

UTC2720

Income inequality — A teleological perspective



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Introduction

Income inequality has always been around since the emergence of human civilisation. Though counterintuitive, income inequality is not always a negative social phenomenon. There is a need to incentivise the hard-working individuals and account for different levels of contributions. However, the baseline is that the majority of the society should still be able to enjoy reasonable benefits from the society's growth and receive adequate resources (such as health care, education and opportunities for upward mobility).

In recent decades, income inequality has been increasing in nearly all countries and societies. Yet, people do not realise how extreme it has become. On a moral basis, it raises questions of social justice which is crucial to countries that pride themselves as fair societies. It can also give the privileged excessive control, undermine the fairness of political institutions as well as that of the economic system and neglect the fair share of workers. It becomes a vicious cycle in which economic inequality can undermine the conditions of its own legitimacy. In fact, the society will become a rather unstable one when capitalism ceases to deliver economic gains to the majority, risking the break down of the underlying social contract.

In our report, we will collate data on several countries, namely Norway, USA, Singapore, Malaysia and Denmark, to see how income inequality has evolved in recent decades. We would then compare the existing level of income inequality to that of an ideal society and devise one-class agent-based simulations for the aforementioned countries.

Description of income shares in various countries

1. Norway

General statistics

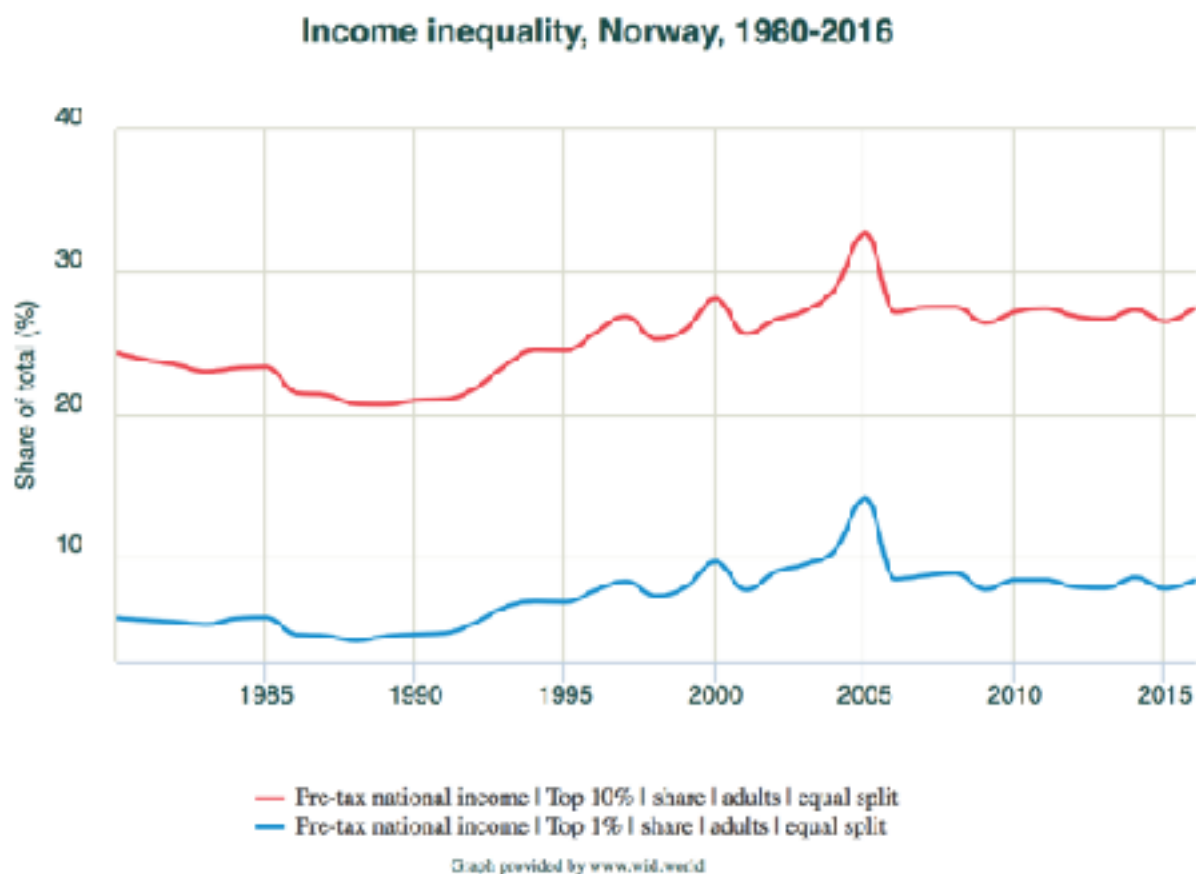


Figure 1. Pre-tax national income share for top 1% and top 10% in Norway

Source: WID.World. See wid.world/country/norway for data series

According to the World Inequality Database (WID), from 1980 to 2016, the pre-tax national income share for the top 10% in Norway averages at 0.252322 and has increased by 1.13 times since 1980. Whilst the pre-tax national income share of the top 1% in Norway averages at 0.072281 and has increased by 1.47 times since 1980.

RANK OVERALL	ECONOMY	OVERALL IDI SCORE	5 YEAR TREND IDI OVERALL (%)
1	Norway	6.08	-0.77
2	Iceland	6.07	12.58
3	Luxembourg	6.07	0.15
4	Switzerland	6.05	1.92
5	Denmark	5.81	4.76

Figure 2. The Inclusive Development Index rankings

Source: World Economic Forum — The Inclusive Development Index 2018
Summary and Data Highlights

According to The Inclusive development Index (IDI) by World Economic Forum in 2018, Norway ranks first in translating economic growth to the highest median income. Like most Nordic countries, it is one of the most equal in terms of income distribution.

Calculations

Next, we will be extracting data from WID and finding:

- 1) Actual income shares of top 1%, top 10%-1%, and bottom 90%
- 2) Maximum, mean and minimum income shares
- 3) Mu (μ) and sigma (σ) using the formulas given:

$$\sigma \approx (\ln(\text{maximum income}) - \ln(\text{minimum income})) / 6$$

$$\mu = \ln(\text{average income}) - (\sigma^2 / 2)$$

- 4) Ideal share of income distribution
- 5) Nonideal inequality coefficient ψ , which is defined as

$$\psi = (\text{actual share} / \text{ideal share}) - 100\%$$

Actual income shares of top 1%, top 10%-1%, and bottom 90% in Norway

	Top 1%	Top10%-1%	Top10%	Bottom 90%
1980	0.0568	0.1863	0.2431	0.7569
1981	0.0554	0.1829	0.2383	0.7617
1982	0.0541	0.1808	0.2349	0.7651
1983	0.0524	0.1779	0.2303	0.7697
1984	0.0565	0.1761	0.2326	0.7674
1985	0.0571	0.1763	0.2334	0.7666
1986	0.0453	0.1699	0.2152	0.7848
1987	0.0444	0.1693	0.2137	0.7863
1988	0.0411	0.1662	0.2073	0.7927
1989	0.0442	0.1628	0.207	0.793
1990	0.0455	0.1645	0.21	0.79
1991	0.0464	0.1644	0.2108	0.7892
1992	0.0539	0.1647	0.2186	0.7814
1993	0.0647	0.17	0.2347	0.7653
1994	0.0685	0.1768	0.2453	0.7547
1995	0.0681	0.1768	0.2449	0.7551
1996	0.0765	0.1811	0.2576	0.7424
1997	0.0826	0.1863	0.2689	0.7311
1998	0.0726	0.1804	0.253	0.747
1999	0.0787	0.1813	0.26	0.74
2000	0.0963	0.1848	0.2811	0.7189
2001	0.0766	0.18	0.2566	0.7434
2002	0.0893	0.1773	0.2666	0.7334
2003	0.0947	0.1783	0.273	0.727
2004	0.1048	0.1839	0.2887	0.7113
2005	0.1409	0.1862	0.3271	0.6729
2006	0.0843	0.1875	0.2718	0.7282
2007	0.0866	0.1887	0.2753	0.7247
2008	0.0884	0.187	0.2754	0.7246
2009	0.077	0.1874	0.2644	0.7356
2010	0.0837	0.1883	0.272	0.728
2011	0.0837	0.1907	0.2744	0.7256
2012	0.0787	0.1902	0.2689	0.7311
2013	0.078	0.189	0.267	0.733
2014	0.0853	0.1881	0.2734	0.7266

Maximum, mean and minimum income shares of Norway

	Maximum Income	Mean Income	Minimum Income
1980	1549835.79117565	33814.5797	14732.3056505743
1981	1596330.86491092	34158.5236	14882.1548193768
1982	1644220.79085824	33638.7853	14655.7157045972
1983	1693547.41458399	34755.3313	15142.1714609858
1984	1744353.83702151	36853.4273	16056.2680379794
1985	1796684.45213216	38969.8865	16978.3650774221
1986	1850584.98569612	39615.4087	17259.6056085482
1987	1906102.535267	39629.6298	17265.8014445972
1988	1963285.61132501	38191.1196	16639.0726153204
1989	2022184.17966476	38196.0935	16641.2396395958
1990	2082849.70505471	38799.7228	16904.2283097535
1991	2145335.19620635	39738.4779	17313.2242868419
1992	2209695.25209254	41330.4524	18006.8143042248
1993	2275986.10965532	42079.7787	18333.2801122152
1994	2344265.69294498	44407.7691	19347.5368744958
1995	2414593.66373332	46404.1451	20217.3161734374
1996	2487031.47364532	48932.4316	21318.8377602996
1997	2561642.41785468	51601.9578	22481.894532542
1998	2638491.69039032	52203.8095	22744.1087395314
1999	2717646.44110203	53311.6336	23226.7645463778
2000	2799175.8343351	55477.6655	24170.4593751411
2001	2883151.10936515	57141.4115	24895.3187350496
2002	2969645.6426461	57593.0301	25092.0795202409
2003	3058735.01192549	58222.6498	25366.3916644792
2004	3150497.06228325	60439.2789	26332.130635801
2005	3245011.97415175	62855.6963	27384.9131938573
2006	3342362.3333763	63402.038	27622.9428540058
2007	3442633.20337759	63881.7049	27831.9236972976
2008	3545912.19947892	63178.9302	27525.7394484988
2009	3652289.56546329	60351.0271	26293.6811710036
2010	3761858.25242718	60480.2961	26350.0009725815
2011	3874714	60271.1818	26258.8942425604
2012	3990955.42	60900.5388	26533.0919338991
2013	4110684.0826	60541.5768	26376.6996928049
2014	4234004.605078	62094.2855	27053.182421783

