

People, Policy and Polarization:
A Study of Income Inequality in the UK in 1980s
using Synthetic Control Method

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Research Question

What role does policy play in stretching of the income distribution?

Chain of Events

People - social and political polarization



Policy - both drastic and abrupt



Polarization - Income distribution

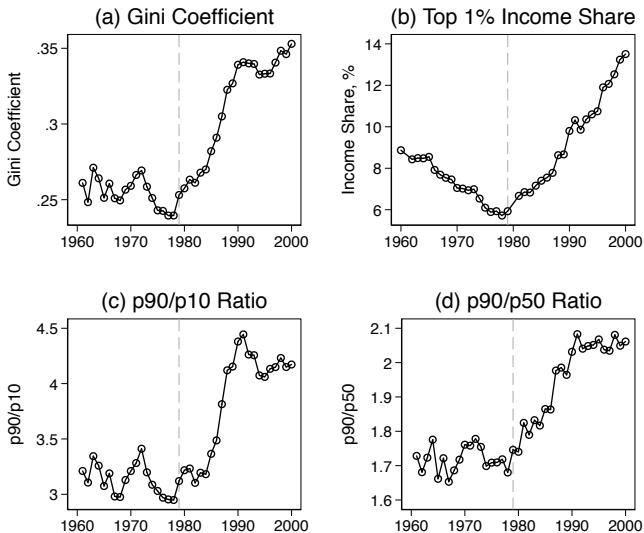
Outline

- ① Inequality Trends in the UK
- ② Socio-political Polarization
- ③ Synthetic Control Methodology
- ④ Data and Results
- ⑤ UK v US
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UK inequality - different measures



Source: Institute of Fiscal Studies UK; World Wealth and Income Database.

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Shock leading to social disturbance

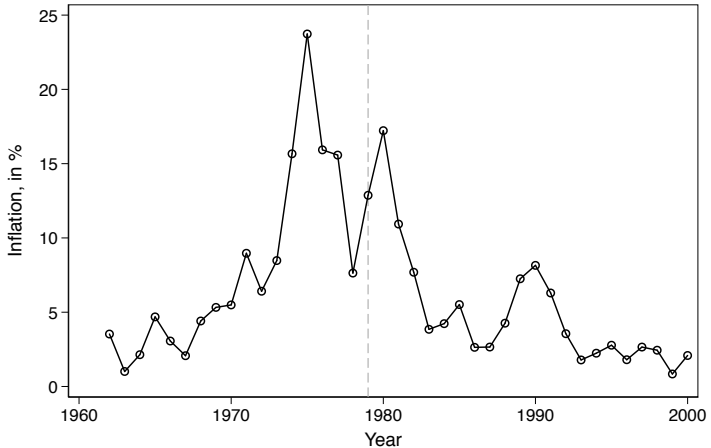
Pre-1970:

- “Consensus-politics”: consensus in the policies
- Full-employment, demand management, commitment for welfare state, mixed economy, and facilitation for trade-unions
- Primary concern: better health, housing, and education

Exogenous shock and economic troubles:

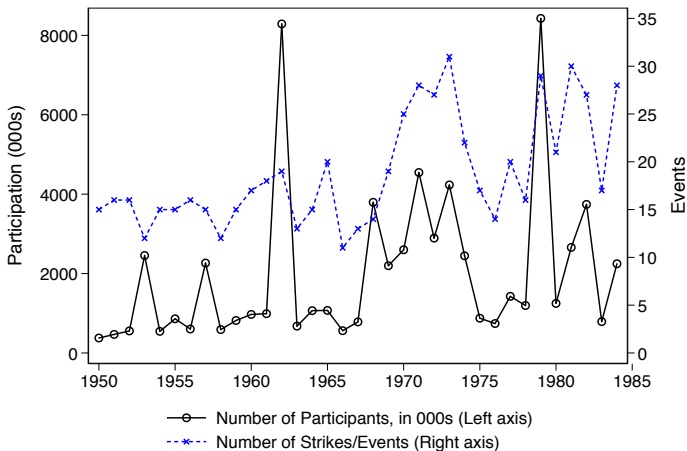
- 1973: OPEC oil embargo
- Inflation soars
- Government announces wage-rise freeze (counter-inflationary policies)
- 1973: 3-day work week announced
- 1976: UK goes to the IMF for help

