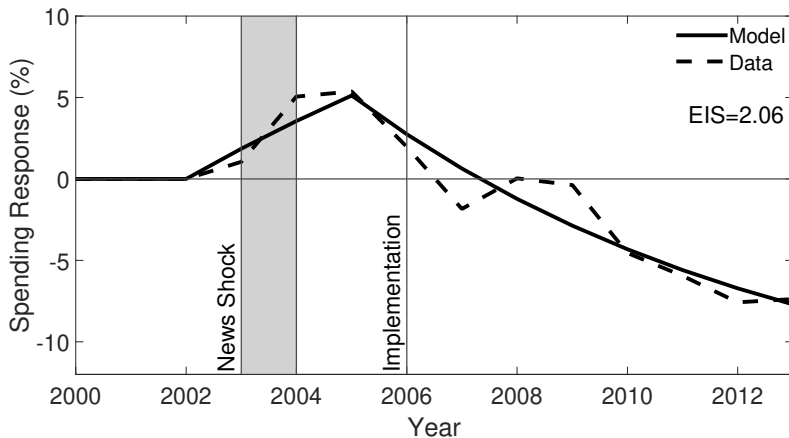
STRUCTURAL MODEL

IDENTIFYING EIS

CALIBRATION STRATEGY

- | Impulse response matching: simultaneous shocks to dividend and labor tax news
- | Large three-dimensional grid for ψ , κ , and θ
- | Calibration targets: differential spending response over 2003-2013.
- | Calibrated EIS: minimizes squared error between model-implied and data responses

SPENDING RESPONSE: MODEL MEETS DATA

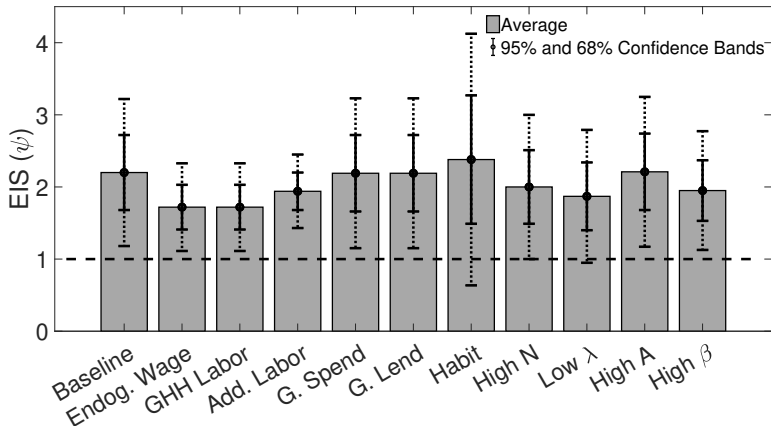


$\kappa = 0.02$ and $\theta = 0.9$

▶ IR matching results

▶ Additional results

ROBUSTNESS



Notes: The figure reports average EIS values as well as 68% and 95% bootstrapped confidence bands implied by each alternative model. Model versions, from left to right, correspond to: the baseline and extensions with endogenous wages, endogenous GHH labor supply, endogenous additively separable labor supply, fiscal rule with government spending instead of lump-sum taxes, fiscal rule with government bond lending instead of lump-sum taxes, habit formation instead of heterogeneous tax incidence, high value of the labor endowment, low share of workers, low productivity, and high discount factor.

CONCLUSION

- | Leverage unique institutional features of the 2006 Norwegian dividend tax reform
- | Administrative household-level data and a diff-in-diff approach
- | Estimate an anticipatory spending response – consistent with $EIS > 1$ for treated individuals
- | Using a calibrated structural model, we back out an EIS of around 2
- | Reform had low pass through

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- | Other implications:
 - dividend taxation reduces inequality (including *consumption* inequality)
 - dividend taxation may impact activity via spending/aggregate demand

Appendix

DESCRIPTIVE STATISTICS FOR 2000

[▶ BACK](#)

	Control		Treated	
	Mean	S.D.	Mean	S.D.
Age	45.49	11.14	50.71	8.71
Spending	43.68	38.45	86.07	145.04
Disposable income	39.38	18.22	94.67	142.8
Labor income	46.55	28.81	56.51	29.52
Transfers	8.84	11.67	4.49	8.39
Dividend income from private businesses	.	.	57.33	131.31
Taxes	15.07	10.98	26.75	22.68
Gross wealth	310.96	276.85	695.31	658.06
Housing wealth	283.62	269.38	548.34	543.89
Deposits	16.38	34.15	63.75	148.9
Public Stocks	0.32	20.02	8.22	56.1
Mutual Funds	2.21	9.22	11.92	36.84
Private Business Wealth	.	.	156.37	401.22
Net Wealth	410.09	294.83	715.72	663.84
Debt	59.42	60.75	71.04	117.09
Exposure to the reform (dividend share of gross income in %)	.	.	36.68	21.69
Number of individuals	1,320,970	.	2,959	.