Determining mu (μ) and sigma (σ)

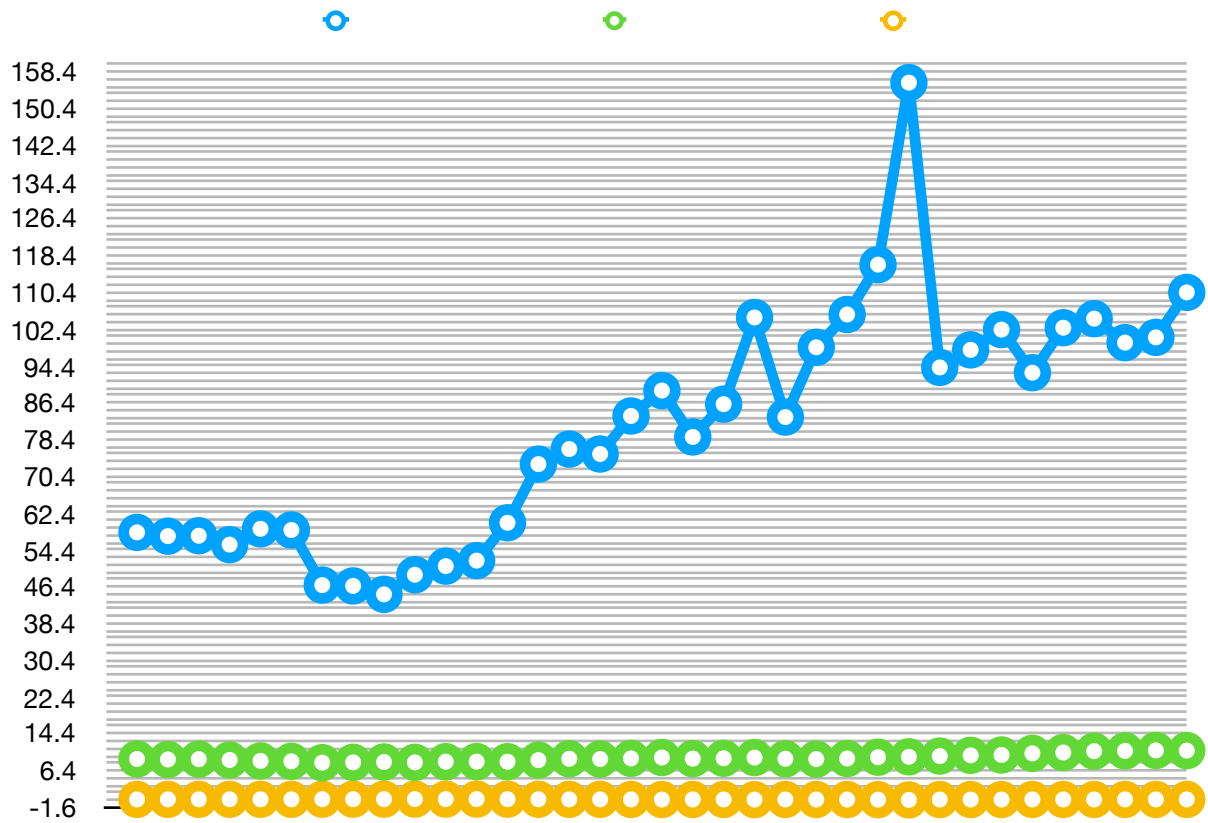
	Maximum Income	Mean Income	Minimum Income	sigma (σ)	mu (μ)
1980	1549835.791175	33814.5797	14732.30565057	0.775976919560	13.95258945226
1981	1596330.864910	34158.5236	14882.15481937	0.779216705552	13.97962900724
1982	1644220.790858	33638.7853	14655.71570459	0.786698576291	14.00332982161
1983	1693547.414583	34755.3313	15142.17146098	0.786182834449	14.03329422423
1984	1744353.837021	36853.4273	16056.26803797	0.781340027798	14.06664863155
1985	1796684.452132	38969.8865	16978.36507742	0.776959730546	14.09962034186
1986	1850584.985696	39615.4087	17259.60560854	0.779148040200	14.12747652128
1987	1906102.535267	39629.6298	17265.80144459	0.784014688143	14.15323164218
1988	1963285.611325	38191.1196	16639.07261532	0.795103496578	14.17403517490
1989	2022184.179664	38196.0935	16641.23963959	0.800008258851	14.19968215516
1990	2082849.705054	38799.7228	16904.22830975	0.802321416510	14.22738773682
1991	2145335.196206	39738.4779	17313.22428684	0.803263411440	14.25619031268
1992	2209695.252092	41330.4524	18006.81430422	0.801643271885	14.28704920132
1993	2275986.109655	42079.7787	18333.28011221	0.803575116445	14.31505748736
1994	2344265.692944	44407.7691	19347.53687449	0.799527062740	14.34786101146
1995	2414593.663733	46404.1451	20217.31617343	0.797124470541	14.37933786496
1996	2487031.473645	48932.4316	21318.83776029	0.793209002539	14.41201011711
1997	2561642.417854	51601.9578	22481.89453254	0.789282267232	14.44467593152
1998	2638491.690390	52203.8095	22744.10873953	0.792276091352	14.47186727998
1999	2717646.441102	53311.6336	23226.76454637	0.793702707956	14.50029479038
2000	2799175.834335	55477.6655	24170.45937514	0.791991517902	14.53121030472
2001	2883151.109365	57141.4115	24895.31873504	0.791993221168	14.56076775799
2002	2969645.642646	57593.0301	25092.07952024	0.795607612176	14.58745745514
2003	3058735.011925	58222.6498	25366.39166447	0.798721929937	14.61453363298
2004	3150497.062283	60439.2789	26332.13063580	0.797420937703	14.64513071995
2005	3245011.974151	62855.6963	27384.91319385	0.795813678462	14.67596989273
2006	3342362.333376	63402.038	27622.94285400	0.799297738527	14.70274996297
2007	3442633.203377	63881.7049	27831.92369729	0.802968037890	14.72936836769
2008	3545912.199478	63178.9302	27525.73944849	0.809738196504	14.75346803143
2009	3652289.565463	60351.0271	26293.68117100	0.822296812911	14.77277878284
2010	3761858.252427	60480.2961	26350.00097258	0.826866669745	14.79856936458
2011	3874714	60271.1818	26258.89424256	0.832370395445	14.82356217398
2012	3990955.42	60900.5388	26533.09193389	0.835565538113	14.85045632959
2013	4110684.0826	60541.5768	26376.69969280	0.841477284007	14.87505800632
2014	4234004.605078	62094.2855	27053.18242178	0.842183148560	14.90402259045

Determining ideal share in Norway

Year	sigma (σ)	Ideal bottom 90%	Ideal top 10-1%	Ideal top 1%
1980	0.77597691956080	0.693422357974172	0.018857673057294	0.000960035841256
1981	0.77921670555249	0.69228400413322	0.018712995700847	0.000949580724619
1982	0.78669857629143	0.68964805156438	0.018382419364092	0.000925834360490
1983	0.78618283444925	0.689830068622922	0.018405049062707	0.000927453575593
1984	0.78134002779845	0.691536932440744	0.018618679124645	0.000942785384977
1985	0.77695973054623	0.693077227091494	0.018813685927070	0.000956853094927
1986	0.77914804020089	0.692308150134606	0.018716052414927	0.000949801225661
1987	0.78401468814323	0.69059474787715	0.018500437657290	0.000934289152896
1988	0.79510349657815	0.686675241830704	0.018016893647728	0.000899809837065
1989	0.80000825885131	0.684934795813792	0.017806411769277	0.000884935389300
1990	0.80232141651015	0.684112545872962	0.017707862148032	0.000877999117916
1991	0.80326341144093	0.683777436766772	0.017667860558759	0.000875188787073
1992	0.80164327188500	0.684353698179117	0.017736706334492	0.000880027416356
1993	0.80357511644569	0.683666516296806	0.017654640759280	0.000874260674665
1994	0.79952706274002	0.68510572998125	0.017826970213420	0.000886384626408
1995	0.79712447054142	0.685958603460709	0.017929915204289	0.000893653304252
1996	0.79320900253906	0.687346390945351	0.018098748956425	0.000905616446722
1997	0.78928226723288	0.68873550947647	0.018269401987208	0.000917761671547
1998	0.79227609135235	0.68767665890242	0.018139171366050	0.000908488448475
1999	0.79370270795615	0.687171549110307	0.018077387539972	0.000904099934787
2000	0.79199151790253	0.687777373221364	0.018151516758803	0.000909366182993
2001	0.79199322116817	0.68777677045479	0.018151442846672	0.000909360927146
2002	0.79560761217690	0.686496548020712	0.017995164599873	0.000898270501278
2003	0.79872192993730	0.685391646748156	0.017861412848393	0.000888814356482
2004	0.79742093770391	0.685853416965658	0.01791718548984	0.000892753434097
2005	0.79581367846246	0.686423491115777	0.017986288777784	0.000897641967385
2006	0.79929773852707	0.685187178337787	0.017836774765695	0.000887076058468
2007	0.80296803789095	0.68388253041741	0.017680395371645	0.000876069107882
2008	0.80973819650425	0.681469996239593	0.017394953776017	0.000856094730057
2009	0.82229681291163	0.676974381879891	0.016875690081708	0.000820147502070
2010	0.82686666974549	0.675332025635243	0.016689998852357	0.000807415385421
2011	0.83237039544595	0.673349515092719	0.016468643614667	0.000792322984942
2012	0.83556553811355	0.672196330498048	0.016341274414390	0.000783680810677
2013	0.84147728400769	0.670058345835423	0.016107797931385	0.000767919278787
2014	0.84218314856008	0.669802696330622	0.016080109454630	0.000766056985245