Inflation in the UK



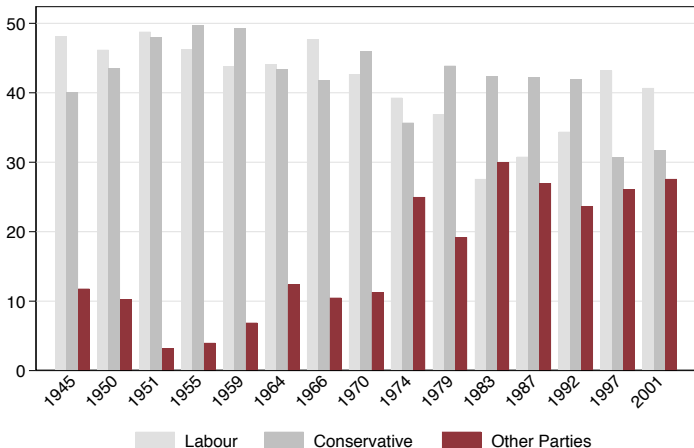
Note: This chart presents the rate of inflation. The broken vertical line represents the year 1979.
Source: Institute of Fiscal Studies.

Unrest in the UK



Note: The solid line (left axis) measures total number of workers participating in strikes (in thousands) per year. The broken line (right axis) measures total number of strikes each year. *Source:* Authors calculation using Biggs 2016.

Election results in the UK



Note: This chart presents the vote share of Labour, Conservative and other parties in UK national election from 1945 to 2001. The three shares add up to 100%. In 1974, there were two separate national elections, first on February 28th and second on October 10th. The results used here are from the latter, although both paint similar picture. *Source:* Authors calculation using Kimber 2018.

Policy Changes

Change in the government:

- Margaret Thatcher: 4 May 1979 – 28 November 1990
- Thatcher: “..every regulation represents a restriction of liberty, every regulation has a cost.”

Changes to the tax code:

- Tax cut in 1979: top rates - 83% to 60%; common rates - 33% to 30%
- Surcharge on investment income (15%) abolished in 1985
- Tax cut in 1988: top rates - 60% to 40%; common rates - 27% to 25%

Additional policy changes

- Increased VAT from 8% to 15%
- Raised taxes on gasoline and NIH payments
- Cut subsidies on nationalized industries
- Cut money for housing, local governments and education
- Privatized public industries: Telecom, BP, BA, National Bus Company, British Ports and Shipyards, and more
- Sold off public housing

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Synthetic Control Method

- Units: $j \in \{1, 2, 3, \dots, J\}$
 - Treatment unit: $j = 1$
 - Control units: $j = 2, 3, \dots, J$
- Time periods: $t \in \{1, 2, \dots, T\}$
 - Intervention: T_0
 - Pre-intervention period: $t \in \{1, 2, \dots, T_0\}$
 - Post-intervention period: $t \in \{T_0 + 1, \dots, T\}$
- Treatment
 - $D_{1t} = 1, t \in \{T_0 + 1, \dots, T\}$
 - $D_{1t} = 0, t \in \{1, 2, \dots, T_0\}$
 - $D_{jt} = 0$ for $j = 2, 3, \dots, J; t \in \{1, 2, \dots, T\}$

Treatment Effect

Following Rubin (1974):

Untreated:

$$y_{jt}(D = 0) = \delta_t + \beta_t Z_j + \lambda_t \mu_j + \varepsilon_{jt}$$

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Treated:

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Treated:

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Effect of the treatment for the treated unit:

$$\theta_{1t} = y_{1t}(1) - y_{1t}(0), \forall t \in \{T_0 + 1, \dots, T\}$$

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Effect of the treatment for the treated unit:

$$\theta_{1t} = y_{1t}(1) - y_{1t}(0), \forall t \in \{T_0 + 1, \dots, T\}$$

Estimated treatment effect using SCM:

$$\hat{\theta}_{1t} = y_{1t}(1) - \sum_{j=2}^J w_j \cdot y_{jt}(0)$$

Optimal Weights

$$w^*(V) = \underset{w}{\operatorname{argmin}} \left(X_1 - \sum_{j=2}^J w_j \cdot X_j \right)' V \left(X_1 - \sum_{j=2}^J w_j \cdot X_j \right)$$

where, X_j is a $(k \times 1)$ vector of variables $(Z_j', y_{j1}, y_{j2}, \dots, y_{jT_0})'$ and V is a positive definite $(k \times k)$ diagonal matrix with each element:

$$v_k^* = \underset{v}{\operatorname{argmin}} \frac{1}{T_0} \sum_{t=1}^{T_0} \left(y_{1t} - \sum_{j=2}^J w_j^*(V) \cdot y_{jt} \right)^2$$

$$\forall t \in \{1, 2, \dots, T_0\}$$

Synthetic Control Estimator

The synthetic control estimator is then:

$$\hat{\theta}_{1t} = y_{1t} - \sum_{j=2}^J w_j^* \cdot y_{jt}, \forall t \in \{T_0 + 1, \dots, T\}$$

with, $w_j \geq 0$ and $\sum_{j=2}^J w_j = 1$

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The Root Mean Squared Prediction Error is:

$$RMSPE = \sqrt{\frac{1}{T_0} \sum_{t=1}^{T_0} \left(y_{1t} - \sum_{j=2}^J w_j^* \cdot y_{jt} \right)^2}, \forall t \in \{1, 2, \dots, T_0\}$$

Inference

Following Abadie et al. (2015):

$$p\text{-value} = \frac{\sum_{j=2}^J \sum_t^T \mathbb{1}\{|\hat{\theta}_{1,T_0}| \leq |\hat{\theta}_{j,t}|\}}{N_{jt}}$$

where, N_{jt} is the total time- and space-placebos; $\hat{\theta}_{j,t}$ is the treatment effect of all possible combinations of time and control units for period 1973-2000.

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Table 1: Description of the Variables

Variables	Variable Definition	Source
Income Share [†]	Total market income share of held by the group	WID
GDP per capita	Gross domestic product per capita	OECD
Human Capital	Human capital index, based on years of schooling and returns to education	PWT
Patent per capita	Stock of domestic patent	Madsen 2007
KOF Globalization Index	Globalization index along economic, social and political dimension	KOF
Trade Share	Trade (% of GDP)	WDI
Government Expenditure	General government final consumption expenditure (% of GDP)	WDI
Investment Share	Total investment (% of GDP)	BL 1994
Union Density	Union membership (% of total labor force)	OECD
Real Interest Rate	Real short-term interest rate	Bordo et al. 2001
Inflation	Change in CPI, %	Bordo et al. 2001
Money Reserve	Money to reserves ratio	Bordo et al. 2001
Growth Rate of Money	Growth rate of money, %	Bordo et al. 2001

Note: The outcome variable is the total market income (income before tax and transfer) share held by each top income group. Income share of the top groups are calculated using World Wealth and Income Database (WID). The top groups here are the Top 1%, Top 5%, Top 10%, Top 5-1% (percentiles 96-99), and Top 10-1% (percentiles 91-99).

Abbreviations: BL 1994 - Barro Lee 1994; WDI - World development Indicators, World Bank; OECD - Organisation for Economic Co-operation and Development; WID - World Wealth and Income Database; KOF - KOF Swiss Economic Institute; PWT - Penn World Table, v9.0.