AGGREGATION AND MARKET CLEARING

[▶ BACK](#)

$$G_t = \tau_t D_t + \tau_{w,t} N_w + \tau_{k,t} N_k$$

$$\text{Firm shares: } S_t = \frac{1}{1-\lambda}$$

$$\text{Labor endowments: } N = \lambda N_w + (1 - \lambda) N_k$$

$$\text{Consumption: } C_t = \lambda C_{wt} + (1 - \lambda) C_{kt}$$

$$\text{Goods market: } Y_t = C_t + I_t$$

EQUILIBRIUM DEFINITION ▶ BACK

DEFINITION 1

A rational expectations general equilibrium, given tax policy innovation shocks $\{\varepsilon_{d,t}, \varepsilon_{k,t}, \varepsilon_{w,t}\}$ and the tax policy processes, is defined as a set of policies for (i) capitalists: C_k and S_k ; (ii) policies for workers: C_w and B_w ; (iii) policies for firms: K' and D ; (iv) firm market value $V(K)$; (v) and aggregate prices m' and R^b , such that: all policies solve the respective agents' optimization problems, $m' = \beta \frac{U_c(c'_k)}{U_c(c_k)}$, and all markets clear at any given time t .

PARAMETERS FIXED EXTERNALLY

[▶ BACK](#)

TABLE: Model parameters fixed externally

Parameter	Value	Description
λ	0.975	Share of workers
β	0.98	Discount factor
δ	0.075	Depreciation rate
α	0.33	Capital share
N	0.3	Labor endowment
A	1	Productivity
σ_d	0.28	St. dev., capitalist dividend tax news
σ_l	0.104	St. dev., capitalist labor tax news

Parameterization frequency: annual

We fix these parameters by relying on prior literature and institutional details of the tax reform

REFERENCES I

- ALSTADSÆTER, A., M. JACOB, AND R. MICHAELY (2017): “Do dividend taxes affect corporate investment?” *Journal of Public Economics*, 151, 74–83.
- ATTANASIO, O. P. AND M. BROWNING (1995): “Consumption over the Life Cycle and over the Business Cycle,” *American Economic Review*, 1118–1137.
- ATTANASIO, O. P. AND G. WEBER (1993): “Consumption growth, the interest rate and aggregation,” *Review of Economic Studies*, 60, 631–649.
- AUERBACH, A. J. (1979): “Wealth maximization and the cost of capital,” *Quarterly Journal of Economics*, 93, 433–446.
- AUERBACH, A. J. AND K. A. HASSETT (2007): “The 2003 Dividend Tax Cuts and the Value of the Firm: An Event Study,” in *Taxing Corporate Income in the 21st Century*, ed. by A. J. Auerbach, J. R. Hines, Jr., and J. Slemrod, Cambridge University Press, 93–126.
- BARRO, R. J. AND J. FURMAN (2018): “Macroeconomic effects of the 2017 tax reform,” *Brookings Papers on Economic Activity*, 2018, 257–345.
- BARSKY, R. B. AND E. R. SIMS (2011): “News shocks and business cycles,” *Journal of Monetary Economics*, 58, 273–289.

REFERENCES II

- BEAUDRY, P. AND B. LUCKE (2010): “Letting Different Views about Business Cycles Compete,” *NBER Macroeconomics Annual*, 24, 413–456.
- BEAUDRY, P. AND F. PORTIER (2004): “An exploration into Pigou’s theory of cycles,” *Journal of Monetary Economics*, 51, 1183–1216.
- (2006): “Stock prices, news, and economic fluctuations,” *American Economic Review*, 96, 1293–1307.
- (2014): “News-driven business cycles: Insights and challenges,” *Journal of Economic Literature*, 52, 993–1074.
- BEAUDRY, P. AND E. VAN WINCOOP (1996): “The intertemporal elasticity of substitution: An exploration using a US panel of state data,” *Economica*, 495–512.
- BEST, M. C., J. S. CLOYNE, E. ILZETZKI, AND H. J. KLEVEN (2020): “Estimating the elasticity of intertemporal substitution using mortgage notches,” *Review of Economic Studies*, 87, 656–690.
- BILBIIE, F. (2008): “Limited asset markets participation, monetary policy and (inverted) aggregate demand logic,” *Journal of Economic Theory*, 140, 162–196.
- (2018): “Monetary Policy and Heterogeneity: An Analytical Framework,” *Working Paper*.