Nonideal inequality coefficient — Norway

	Top 1%	Ideal top	Top 1%	Top10%	Ideal top	10-1% ψ	Bottom 5%	Ideal bot	Bottom 5%
1980	0.0568	0.00096	58.1644	0.1863	0.01885	8.87926	0.7569	0.69342	0.09154
1981	0.0554	0.00094	57.3415	0.1829	0.01871	8.77395	0.7617	0.69228	0.10027
1982	0.0541	0.00092	57.4337	0.1808	0.01838	8.83548	0.7651	0.68964	0.10940
1983	0.0524	0.00092	55.4987	0.1779	0.01840	8.66582	0.7697	0.68983	0.11578
1984	0.0565	0.00094	58.9288	0.1761	0.01861	8.45824	0.7674	0.69153	0.10970
1985	0.0571	0.00095	58.6747	0.1763	0.01881	8.37083	0.7666	0.69307	0.10608
1986	0.0453	0.00094	46.6941	0.1699	0.01871	8.07776	0.7848	0.69230	0.13359
1987	0.0444	0.00093	46.5227	0.1693	0.01850	8.15113	0.7863	0.69059	0.13858
1988	0.0411	0.00089	44.6763	0.1662	0.01801	8.22467	0.7927	0.68667	0.15440
1989	0.0442	0.00088	48.9471	0.1628	0.01780	8.14277	0.793	0.68493	0.15777
1990	0.0455	0.00087	50.8223	0.1645	0.01770	8.28965	0.79	0.68411	0.15478
1991	0.0464	0.00087	52.0171	0.1644	0.01766	8.30503	0.7892	0.68377	0.15417
1992	0.0539	0.00088	60.2480	0.1647	0.01773	8.28582	0.7814	0.68435	0.14180
1993	0.0647	0.00087	73.0053	0.17	0.01765	8.62919	0.7653	0.68366	0.11940
1994	0.0685	0.00088	76.2802	0.1768	0.01782	8.91755	0.7547	0.68510	0.10158
1995	0.0681	0.00089	75.2040	0.1768	0.01792	8.86061	0.7551	0.68595	0.10079
1996	0.0765	0.00090	83.4728	0.1811	0.01809	9.00621	0.7424	0.68734	0.08009
1997	0.0826	0.00091	89.0015	0.1863	0.01826	9.19737	0.7311	0.68873	0.06151
1998	0.0726	0.00090	78.9129	0.1804	0.01813	8.94532	0.747	0.68767	0.08626
1999	0.0787	0.00090	86.0478	0.1813	0.01807	9.02910	0.74	0.68717	0.07687
2000	0.0963	0.00090	104.897	0.1848	0.01815	9.18096	0.7189	0.68777	0.04525
2001	0.0766	0.00090	83.2349	0.18	0.01815	8.91656	0.7434	0.68777	0.08087
2002	0.0893	0.00089	98.4132	0.1773	0.01799	8.85264	0.7334	0.68649	0.06832
2003	0.0947	0.00088	105.546	0.1783	0.01786	8.98241	0.727	0.68539	0.06070
2004	0.1048	0.00089	116.389	0.1839	0.01791	9.26388	0.7113	0.68585	0.03710
2005	0.1409	0.00089	155.966	0.1862	0.01798	9.35233	0.6729	0.68642	-0.01970
2006	0.0843	0.00088	94.0313	0.1875	0.01783	9.51199	0.7282	0.68518	0.06277
2007	0.0866	0.00087	97.8506	0.1887	0.01768	9.67283	0.7247	0.68388	0.05968
2008	0.0884	0.00085	102.259	0.187	0.01739	9.75024	0.7246	0.68146	0.06328
2009	0.077	0.00082	92.8855	0.1874	0.01687	10.1047	0.7356	0.67697	0.08659
2010	0.0837	0.00080	102.664	0.1883	0.01668	10.2822	0.728	0.67533	0.07798
2011	0.0837	0.00079	104.638	0.1907	0.01646	10.5795	0.7256	0.67334	0.07759
2012	0.0787	0.00078	99.4235	0.1902	0.01634	10.6392	0.7311	0.67219	0.08762
2013	0.078	0.00076	100.573	0.189	0.01610	10.7334	0.733	0.67005	0.09393
2014	0.0853	0.00076	110.349	0.1881	0.01608	10.6976	0.7266	0.66980	0.08479



Blue — Top 1 %
 Green — Top 10-1%
 Yellow — Bottom 90%

2. United States of America (USA)

General Statistics

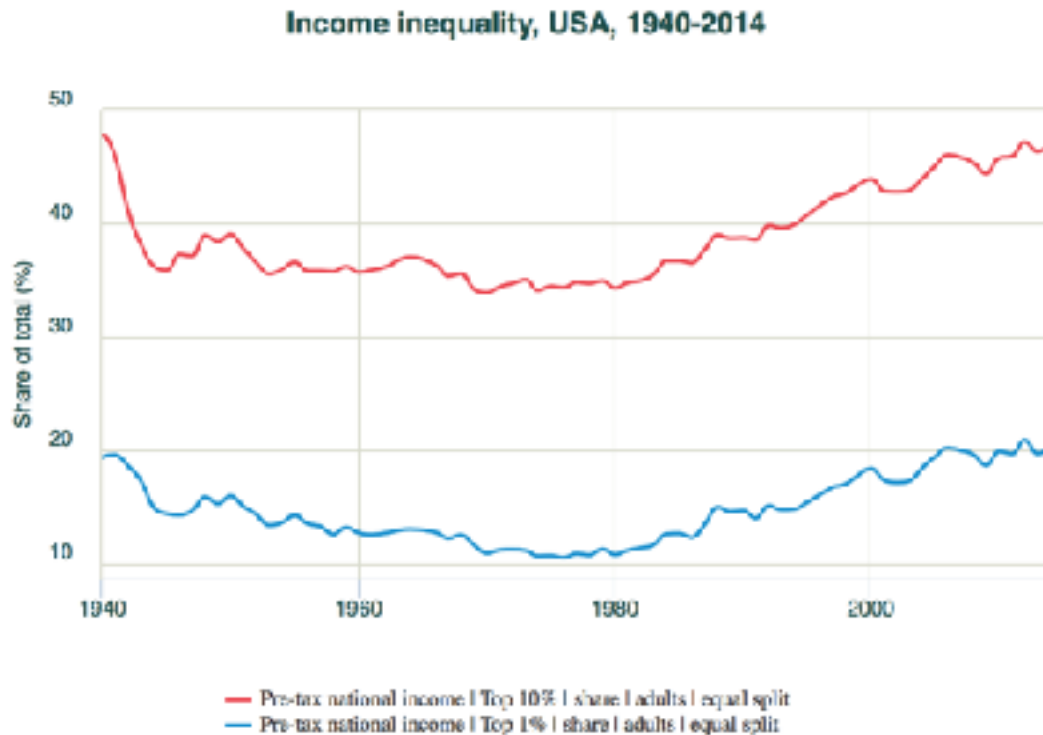


Figure 3. Pre-tax national income share for top 1% and top 10% in USA

Source: WID.World. See wid.world/country/usa for data series

Income inequality has increased in the United States over the past decades, as income has flowed unequally to those at the very top of the income spectrum. In 2012, the top 10 percent of earners took home 50 percent of all income. The top 1 percent took home 20 percent of the income, according to a study by economists Emmanuel Saez and Thomas Piketty. By 2015, America's top 10 percent already averaged more than nine times as much income as the bottom 90 percent.

According to analysts, this phenomenon is attributed to technology (skills are not supplied to keep up with demand), trade (globalisation resulting

in job losses) and institutions (policies such as deregulation, tax changes, federal monetary policies reduced wages and employment).

Also, since the rich got richer faster, their piece of the pie grew larger while everyone else's share of the pie shrank. Even though the income going to the poor improved, they fell further behind when compared to the richest. As a result, economic mobility decreases, making it tougher to eradicate this problem of extreme income inequality.

It is crucial for USA to acknowledge the fact that there is an underlying shift in the global economy and that there is a need to be more sophisticated in managing the economy. Instead of trying to prevent companies from outsourcing or using protectionist trade policies or walls, the government should target their policies to benefit the poor, in terms of education, skills, taxations etcetera.