Table 2: Counterfactual Weights

	(1) Top 1%	(2) Top 5%	(3) Top 10%	(4) Top 5-1%	(5) Top 10-1%
Australia	0.502	0.533	0.598	0.567	0.532
Canada	0.268	0.263	0.193	0	0
Denmark	0.087	0	0	0	0
Finland	0	0	-	0	-
France	0	0	0	0.072	0
Japan	0.037	0	0	0.361	0.468
New Zealand	0	0	0.094	0	0
Norway	0	0.102	0.115	0	0
Sweden	0.105	0.102	0	0	0

Note: Each column represents a synthetic control counterfactual. Each entry in a column represents country weights, w_j , for the corresponding synthetic counterfactual, with $\sum_{j=2}^J w_j = 1$. Additionally w_j is bounded from below $w_j \geq 0$. Finland does not have income shares for the Top 10%.

Table 3: Pre-treatment Balance of Variables, 1970-1979

	UK	(1) Top 1%	(2) Top 5%	(3) Top 10%	(4) Top 5-1%	(5) Top 10-1%
GDPpc (in 1000s)	18.20	23.14	23.87	23.50	20.26	19.74
Human Capital	2.83	2.94	3.04	3.06	2.95	2.98
Patent per capita	397.16	463.31	384.48	335.95	586.78	676.40
KOF	61.34	47.03	48.49	50.59	40.91	39.39
Trade Share	49.44	36.40	28.34	35.78	25.87	24.72
GovExpend	19.33	19.81	18.41	17.33	14.76	14.26
Investment	21.55	27.40	26.65	28.51	33.99	35.00
Union Density	46.34	54.62	45.20	46.36	40.85	41.23
Real Interest Rate	-3.38	-1.74	-1.43	-1.78	-2.96	-3.24
Inflation	12.59	8.38	8.09	8.84	9.58	9.67
Money Reserve	10.94	7.75	6.14	5.19	5.22	5.69
GRM	13.80	16.73	14.19	13.27	13.79	14.68
Top 1%	6.44	6.43	-	-	-	-
Top 5%	17.84	-	17.89	-	-	-
Top 10%	28.23	-	-	28.24	-	-
Top 5-1%	11.41	-	-	-	11.39	-
Top 10-1%	21.80	-	-	-	-	21.80
<i>RMSPE</i>		0.09	0.18	0.48	0.34	0.55

Note: Each column represents the average of the variable for the UK and all the counterfactuals. The average is for the pre-treatment period, 1970-1979. Outcome variables are average for the years 1976 and 1978. Root mean square prediction error (RMSPE) is the average difference between the UK and the counterfactual in the pre-treatment period. RMSPE is calculated for the period 1970-1979.