REFERENCES III

- BLUNDELL, R., M. BROWNING, AND C. MEGHIR (1994): “Consumer demand and the life-cycle allocation of household expenditures,” *Review of Economic Studies*, 61, 57–80.
- BOISSEL, C. AND A. MATRAY (2022): “Dividend Taxes and the Allocation of Capital,” *Working Paper*.
- BRADFORD, D. F. (1981): “The incidence and allocation effects of a tax on corporate distributions,” *Journal of Public Economics*, 15, 1–22.
- CALVET, L. E., J. Y. CAMPBELL, F. GOMES, AND P. SODINI (2021): “The cross-section of household preferences,” *Working Paper*.
- CAMPBELL, J. Y. AND N. G. MANKIW (1989): “Consumption, income, and interest rates: Reinterpreting the time series evidence,” *NBER Macroeconomics Annual*, 4, 185–216.
- CASHIN, D. AND T. UNAYAMA (2016): “Measuring Intertemporal Substitution in Consumption: Evidence from a VAT Increase in Japan,” *Review of Economics and Statistics*, 98, 285–297.
- CHETTY, R. AND E. SAEZ (2005): “Dividend taxes and corporate behavior: Evidence from the 2003 dividend tax cut,” *Quarterly Journal of Economics*, 120, 791–833.
- CHODOROW-REICH, G., M. SMITH, O. M. ZIDAR, AND E. ZWICK (2024): “Tax policy and investment in a global economy,” Tech. rep., National Bureau of Economic Research.

REFERENCES IV

- CRUMP, R. K., S. EUSEPI, A. TAMBALOTTI, AND G. TOPA (2022): “Subjective intertemporal substitution,” *Journal of Monetary Economics*, 126, 118–133.
- CUMMINS, J. G., K. A. HASSETT, R. G. HUBBARD, R. E. HALL, AND R. J. CABALLERO (1994): “A reconsideration of investment behavior using tax reforms as natural experiments,” *Brookings Papers on Economic Activity*, 1994, 1–74.
- DEBORTOLI, D. AND J. GALI (2017): “Monetary Policy with Heterogeneous Agents: Insights from TANK models,” *Working Paper*.
- FELDSTEIN, M. S. (1970): “Corporate taxation and dividend behaviour,” *Review of Economic Studies*, 37, 57–72.
- FLYNN, J. P., L. D. SCHMIDT, AND A. A. TODA (2022): “Robust Comparative Statics for the Elasticity of Intertemporal Substitution,” *arXiv preprint arXiv:2201.10673*.
- FURNO, F. (2022): “The Macroeconomic Effects of Corporate Tax Reforms,” *Working Paper*.
- GALÍ, J., J. D. LÓPEZ-SALIDO, AND J. VALLÉS (2007): “Understanding the effects of government spending on consumption,” *Journal of the European Economic Association*, 5, 227–270.
- GRUBER, J. (2013): “A Tax-Based Estimate of the Elasticity of Intertemporal Substitution.” *Quarterly Journal of Finance*, 3, 1 – 20.

REFERENCES V

- HALL, R. E. (1988): "Intertemporal Substitution in Consumption," *Journal of Political Economy*, 96, 339–357.
- HALL, R. E. AND D. W. JORGENSON (1967): "Tax policy and investment behavior," *American Economic Review*, 57, 391–414.
- HANSEN, L. P. AND K. J. SINGLETON (1983): "Stochastic consumption, risk aversion, and the temporal behavior of asset returns," *Journal of political economy*, 91, 249–265.
- HARBERGER, A. C. (1962): "The incidence of the corporation income tax," *Journal of Political Economy*, 70, 215–240.
- HOUSE, C. L. AND M. D. SHAPIRO (2008): "Temporary investment tax incentives: Theory with evidence from bonus depreciation," *American Economic Review*, 98, 737–68.
- JACOB, M., R. MICHAELY, AND A. ALSTADSÆTER (2015): "Taxation and dividend policy: The muting effect of diverse ownership structure," *Accounting Research Centre, Chicago Booth*.
- JAKOBSEN, K., K. JAKOBSEN, H. KLEVEN, AND G. ZUCMAN (2020): "Wealth taxation and wealth accumulation: Theory and evidence from Denmark," *Quarterly Journal of Economics*, 135, 329–388.
- MANKIW, N. G. AND S. P. ZELDES (1991): "The consumption of stockholders and nonstockholders," *Journal of Financial Economics*, 29, 97–112.

REFERENCES VI

- POTERBA, J. M. AND L. H. SUMMERS (1983): “Dividend taxes, corporate investment, and ‘Q’,” *Journal of Public Economics*, 22, 135–167.
- RING, M. A. K. (2020): “Wealth taxation and household saving: Evidence from assessment discontinuities in Norway,” *Working Paper*.
- STRAUB, L. AND I. WERNING (2020): “Positive long-run capital taxation: Chamley-Judd revisited,” *American Economic Review*, 110, 86–119.
- VISSING-JØRGENSEN, A. (2002): “Limited asset market participation and the elasticity of intertemporal substitution,” *Journal of Political Economy*, 110, 825–853.
- VISSING-JØRGENSEN, A. AND O. P. ATTANASIO (2003): “Stock-market participation, intertemporal substitution, and risk-aversion,” *American Economic Review*, 383–391.
- YAGAN, D. (2015): “Capital tax reform and the real economy: The effects of the 2003 dividend tax cut,” *American Economic Review*, 105, 3531–63.
- ZWICK, E. AND J. MAHON (2017): “Tax policy and heterogeneous investment behavior,” *American Economic Review*, 107, 217–48.