Calculations

Next, we will be extracting data from WID and finding:

- 1) Actual income shares of top 1%, top 10%-1%, and bottom 90%
- 2) Maximum, mean and minimum income shares
- 3) Mu (μ) and sigma (σ) using the formulas given:

$$\sigma \approx (\ln(\text{maximum income}) - \ln(\text{minimum income})) / 6$$

$$\mu = \ln(\text{average income}) - (\sigma^2 / 2)$$

- 4) Ideal share of income distribution
- 5) Nonideal inequality coefficient ψ , which is defined as
 $\psi = (\text{actual share} / \text{ideal share}) - 100\%$

Maximum, mean and minimum income shares of USA

	Maximum Income	Mean Income	Minimum Income
1980	536998.483224543	31813.8667	13860.636811376
1981	553108.437721279	32057.3256	13966.706765815
1982	569701.690852918	31006.4287	13508.8529502302
1983	586792.741578505	31512.1616	13729.1902049426
1984	604396.523825861	33613.8961	14644.8720003415
1985	622528.419540636	34214.9896	14906.7558754374
1986	641204.272126856	34537.4439	15047.2424746525
1987	660440.400290661	35614.3048	15516.4082623897
1988	680253.612299381	37114.486	16170.0058574426
1989	700661.220668363	37564.4348	16366.0391456727
1990	721681.057288414	37545.0352	16357.5871454043
1991	743331.489007066	36788.7628	16028.0950668175
1992	765631.433677278	37511.0889	16342.797451972
1993	788600.376687596	37820.3462	16477.5343941044
1994	812258.387988224	39051.2113	17013.7965930938
1995	836626.139627871	39917.3553	17391.1574314842
1996	861724.923816707	41178.5331	17940.6262403282
1997	887576.671531208	42679.2275	18594.4474258953
1998	914203.971677145	44314.4701	19306.8884501449
1999	941630.090827459	45647.4945	19887.659321015
2000	969878.993552283	47151.8049	20543.0559222076
2001	998975.363358851	46934.2655	20448.278552201
2002	1028944.62425962	46823.8955	20400.192649934
2003	1059812.96298741	47336.2759	20623.4260814637
2004	1091607.35187703	48659.9417	21200.1196059085
2005	1124355.57243334	49784.2129	21689.9410704804
2006	1158086.23960634	51031.3156	22233.277652424
2007	1192828.82679453	50380.937	21949.9212893167
2008	1228613.69159836	49262.195	21462.5087816245
2009	1265472.10234632	47012.6707	20482.4380591724
2010	1303436.26541671	48086.8382	20950.4303888216
2011	1342539.35337921	48861.7508	21288.0436129683
2012	1382815.53398058	50023.9906	21794.4072030165
2013	1424300	50094.7487	21825.2350283422
2014	1467029	51164.7515	22291.4128852436

Actual income shares of top 1%, top 10%-1%, and bottom 90% in USA

	Top 1%	Top10%-1%	Top10%	Bottom 90%
1980	0.10671	0.2357199993	0.3424299993	0.6575700007
1981	0.1105199998	0.2367099971	0.3472299969	0.6527700031
1982	0.1126399995	0.2363400013	0.3489800008	0.6510199992
1983	0.1151400001	0.2390699964	0.3542099965	0.6457900035
1984	0.1249600011	0.2416400015	0.3666000026	0.6333999974
1985	0.1255300009	0.2410400007	0.3665700016	0.6334299984
1986	0.1220899987	0.242639998	0.3647299967	0.6352700033
1987	0.1330699984	0.2430500034	0.3761200018	0.6238799982
1988	0.1487599999	0.2407300044	0.3894900043	0.6105099957
1989	0.1446499996	0.24206	0.3867099996	0.6132900004
1990	0.1454200004	0.2417099997	0.3871300001	0.6128699999
1991	0.1389100003	0.2466499973	0.3855599976	0.6144400024
1992	0.1501299998	0.2476200015	0.3977500013	0.6022499987
1993	0.1464400007	0.2491499968	0.3955899975	0.6044100025
1994	0.1468700011	0.2517200001	0.3985900012	0.6014099988
1995	0.1528299991	0.2537399977	0.4065699968	0.5934300032
1996	0.1596699988	0.2558200005	0.4154899993	0.5845100007
1997	0.166290001	0.2564000003	0.4226900013	0.5773099987
1998	0.1692299992	0.2570900023	0.4263200015	0.5736799985
1999	0.1770900016	0.2564200014	0.4335100003	0.5664899997
2000	0.1826599991	0.2561900001	0.4388499992	0.5611500008
2001	0.1726799998	0.255309999	0.4279899988	0.5720100012
2002	0.1705800006	0.2566700019	0.4272500025	0.5727499975
2003	0.1720200013	0.2566299998	0.4286500011	0.5713499989
2004	0.1832199997	0.25581	0.4390299997	0.5609700003
2005	0.1937199999	0.2568900007	0.4506100006	0.5493899994
2006	0.2010000019	0.2592900004	0.4602900023	0.5397099977
2007	0.1986700007	0.2592799998	0.4579500005	0.5420499995
2008	0.195199999	0.2578600049	0.4530600039	0.5469399961
2009	0.1854099992	0.2579899971	0.4433999963	0.5566000037
2010	0.197999999	0.2595099975	0.4575099965	0.5424900035
2011	0.1959999999	0.2632400021	0.459240002	0.540759998
2012	0.2077899998	0.2636500001	0.4714399999	0.5285600001
2013	0.1959200016	0.267239999	0.4631600006	0.5368399994
2014	0.2019999978	0.2681699973	0.4701699951	0.5298300049

Determining mu (μ) and sigma (σ) in USA

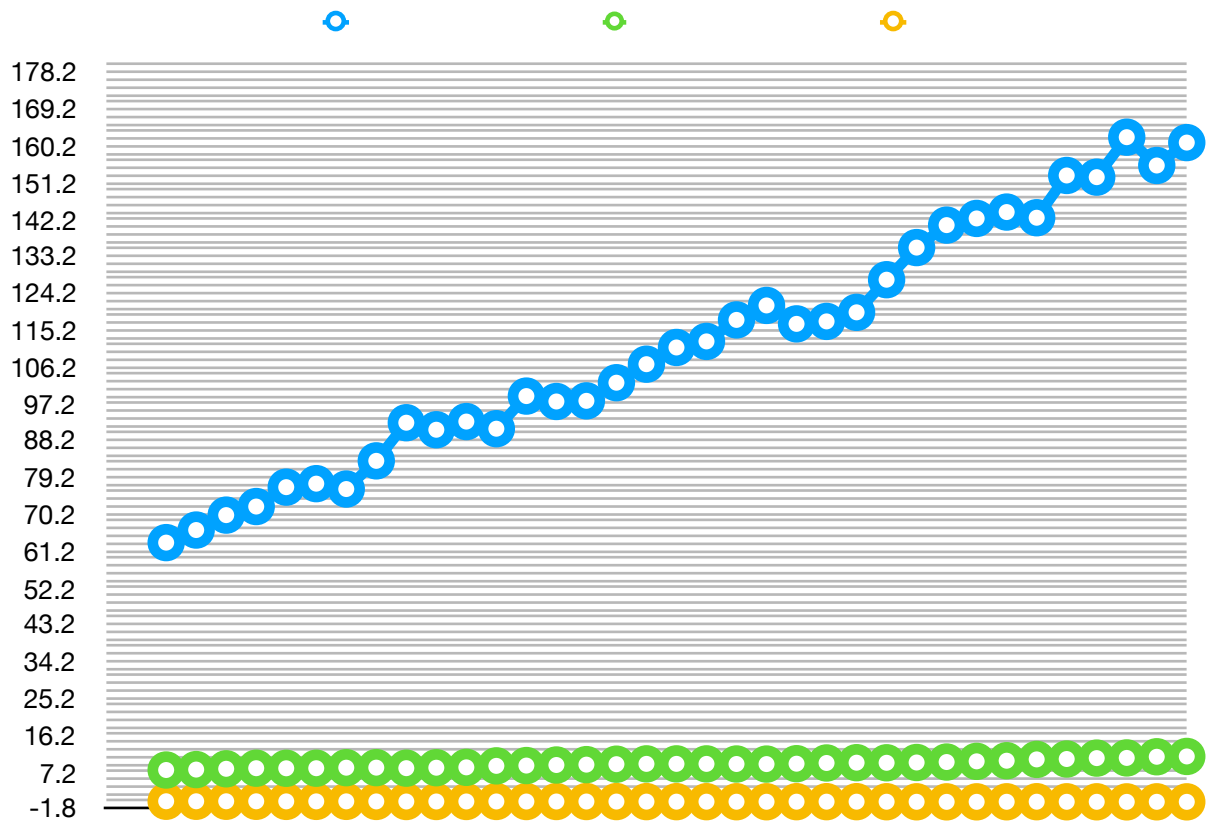
	Maximum Income	Mean Income	Minimum Income	sigma (σ)	mu (μ)
1980	536998.4832245	31813.8667	13860.63681137	0.609490388546	10.18191826660
1981	553108.4377212	32057.3256	13966.70676581	0.613146277149	10.18730682550
1982	569701.6908529	31006.4287	13508.85295023	0.623627938307	10.14749393666
1983	586792.7415785	31512.1616	13729.19020494	0.625857906438	10.16227977331
1984	604396.5238258	33613.8961	14644.87200034	0.620023373142	10.23048034323
1985	622528.4195406	34214.9896	14906.75587543	0.621995792754	10.24697973632
1986	641204.2721268	34537.4439	15047.24247465	0.625358888881	10.25426247495
1987	660440.4002906	35614.3048	15516.40826238	0.625168137346	10.28508505637
1988	680253.6122993	37114.486	16170.00585744	0.623217942011	10.32756232898
1989	700661.2206683	37564.4348	16366.03914567	0.626136014358	10.33778984453
1990	721681.0572884	37545.0352	16357.58714540	0.631148576181	10.33412216746
1991	743331.4890070	36788.7628	16028.09506681	0.639466495095	10.30848901965
1992	765631.4336772	37511.0889	16342.79745197	0.641152269899	10.32685375564
1993	788600.3766875	37820.3462	16477.53439410	0.644710299638	10.33277681082
1994	812258.3879882	39051.2113	17013.79659309	0.644298987022	10.36506858165
1995	836626.1396278	39917.3553	17391.15743148	0.645569236689	10.38618665855
1996	861724.9238167	41178.5331	17940.62624032	0.645311390387	10.41745896300
1997	887576.6715312	42679.2275	18594.44742589	0.644271982902	10.45392441146
1998	914203.9716771	44314.4701	19306.88845014	0.642931960595	10.49238578854
1999	941630.0908274	45647.4945	19887.65932101	0.642918851302	10.52203167484
2000	969878.9935522	47151.8049	20543.05592220	0.642441390381	10.55476209724
2001	998975.3633588	46934.2655	20448.27855220	0.648138569412	10.54646149276
2002	1028944.624259	46823.8955	20400.19264993	0.653457429142	10.54064563335
2003	1059812.962987	47336.2759	20623.42608146	0.656570017236	10.54949011911
2004	1091607.351877	48659.9417	21200.11960590	0.656899950052	10.57685264603
2005	1124355.572433	49784.2129	21689.94107048	0.658019453011	10.59895840244
2006	1158086.239606	51031.3156	22233.27765242	0.658822328064	10.62317132466
2007	1192828.826794	50380.937	21949.92128931	0.665886562814	10.60566569111
2008	1228613.691598	49262.195	21462.50878162	0.674555682891	10.57739954550
2009	1265472.102346	47012.6707	20482.43805917	0.687272116005	10.52200095300
2010	1303436.265416	48086.8382	20950.43038882	0.688433357906	10.54379354041
2011	1342539.353379	48861.7508	21288.04361296	0.690695426178	10.55822009128
2012	1382815.533980	50023.9906	21794.40720301	0.691703925856	10.58103082081
2013	1424300	50094.7487	21825.23502834	0.696394812250	10.57918859794
2014	1467029	51164.7515	22291.41288524	0.697798835714	10.59934451911