Figure 1: UK v Counterfactual, income share in %

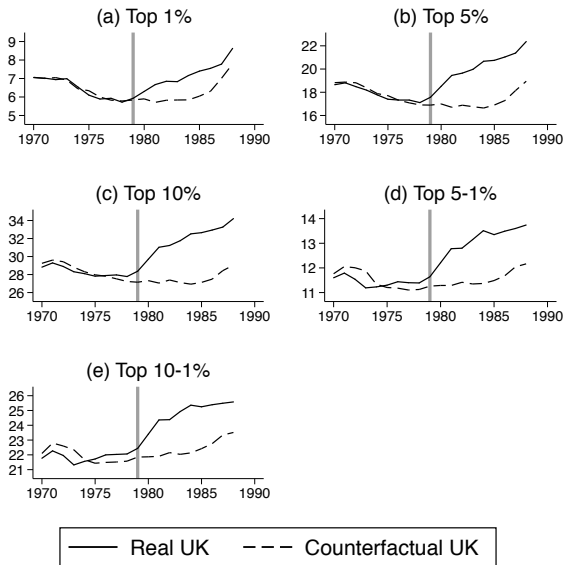


Table 4: Annual Effect for the UK, $\hat{\theta}_{UK,t}$

$\hat{\theta}_{UK,t}$	(1) Top 1%	(2) Top 5%	(3) Top 10%	(4) Top 5-1%	(5) Top 10-1%
1980	9.53	11.25	9.08	8.96	5.22
1981	19.62	19.42	15.68	15.12	9.68
1982	20.88	20.03	15.35	13.93	8.58
1983	19.69	20.49	16.69	17.19	11.40
1984	25.45	25.28	20.39	22.08	13.87
1985	25.54	24.08	20.74	21.16	13.07
1986	23.59	23.96	21.80	22.68	13.06
1987	14.54	21.17	20.19	22.57	12.08
1988	15.10	22.79	22.38	23.77	12.15
<i>p</i> -value	0.086	0.043	0.039	0.043	0.040
<i>N</i>	3,537	3,537	3,159	3,537	3,159
RMSPE	0.092	0.184	0.484	0.344	0.552
RMSPE Pectentile	0.000	0.000	0.000	0.322	0.380

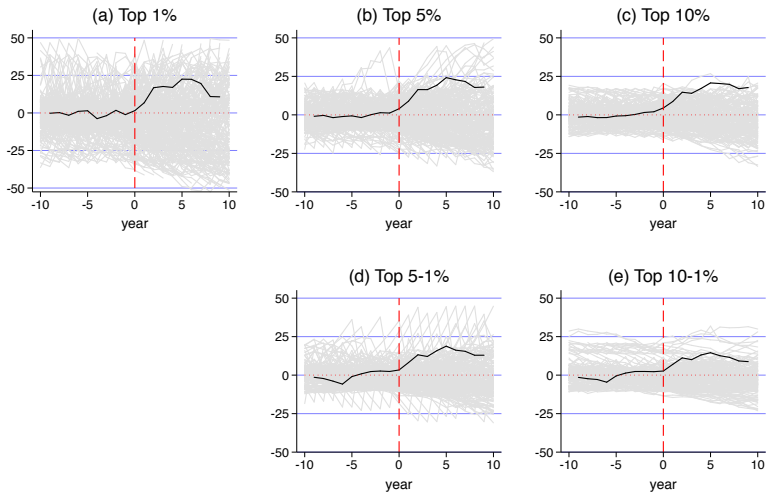
Note: Each column represents $\hat{\theta}_t$ for each year after the tax cut for the UK. $\hat{\theta}_t$ are expressed as the percent increase over the counterfactual. *p*-value is constructed using the permutation test described in Section 3. *N* represents the number of placebos, which are all possible unit-year combinations for years 1973-2000. RMSPE for the UK is calculated for the pre-treatment years, 1970-1979. RMSPE percentile is based on a comparison among all placebo estimates with equal pre-treatment period as the treatment unit.

Table 5: Average 3- and 5-year Effect, $\hat{\theta}'_{UK}$

	(1) Top 1%		(2) Top 5%		(3) Top 10%		(4) Top 5-1%		(5) Top 10-1%	
	3-year	5-year	3-year	5-year	3-year	5-year	3-year	5-year	3-year	5-year
Excluding US										
$\hat{\theta}'_{UK}$	16.680	19.037	16.903	19.295	13.367	15.436	12.669	15.455	7.827	9.749
<i>p</i> -value	0.143	0.140	0.054	0.047	0.061	0.052	0.066	0.054	0.126	0.108
<i>N</i>	258	258	258	258	231	231	258	258	231	231
Including US										
$\hat{\theta}'_{UK}$	14.234	12.954	10.444	10.984	9.600	11.762	11.071	13.661	4.515	5.657
<i>p</i> -value	0.218	0.256	0.182	0.182	0.074	0.058	0.067	0.060	0.066	0.043
<i>N</i>	285	285	285	285	258	258	285	285	258	258