Determining ideal share in USA

Year	sigma (σ)	Ideal bottom 90%	Ideal top 10-1%	Ideal top 1%
1980	0.60949038854609	0.749227624670567	0.027646133446870	0.001663238561508
1981	0.61314627714908	0.748062539665074	0.027422479484850	0.001643742376481
1982	0.62362793830717	0.744706396231867	0.026789376724538	0.001588994040211
1983	0.62585790643812	0.74398937523435	0.026656228937524	0.001577562946134
1984	0.62002337314254	0.74586317956709	0.027005742217615	0.001607631219506
1985	0.62199579275471	0.74523052800381	0.026887171731300	0.001597408414385
1986	0.62535888888119	0.744149919872065	0.026685977634554	0.001580114442280
1987	0.62516813734682	0.744211274841917	0.026697356327060	0.001581090755621
1988	0.62321794201193	0.744838111553938	0.026813915676148	0.001591103930006
1989	0.62613601435851	0.743899879157881	0.026639661370929	0.001576142599824
1990	0.63114857618118	0.742284026571197	0.026342483923565	0.001550741600510
1991	0.63946649509565	0.739591025509946	0.025855302101945	0.001509413202807
1992	0.64115226989978	0.73904347966682	0.025757466737221	0.001501160710000
1993	0.64471029963825	0.737885878192033	0.025551964470240	0.001483877794765
1994	0.64429898702259	0.738019832749555	0.025575652176460	0.001485866398456
1995	0.64556923668987	0.737606030052038	0.025502555572034	0.001479732856304
1996	0.64531139038754	0.737690054380604	0.025517379546190	0.001480976023922
1997	0.64427198290229	0.738028626109598	0.025577207984337	0.001485997042307
1998	0.64293196059501	0.738464787841958	0.025654508707368	0.001492493145892
1999	0.64291885130230	0.738469052922763	0.025655265872267	0.001492556824341
2000	0.64244139038186	0.738624369491695	0.025682855426530	0.001494877782821
2001	0.64813856941214	0.736768009819367	0.025355224392359	0.001467397116519
2002	0.65345742914229	0.735028862980887	0.025052437738650	0.001442158223381
2003	0.65657001723632	0.734008415791357	0.024876622543815	0.001427572896603
2004	0.65689995005274	0.733900132308378	0.024858045512925	0.001426034779694
2005	0.65801945301186	0.733532546719354	0.024795095890927	0.001420827028475
2006	0.65882232806468	0.733268766927669	0.024750030591541	0.001417102879019
2007	0.66588656281410	0.730942180030862	0.024356397833424	0.001384717496740
2008	0.67455568289133	0.728073177710635	0.023880361706008	0.001345899027260
2009	0.68727211600507	0.723837389369589	0.023195916258790	0.001290754673704
2010	0.68843335790660	0.723448976994719	0.023134225872238	0.001285823364184
2011	0.69069542617879	0.722691591957395	0.023014442074925	0.001276266739168
2012	0.69170392585649	0.722353599763489	0.022961203473688	0.001272027074240
2013	0.69639481225095	0.720778839554775	0.022714902409765	0.001252475691713
2014	0.69779883571433	0.720306657303565	0.022641606843854	0.001246677474399

Nonideal inequality coefficient-USA

	Top 1%	Ideal top	Top 1%	Top10%	Ideal top	10-1% ψ	Bottom 5%	Ideal bot	Bottom 5%
1980	0.10671	0.00166	63.1579	0.23571	0.02764	7.52632	0.65757	0.74922	-0.12233
1981	0.11051	0.00164	66.2368	0.23670	0.02742	7.63196	0.65277	0.74806	-0.12738
1982	0.11263	0.00158	69.8876	0.23634	0.02678	7.82215	0.65101	0.74470	-0.12580
1983	0.11514	0.00157	71.9859	0.23906	0.02665	7.96863	0.64579	0.74398	-0.13199
1984	0.12496	0.00160	76.7292	0.24164	0.02700	7.94772	0.63339	0.74586	-0.15078
1985	0.12553	0.00159	77.5835	0.24104	0.02688	7.96487	0.63342	0.74523	-0.15002
1986	0.12208	0.00158	76.2665	0.24263	0.02668	8.09241	0.63527	0.74414	-0.14637
1987	0.13306	0.00158	83.1634	0.24305	0.02669	8.10389	0.62387	0.74421	-0.16168
1988	0.14875	0.00159	92.4948	0.24073	0.02681	7.97780	0.61050	0.74483	-0.18034
1989	0.14464	0.00157	90.7746	0.24206	0.02663	8.08645	0.61329	0.74389	-0.17557
1990	0.14542	0.00155	92.7744	0.24170	0.02634	8.17567	0.61286	0.74228	-0.17434
1991	0.13891	0.00150	91.0291	0.24664	0.02585	8.53962	0.61444	0.73959	-0.16927
1992	0.15012	0.00150	99.0092	0.24762	0.02575	8.61352	0.60224	0.73904	-0.18509
1993	0.14644	0.00148	97.6873	0.24914	0.02555	8.75071	0.60441	0.73788	-0.18088
1994	0.14687	0.00148	97.8446	0.25172	0.02557	8.84217	0.60140	0.73801	-0.18510
1995	0.15282	0.00147	102.282	0.25373	0.02550	8.94959	0.59343	0.73760	-0.19546
1996	0.15966	0.00148	106.814	0.25582	0.02551	9.02532	0.58451	0.73769	-0.20764
1997	0.16629	0.00148	110.904	0.25640	0.02557	9.02455	0.57730	0.73802	-0.21776
1998	0.16922	0.00149	112.387	0.25709	0.02565	9.02124	0.57367	0.73846	-0.22314
1999	0.17709	0.00149	117.648	0.25642	0.02565	8.99482	0.56648	0.73846	-0.23288
2000	0.18265	0.00149	121.190	0.25619	0.02568	8.97513	0.56115	0.73862	-0.24027
2001	0.17267	0.00146	116.677	0.25530	0.02535	9.06932	0.57201	0.73676	-0.22362
2002	0.17058	0.00144	117.281	0.25667	0.02505	9.24531	0.57274	0.73502	-0.22077
2003	0.17202	0.00142	119.498	0.25662	0.02487	9.31611	0.57134	0.73400	-0.22160
2004	0.18321	0.00142	127.482	0.25581	0.02485	9.29083	0.56097	0.73390	-0.23563
2005	0.19371	0.00142	135.343	0.25689	0.02479	9.36051	0.54938	0.73353	-0.25103
2006	0.20100	0.00141	140.838	0.25929	0.02475	9.47635	0.53970	0.73326	-0.26396
2007	0.19867	0.00138	142.473	0.25927	0.02435	9.64525	0.54204	0.73094	-0.25842
2008	0.19519	0.00134	144.033	0.25786	0.02388	9.79799	0.54693	0.72807	-0.24878
2009	0.18540	0.00129	142.644	0.25798	0.02319	10.1222	0.55660	0.72383	-0.23104
2010	0.19799	0.00128	152.986	0.25950	0.02313	10.2175	0.54249	0.72344	-0.25013
2011	0.19599	0.00127	152.572	0.26324	0.02301	10.4380	0.54075	0.72269	-0.25174
2012	0.20778	0.00127	162.353	0.26365	0.02296	10.4824	0.52856	0.72235	-0.26828
2013	0.19592	0.00125	155.426	0.26723	0.02271	10.7649	0.53683	0.72077	-0.25519
2014	0.20199	0.00124	161.030	0.26816	0.02264	10.8441	0.52983	0.72030	-0.26443



Blue — Top 1 %
 Green — Top 10-1%
 Yellow — Bottom 90%

3. Singapore

General Statistics

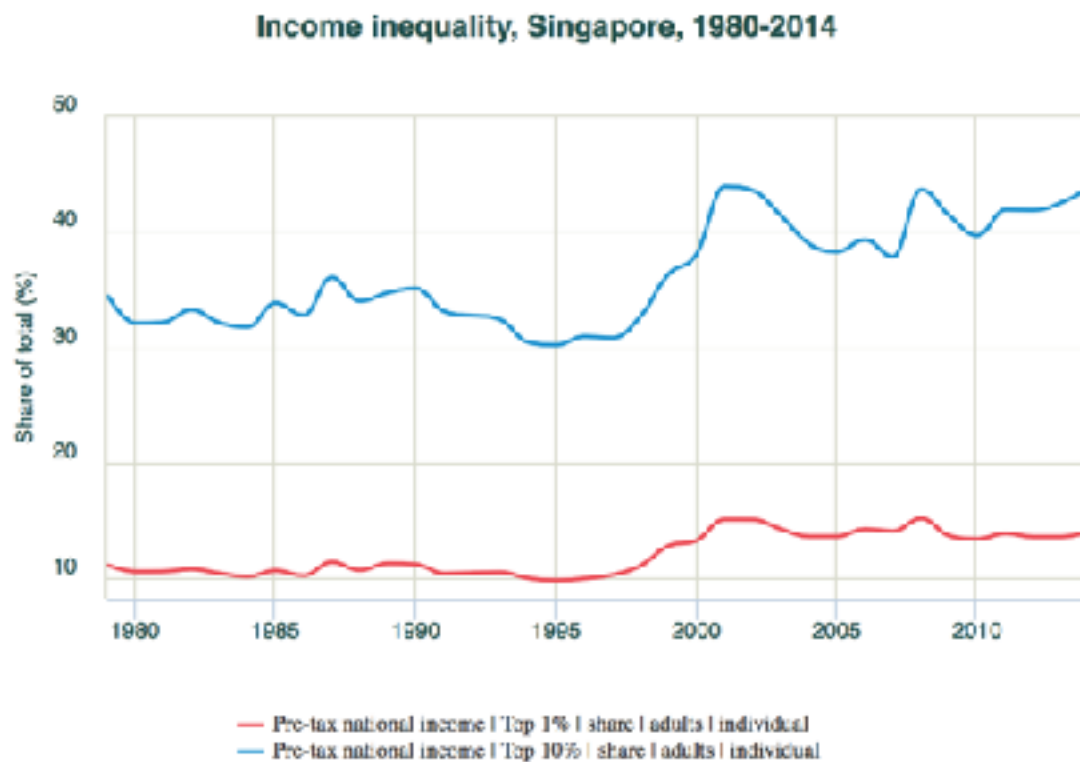


Figure 4. Pre-tax national income share for top 1% and top 10% in Singapore
Source: WID.World. See wid.world/country/singapore for data series

Singapore has a similar level of income inequality as most rich nations, judging by its Gini coefficient. Based on the graph above, it has been on an increasing trend, where the privileged holds onto a larger share of the income pie. While the country has less income inequality than the United States, China and India, it is significantly more unequal compared to South Korea and Japan. In recent years, the government has been doing more to mitigate the problem through government transfers and taxes, education and policies such as SkillsFuture movement and Silver Support Scheme. As a result, Singapore's 90/10 income inequality ratio declined significantly when accounting in government transfers and taxes. This would imply that the government has been effective in reducing income inequality.

Gini Coefficients by Country

Coefficient of 0 indicates perfect income equality, while 1 indicates perfect inequality



However, when we compare the Gini coefficients from other rich nations such as the United States, U.K., Australia and Japan after accounting taxes and transfers to that of Singapore's, Singapore's Gini coefficient decreased by a smaller extent. This suggests that the Singapore government can do more to contain income inequality through taxation and redistribution.

Calculations

Next, we will be extracting data from WID and finding:

- 1) Actual income shares of top 1%, top 10%-1%, and bottom 90%
- 2) Maximum, mean and minimum income shares
- 3) Mu (μ) and sigma (σ) using the formulas given:

$$\sigma \approx (\ln(\text{maximum income}) - \ln(\text{minimum income})) / 6$$

$$\mu = \ln(\text{average income}) - (\sigma^2 / 2)$$

- 4) Ideal share of income distribution
- 5) Nonideal inequality coefficient ψ , which is defined as

$$\psi = (\text{actual share} / \text{ideal share}) - 100\%$$

Actual income shares of top 1%, top 10%-1%, and bottom 90% in Singapore

	Top 1%	Top10%-1%	Top10%	Bottom 90%
1980	0.1058814079	0.2147954255	0.3206768334	0.6793231666
1981	0.1060298309	0.2153507247	0.3213805556	0.6786194444
1982	0.107911706	0.2243094742	0.3322211802	0.6677788198
1983	0.1044692546	0.2167704851	0.3212397397	0.6787602603
1984	0.1016516909	0.2157593444	0.3174110353	0.6825889647
1985	0.1067237705	0.2312263399	0.3379501104	0.6620498896
1986	0.1026351452	0.2249417901	0.3275769353	0.6724230647
1987	0.1140905097	0.245999895	0.3600904047	0.6399095953
1988	0.1071810648	0.2323607877	0.3395418525	0.6604581475
1989	0.1130055711	0.2337101474	0.3467157185	0.6532842815
1990	0.1122321337	0.2381757051	0.3504078388	0.6495921612
1991	0.1042998508	0.2266299054	0.3309297562	0.6690702438
1992		0		1
1993	0.1053111181	0.2184252515	0.3237363696	0.6762636304
1994	0.1002397388	0.2038952559	0.3041349947	0.6958650053
1995	0.0983611271	0.2033918872	0.3017530143	0.6982469857
1996	0.0998667926	0.2092751413	0.3091419339	0.6908580661
1997	0.1031218842	0.2047299966	0.3078518808	0.6921481192
1998	0.1110216156	0.2154078707	0.3264294863	0.6735705137
1999	0.1278095692	0.2349876911	0.3627972603	0.6372027397
2000	0.1326229423	0.2479600162	0.3805829585	0.6194170415
2001	0.1506715417	0.28803882	0.4387103617	0.5612896383
2002	0.1506433785	0.284704119	0.4353474975	0.5646525025
2003	0.142432332	0.2711623907	0.4135947227	0.5864052773
2004	0.1360050142	0.253219068	0.3892240822	0.6107759178
2005	0.1359627843	0.2465380132	0.3825007975	0.6174992025
2006	0.142273277	0.2501086891	0.3923819661	0.6076180339
2007	0.1405740827	0.237612024	0.3781861067	0.6218138933
2008	0.1515111625	0.2844428718	0.4359540343	0.5640459657
2009	0.1366150975	0.2768383026	0.4134534001	0.5865465999
2010	0.133937642	0.262251541	0.396189183	0.603810817
2011	0.138500005	0.2800000012	0.4185000062	0.5814999938
2012	0.1357000023	0.2823999971	0.4180999994	0.5819000006
2013	0.1357477605	0.2891794741	0.4249272346	0.5750727654
2014	0.1402371079	0.2973232418	0.4375603497	0.5624396503

Maximum, mean and minimum income shares of Singapore

	Maximum Income	Mean Income	Minimum Income
1980	439253.879691166	23358.0334	10176.6069694819
1981	452431.496081901	24781.266	10796.6796677406
1982	466004.440964358	25770.1279	11227.5061303569
1983	479984.574193289	27567.8152	12010.7209153023
1984	494384.111419088	29692.2921	12936.3110990651
1985	509215.63476166	28667.0237	12489.6230852947
1986	524492.10380451	27695.6696	12066.4244052254
1987	540226.866918645	29236.121	12737.5668847711
1988	556433.672926205	31952.3821	13920.9850761841
1989	573126.683113991	34501.7565	15031.6942203391
1990	590320.483607411	36699.5117	15989.2102278955
1991	608030.098115633	37257.7929	16232.4416786584
1992	626271.001059102	38950.1639	16969.7723528045
1993	645059.131090875	40853.8079	17799.1502574449
1994	664410.905023601	45081.317	19640.9876173747
1995	684343.232174309	45541.6001	19841.5233441279
1996	704873.529139539	47472.9205	20682.9592778116
1997	726019.735013725	50394.3679	21955.7728517409
1998	747800.327064137	47460.3863	20677.4983888363
1999	770234.336876061	49165.0013	21420.1635178828
2000	793341.366982343	52384.718	22822.9267919938
2001	817141.607991813	49741.3513	21671.2671671678
2002	841655.856231567	50088.3843	21822.4621922781
2003	866905.531918514	50396.2045	21956.5730199759
2004	892912.69787607	53574.1288	23341.1282188681
2005	919700.078812352	55809.0726	24314.8465222027
2006	947291.081176723	59080.1858	25740.0021771768
2007	975709.813612024	62908.9575	27408.1179855382
2008	1004981.10802039	61874.5149	26957.4329645686
2009	1035130.541261	58907.4815	25664.7585231867
2010	1066184.45749883	67043.7128	29209.5444533625
2011	1098169.99122379	69463.9093	30263.9734863056
2012	1131115.09096051	69682.4685	30359.1951618584
2013	1165048.54368932	71360.996	31090.4945123836
2014	1200000	71719.5476	31246.7079507752