Note: Each column represents 3- or 5-year average effect, $\hat{\theta}'_{UK}$, for each counterfactual. The *p*-value is constructed using the permutation test described in Section 3. *N* represents the number of placebos, which are all possible unit-year combinations for years 1973-2000.
$$\hat{\theta}'_{UK} = \frac{1}{T - (T_0 + 1)} \sum_{t=T_0+1}^T \hat{\theta}_{UK,t}$$

Figure 2: Difference between treatment and control: UK compared to all placebos



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Figure 3: UK-1979 v US-1981, income share in %

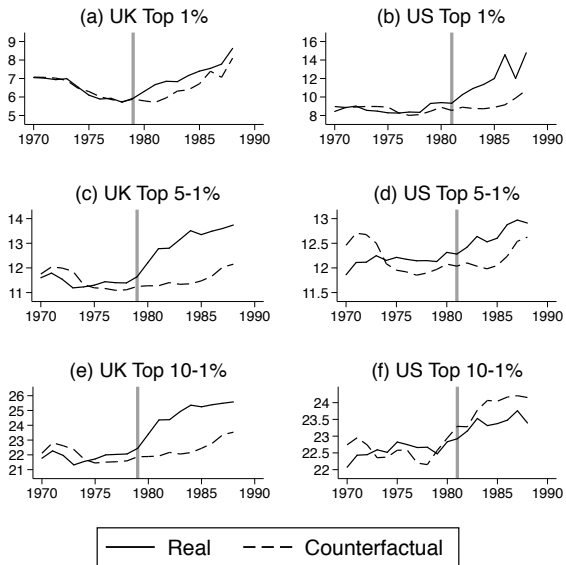
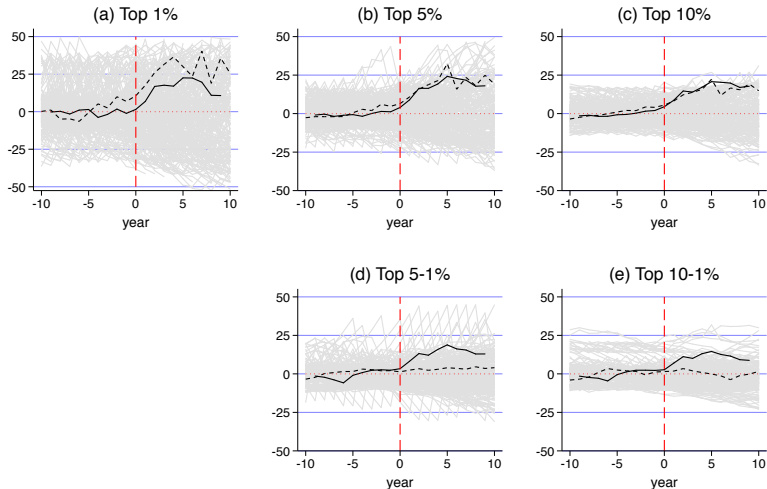


Table 6: Annual Effect: UK (1979) v US (1981), $\hat{\theta}_{UK,t}$

post-intervention period	(1)		(2)		(3)		(4)		(5)	
	Top 1%		Top 5%		Top 10%		Top 5-1%		Top 10-1%	
	UK	US	UK	US	UK	US	UK	US	UK	US
1	9.36	15.32	6.94	10.15	7.04	7.73	7.89	2.62	3.43	-0.54
2	17.46	24.67	13.36	15.17	10.57	11.74	13.24	5.01	5.29	-1.05
3	15.88	30.16	11.03	18.13	11.20	13.38	12.08	4.56	4.83	-3.12
4	9.00	35.08	10.24	20.78	13.82	15.26	15.74	4.59	7.24	-2.78
5	13.06	59.18	13.35	31.77	16.19	21.84	19.35	5.23	7.50	-2.85
6	11.30	21.61	10.82	15.29	16.69	11.46	17.35	3.45	6.70	-1.85
7	3.51	37.62	4.71	22.96	18.85	16.28	17.38	2.26	5.88	-3.15
<i>p</i> -value	0.160	0.043	0.143	0.040	0.065	0.044	0.039	0.159	0.088	0.175
<i>N</i>	3,915	3,884	3,915	3,884	3,537	3,506	3,915	3,884	3,537	3,506
RMSPE	0.092	0.452	0.184	0.709	0.484	0.916	0.344	0.303	0.552	0.554
RMSPE Pectentile	0.000	0.287	0.000	0.187	0.000	0.197	0.322	0.200	0.380	0.385