Determining mu (μ) and sigma (σ) in Singapore

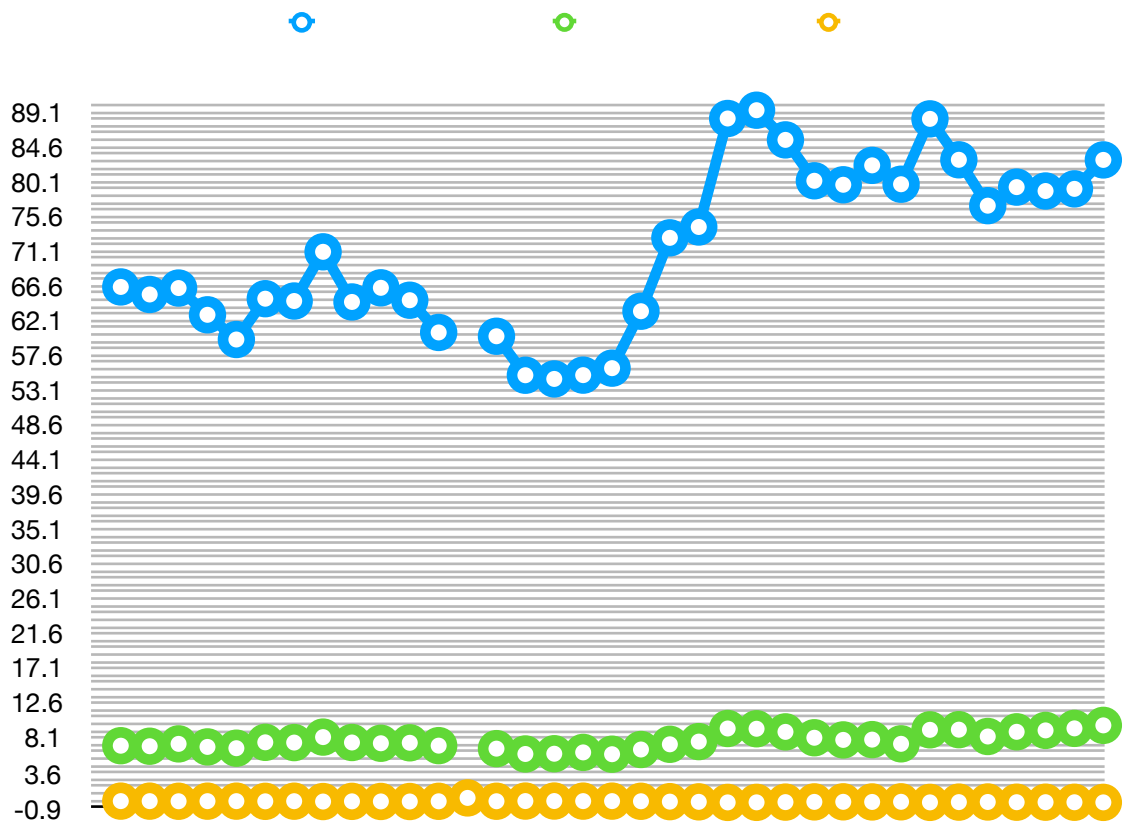
	Maximum Income	Mean Income	Minimum Income	sigma (σ)	mu (μ)
1980	439253.87969116	23358.0334	10176.60696948	0.627497651264	9.861819595583
1981	452431.49608196	24781.266	10796.67966774	0.622566285519	9.924048853533
1982	466004.4409643	25770.1279	11227.50613035	0.620971415342	9.964168517433
1983	479984.5741932	27567.8152	12010.72091530	0.614659050957	10.03550138085
1984	494384.1114190	29692.2921	12936.31109906	0.607212432908	10.11428929651
1985	509215.6347616	28667.0237	12489.62308529	0.617995570734	10.07254347841
1986	524492.1038045	27695.6696	12066.42440522	0.628667269994	10.03142007964
1987	540226.8669186	29236.121	12737.56688477	0.624572254284	10.08811499391
1988	556433.6729262	31952.3821	13920.98507618	0.614691759687	10.18307903443
1989	573126.6831139	34501.7565	15031.69422033	0.606824309957	10.26464764318
1990	590320.4836074	36699.5117	15989.21022789	0.601458574663	10.32964252025
1991	608030.0981156	37257.7929	16232.44167865	0.603868761950	10.34328766646
1992	626271.0010591	38950.1639	16969.77235280	0.601391586998	10.38920233879
1993	645059.1310908	40853.8079	17799.15025744	0.598365211815	10.43873484923
1994	664410.9050236	45081.317	19640.98761737	0.586880367211	10.54400889974
1995	684343.2321743	45541.6001	19841.52334412	0.590113785469	10.55226433524
1996	704873.5291395	47472.9205	20682.95927781	0.588118042914	10.59497331651
1997	726019.7350137	50394.3679	21955.77285174	0.583091182107	10.65763703647
1998	747800.3270641	47460.3863	20677.49838883	0.598014987541	10.58883970678
1999	770234.3368760	49165.0013	21420.16351788	0.597060350545	10.62469676255
2000	793341.3669823	52384.718	22822.92679199	0.591414668769	10.69148453133
2001	817141.6079918	49741.3513	21671.26716716	0.604970852859	10.63159701785
2002	841655.8562315	50088.3843	21822.46219227	0.608738565627	10.63626308925
2003	866905.5319185	50396.2045	21956.57301997	0.612643910368	10.64000486322
2004	892912.6978760	53574.1288	23341.12821886	0.607378641540	10.70436715179
2005	919700.0788123	55809.0726	24314.84652220	0.605493413971	10.74638058936
2006	947291.0811767	59080.1858	25740.00217717	0.600926688515	10.80609443904
2007	975709.8136120	62908.9575	27408.11798553	0.595387662288	10.87220060693
2008	1004981.108020	61874.5149	26957.43296456	0.603077492877	10.85101242863
2009	1035130.541261	58907.4815	25664.75852318	0.616194006233	10.79387585528
2010	1066184.457498	67043.7128	29209.54445336	0.599557684350	10.93336540705
2011	1098169.991223	69463.9093	30263.97348630	0.598573736300	10.96941734713
2012	1131115.090960	69682.4685	30359.19516185	0.602976631489	10.96991362807
2013	1165048.543689	71360.996	31090.49451238	0.603935983959	10.99313738819
2014	1200000	71719.5476	31246.70795077	0.608027135119	10.99567012131

Determining ideal share in Singapore

Year	sigma (σ)	Ideal bottom 90%	Ideal top 10-1%	Ideal top 1%
1980	0.62749765126440	0.743461464355428	0.026558666172914	0.001569205290231
1981	0.62256628551932	0.745047389424123	0.026852955980504	0.001594462686860
1982	0.62097141534240	0.745559198885224	0.026948698483474	0.001602710217090
1983	0.61465905095741	0.747579603689105	0.027330363850665	0.001635736100064
1984	0.60721243290854	0.7499521348369	0.027786236667990	0.001675492738235
1985	0.61799557073457	0.746512735069015	0.027128084439380	0.001618203185309
1986	0.6286672699943	0.743084562960473	0.026489252965559	0.001563268517295
1987	0.62457225428448	0.744402890328778	0.026732927299557	0.001584144174714
1988	0.61469175968771	0.747569156409872	0.027328374931328	0.001635563383861
1989	0.60682430995797	0.750075467603365	0.027810165019622	0.001677588809826
1990	0.60145857466321	0.751777208869127	0.028142684510249	0.001706812376228
1991	0.60386876195023	0.751013583981568	0.027992927025375	0.001693628840872
1992	0.60139158699840	0.751798414864539	0.028146856046885	0.001707180124259
1993	0.59836521181515	0.752755452754385	0.028335840778878	0.001723869713469
1994	0.58688036721102	0.756369309150242	0.029062379565411	0.001788565204899
1995	0.59011378546991	0.755354765566631	0.028856326851380	0.001770131157974
1996	0.58811804291424	0.755981234561205	0.028983367636610	0.001781488559290
1997	0.58309118210796	0.757555337485684	0.029305358501608	0.001810389862097
1998	0.59801498754102	0.752866077494054	0.028357776959704	0.001725810656703
1999	0.59706035054572	0.753167482561738	0.028417640085088	0.001731111360361
2000	0.59141466876992	0.754945948972349	0.028773760329000	0.001762763578187
2001	0.60497085285918	0.75066399007592	0.027924663715232	0.001687631436743
2002	0.60873856562712	0.749466866876103	0.027692310060417	0.001667273910765
2003	0.61264391036872	0.748222806671326	0.027453125190185	0.001646409011610
2004	0.60737864154071	0.749899309301975	0.027775994764089	0.001674595852255
2005	0.60549341397146	0.750498137480948	0.027892343529260	0.001684794505779
2006	0.60092668851539	0.751945559144199	0.028175820556820	0.001709734306087
2007	0.59538766228801	0.753695121288371	0.028522776959565	0.001740434845438
2008	0.60307749287730	0.751264421237612	0.028042021377440	0.001697946762545
2009	0.61619400623314	0.747089088299909	0.027237154346570	0.001627648755637
2010	0.59955768435052	0.752378590030961	0.028261253573630	0.001717275920212
2011	0.59857373630023	0.752689573910077	0.028322786437808	0.001722715014486
2012	0.60297663148953	0.751296385257501	0.028048284336630	0.001698497878464
2013	0.60393598395937	0.75099226798159	0.027988759440168	0.001693262474370
2014	0.60802713511968	0.749693144153405	0.027736063339310	0.001671100665656

Nonideal inequality coefficient — Singapore

	Top 1%	Ideal top	Top 1%	Top10%	Ideal top	10-1% ψ	Bottom 9%	Ideal bot	Bottom 9%
1980	0.10588	0.00156	66.4745	0.21479	0.02655	7.08758	0.67932	0.74346	-0.08626
1981	0.10602	0.00159	65.4987	0.21535	0.02685	7.01962	0.67861	0.74504	-0.08915
1982	0.10791	0.00160	66.3307	0.22430	0.02694	7.32357	0.66777	0.74555	-0.10432
1983	0.10446	0.00163	62.8668	0.21677	0.02733	6.93148	0.67876	0.74757	-0.09205
1984	0.10165	0.00167	59.6697	0.21575	0.02778	6.76497	0.68258	0.74995	-0.08982
1985	0.10672	0.00161	64.9520	0.23122	0.02712	7.52350	0.66204	0.74651	-0.11314
1986	0.10263	0.00156	64.6542	0.22494	0.02648	7.49181	0.67242	0.74308	-0.09509
1987	0.11409	0.00158	71.0202	0.24599	0.02673	8.20213	0.63990	0.74440	-0.14037
1988	0.10718	0.00163	64.5315	0.23236	0.02732	7.50254	0.66045	0.74756	-0.11652
1989	0.11300	0.00167	66.3619	0.23371	0.02781	7.40376	0.65328	0.75007	-0.12904
1990	0.11223	0.00170	64.7554	0.23817	0.02814	7.46314	0.64959	0.75177	-0.13592
1991	0.10429	0.00169	60.5836	0.22662	0.02799	7.09597	0.66907	0.75101	-0.10917
1992		0.00170	-1	0	0.02814	-1	1	0.75179	0.33014
1993	0.10531	0.00172	60.0899	0.21842	0.02833	6.70844	0.67626	0.75275	-0.10167
1994	0.10023	0.00178	55.0447	0.20389	0.02906	6.01577	0.69586	0.75636	-0.07999
1995	0.09836	0.00177	54.5671	0.20339	0.02885	6.04843	0.69824	0.75535	-0.07560
1996	0.09986	0.00178	55.0580	0.20927	0.02898	6.22052	0.69085	0.75598	-0.08614
1997	0.10312	0.00181	55.9611	0.20472	0.02930	5.98609	0.69214	0.75755	-0.08633
1998	0.11102	0.00172	63.3301	0.21540	0.02835	6.59607	0.67357	0.75286	-0.10532
1999	0.12780	0.00173	72.8309	0.23498	0.02841	7.26907	0.63720	0.75316	-0.15396
2000	0.13262	0.00176	74.2358	0.24796	0.02877	7.61757	0.61941	0.75494	-0.17952
2001	0.15067	0.00168	88.2798	0.28803	0.02792	9.31485	0.56128	0.75066	-0.25227
2002	0.15064	0.00166	89.3531	0.28470	0.02769	9.28098	0.56465	0.74946	-0.24659
2003	0.14243	0.00164	85.5109	0.27116	0.02745	8.87728	0.58640	0.74822	-0.21626
2004	0.13600	0.00167	80.2166	0.25321	0.02777	8.11647	0.61077	0.74989	-0.18552
2005	0.13596	0.00168	79.6999	0.24653	0.02789	7.83891	0.61749	0.75049	-0.17727
2006	0.14227	0.00170	82.2136	0.25010	0.02817	7.87671	0.60761	0.75194	-0.19193
2007	0.14057	0.00174	79.7695	0.23761	0.02852	7.33060	0.62181	0.75369	-0.17497
2008	0.15151	0.00169	88.2319	0.28444	0.02804	9.14345	0.56404	0.75126	-0.24920
2009	0.13661	0.00162	82.9340	0.27683	0.02723	9.16399	0.58654	0.74708	-0.21489
2010	0.13393	0.00171	76.9942	0.26225	0.02826	8.27954	0.60381	0.75237	-0.19746
2011	0.13850	0.00172	79.3963	0.28000	0.02832	8.88603	0.58149	0.75268	-0.22743
2012	0.13570	0.00169	78.8941	0.28239	0.02804	9.06835	0.58190	0.75129	-0.22547
2013	0.13574	0.00169	79.1693	0.28917	0.02798	9.33198	0.57507	0.75099	-0.23424
2014	0.14023	0.00167	82.9190	0.29732	0.02773	9.71973	0.56243	0.74969	-0.24977