Note: Each column represents $\hat{\theta}_t$ for each year after the tax cut for the UK (1979) and US (1981). $\hat{\theta}_t$ are expressed as the percent increase over the counterfactual. *p*-value is constructed using the permutation test described in Section 3. *N* represents the number of placebos, which are all possible unit-year combinations for years 1973-2000. RMSPE for the UK is calculated for the pre-treatment years, 1970-1979. RMSPE percentile is based on a comparison among all placebo estimates with equal pre-treatment period as the treatment unit.

Figure 4: Difference between treatment and control: UK-1979 (solid line) and US-1981 (broken line) compared to all placebos



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Conclusion

- I find that the tax cut in 1979 was an important catalyst for the divergence of income in the UK.
- In particular, in the short-run I find a 10% increase in the income share of the top decile compared to its counterfactual.
- Drastic policy changes in a very short time can potentially lead to unwarranted outcomes.
- Drastic policy, especially in a democratic state, has to be influenced by the people.

APPENDIX

Table 7: Counterfactual Weights, including US

	(1) Top 1%	(2) Top 5%	(3) Top 10%	(4) Top 5-1%	(5) Top 10-1%
Australia	0.145	0.276	0.300	0.567	0.528
Canada	0	0	0	0	0
Denmark	0.039	0	0	0	0
Finland	0	0	-	0	-
France	0	0	0	0.072	0
Japan	0.050	0	0	0.360	0.472
New Zealand	0	0	0.144	0	0
Norway	0	0	0.131	0	0
Sweden	0.511	0.299	0.126	0	0
United States	0.254	0.425	0.299	0	0

Note: Each column represents a synthetic control counterfactual. Each entry in a column represents country weights, w_j , for the corresponding synthetic counterfactual, with $\sum_{j=2}^J w_j = 1$. Additionally w_j is bounded from below $w_j \geq 0$. Finland does not have income shares for the Top 10%.

Figure 5: UK v Counterfactual including US, income share in %

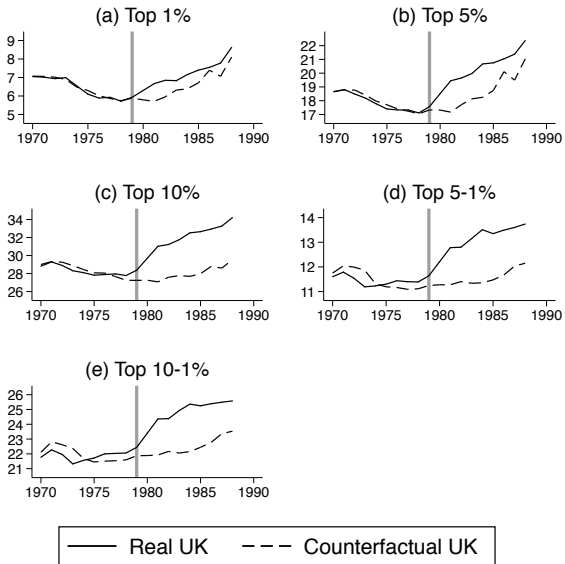
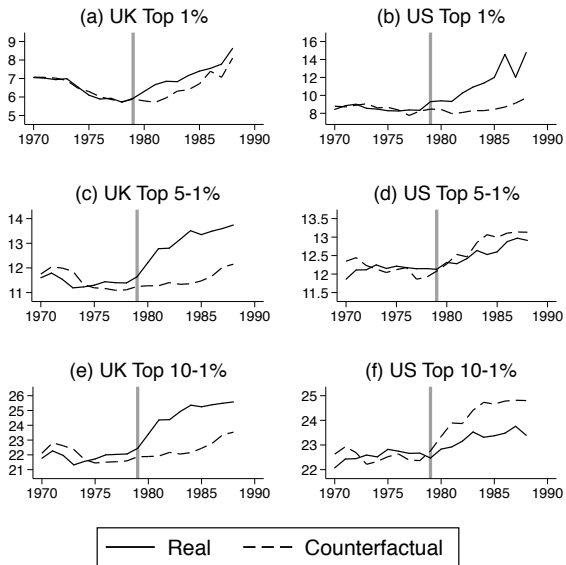


Table 8: Annual Effect for the UK (including US), $\hat{\theta}_{1,t}$

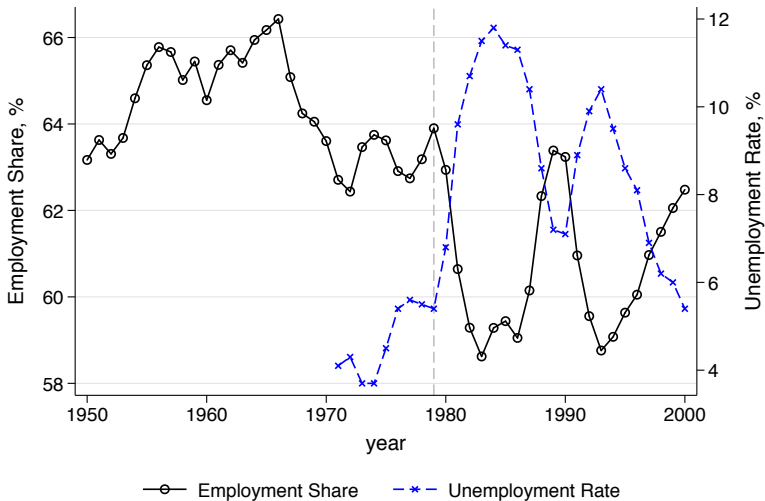
theta	(1) Top 1%	(2) Top 5%	(3) Top 10%	(4) Top 5-1%	(5) Top 10-1%
1980	9.36	6.94	7.04	7.89	3.43
1981	17.46	13.36	10.57	13.24	5.29
1982	15.88	11.03	11.20	12.08	4.83
1983	9.00	10.24	13.82	15.74	7.24
1984	13.06	13.35	16.19	19.35	7.50
1985	11.30	10.82	16.69	17.35	6.70
1986	3.51	4.71	18.85	17.38	5.88
1987	10.79	9.75	14.46	15.52	4.81
1988	7.43	6.41	16.60	15.80	3.99
p-value	0.160	0.143	0.065	0.046	0.088
N	3915	3915	3537	3915	3537
RMSPE	0.092	0.184	0.484	0.344	0.552
RMSPE Pectentile	0.000	0.000	0.000	0.322	0.380

Note: Each column represents $\hat{\theta}_t$ for each year after the tax cut for the UK. $\hat{\theta}_t$ are expressed as the percent increase over the counterfactual. p -value is constructed using the permutation test described in Section 3. N represents the number of placebos, which are all possible unit-year combinations for years 1973-2000. RMSPE for the UK is calculated for the pre-treatment years, 1970-1979. RMSPE percentile is based on a comparison among all placebo estimates with equal pre-treatment period as the treatment unit.

Figure 6: UK-1979 v US-1979, income share in %



Unemployment in the UK



Source: ONS, WID