Blue — Top 1 %
 Green — Top 10-1%
 Yellow — Bottom 90%

4. Malaysia

General Statistics

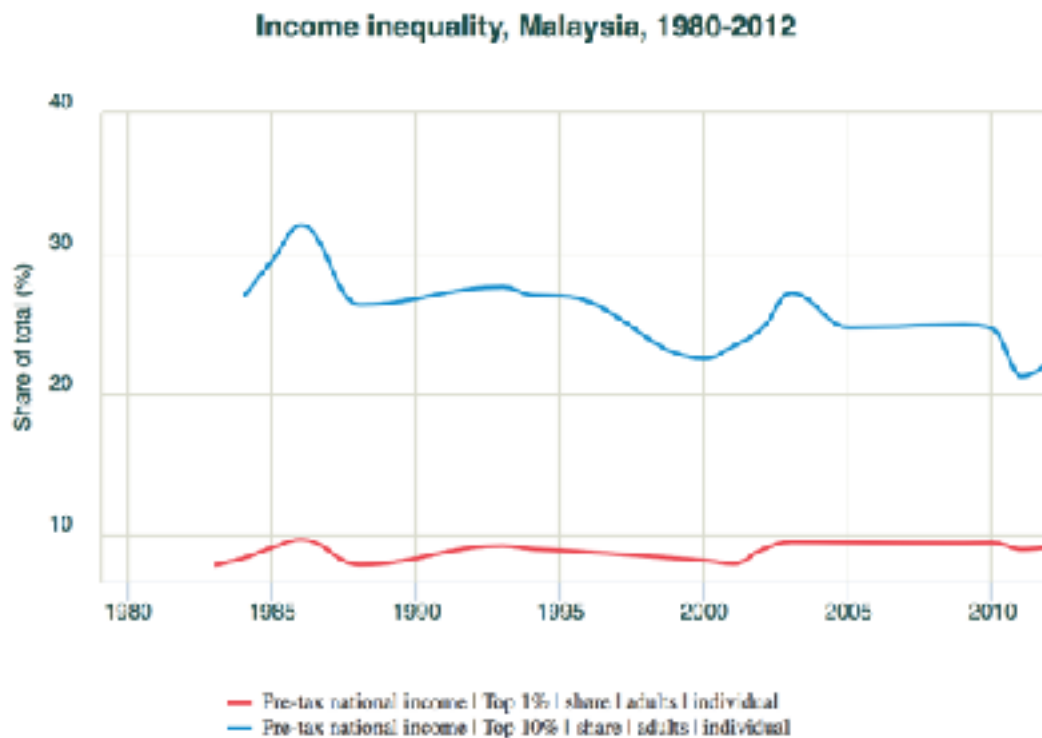


Figure 5. Pre-tax national income share for top 1% and top 10% in Malaysia

Source: WID.World. See wid.world/country/malaysia for data series

Income inequality in Malaysia has long been on the higher end of the scale since its independence in 1957, and signified a racial disparity. In the past two decades, the actual differences in household income, adjusted to inflation, have almost doubled between the top 20 and bottom 40 per cent of the households.

Although the government has repeatedly boasted of eradicating hardcore poverty, relative poverty has increased by more than 50 per cent to three million households since 1995. This means 43 per cent of the country's 6.9 million households are relatively poor.

Asset Class	Chinese	Bumiputera	Indian
Savings	RM 1.00	RM 0.20	RM 0.40
Financial Assets	RM 1.00	RM 0.32	RM 0.49
Investment Assets	RM 1.00	RM 0.40	RM 0.54
Income	RM 1.00	RM 0.57	RM 0.78
Real Estate	RM 1.00	RM 0.58	RM 0.70
Wealth	RM 1.00	RM 0.65	RM 0.68

Source: HIS 2007

Figure 6. Differences in Asset Ownership between races in Malaysia, 2007

Not only has the relative poverty increased, the gap between Malays and other ethnic groups (Chinese and Indians) has risen dramatically despite poverty measures that favoured the Malays (for example, the Bumiputera education reform).

Calculations

Next, we will be extracting data from WID and finding:

- 1) Actual income shares of top 1%, top 10%-1%, and bottom 90%
- 2) Maximum, mean and minimum income shares
- 3) Mu (μ) and sigma (σ) using the formulas given:

$$\sigma \approx (\ln(\text{maximum income}) - \ln(\text{minimum income})) / 6$$

$$\mu = \ln(\text{average income}) - (\sigma^2 / 2)$$

- 4) Ideal share of income distribution
- 5) Nonideal inequality coefficient ψ , which is defined as

$$\psi = (\text{actual share} / \text{ideal share}) - 100\%$$

Actual income shares of top 1%, top 10%-1%, and bottom 90% in Malaysia

	Top 1%	Top10%-1%	Top10%	Bottom 90%
1980		0		1
1981		0		1
1982		0		1
1983	0.078702122	-0.078702122		1
1984	0.0835080966	0.1857476607	0.2692557573	0.7307442427
1985	0.0907925889	0.2046032026	0.2953957915	0.7046042085
1986	0.0965756848	0.2235324607	0.3201081455	0.6798918545
1987		0		1
1988	0.0790274888	0.1843759567	0.2634034455	0.7365965545
1989		0		1
1990		0		1
1991		0		1
1992		0		1
1993	0.091885291	0.1841659919	0.2760512829	0.7239487171
1994	0.0897429362	0.1805065498	0.270249486	0.729750514
1995	0.088835679	0.1806657091	0.2695013881	0.7304986119
1996		0		1
1997		0		1
1998		0		1
1999		0		1
2000	0.0818477347	0.1434061304	0.2252538651	0.7747461349
2001	0.0795741901	0.1546062901	0.2341804802	0.7658195198
2002	0.089324519	0.1575774253	0.2469019443	0.7530980557
2003	0.0948181078	0.1768906787	0.2717087865	0.7282912135
2004		0		1
2005	0.0945494622	0.1527951062	0.2473445684	0.7526554316
2006		0		1
2007		0		1
2008		0		1
2009	0.0941300467	0.1549561098	0.2490861565	0.7509138435
2010	0.0942526832	0.1520875022	0.2463401854	0.7536598146
2011	0.0894851536	0.1232824772	0.2127676308	0.7872323692
2012	0.0911032706	0.1320869178	0.2231901884	0.7768098116
2013		0		1
2014		0		1

Maximum, mean and minimum income shares of Malaysia

	Maximum Income	Mean Income	Minimum Income
1980	3660448.99742639	9882.5591	4305.62445438481
1981	3770262.46734918	9517.7915	4146.70283470765
1982	3883370.34136965	9226.5897	4019.83229656527
1983	3999871.45161074	9493.8113	4136.25516275383
1984	4119867.59515906	10075.9346	4389.87411818686
1985	4243463.62301384	9360.9126	4078.35397674666
1986	4370767.53170425	8138.2235	3545.65389007885
1987	4501890.55765538	8962.2732	3904.67512173012
1988	4636947.27438504	9728.3679	4238.44657114089
1989	4776055.69261659	10421.1455	4540.27529240905
1990	4919337.36339509	11268.8789	4909.61501716099
1991	5066917.48429694	11770.2666	5128.05915904806
1992	5218925.00882585	12025.529	5239.2716517439
1993	5375492.75909063	12858.3577	5602.11771021407
1994	5536757.54186335	13487.2477	5876.11193941307
1995	5702860.26811925	14301.5767	6230.89806523697
1996	5873946.07616282	15176.3906	6612.03619785646
1997	6050164.45844771	15724.023	6850.6281890193
1998	6231669.39220114	14478.1013	6307.80614409283
1999	6418619.47396718	14000.3214	6099.64742726274
2000	6611178.05818619	15842.0655	6902.05683918105
2001	6809513.39993178	14992.9968	6532.13535212688
2002	7013798.80192973	15751.8692	6862.76019637372
2003	7224212.76598762	16660.0582	7258.43916252362
2004	7440939.14896725	18072.8091	7873.94520315981
2005	7664167.32343627	19772.1624	8614.31791948584
2006	7894092.34313936	20780.3878	9053.58065435498
2007	8130915.11343354	22198.2429	9671.31048825339
2008	8374842.56683655	24139.7421	10517.1811123601
2009	8626087.84384164	20885.2097	9099.24936540727
2010	8884870.47915689	22941.1019	9994.95862880029
2011	9151416.5935316	24352.1474	10609.7216622993
2012	9425959.09133754	24281.4623	10578.9256415479
2013	9708737.86407767	24749.9988	10783.0572021851
2014	10000000	25506.6084	11112.6961917644

Determining mu (μ) and sigma (σ) in Malaysia

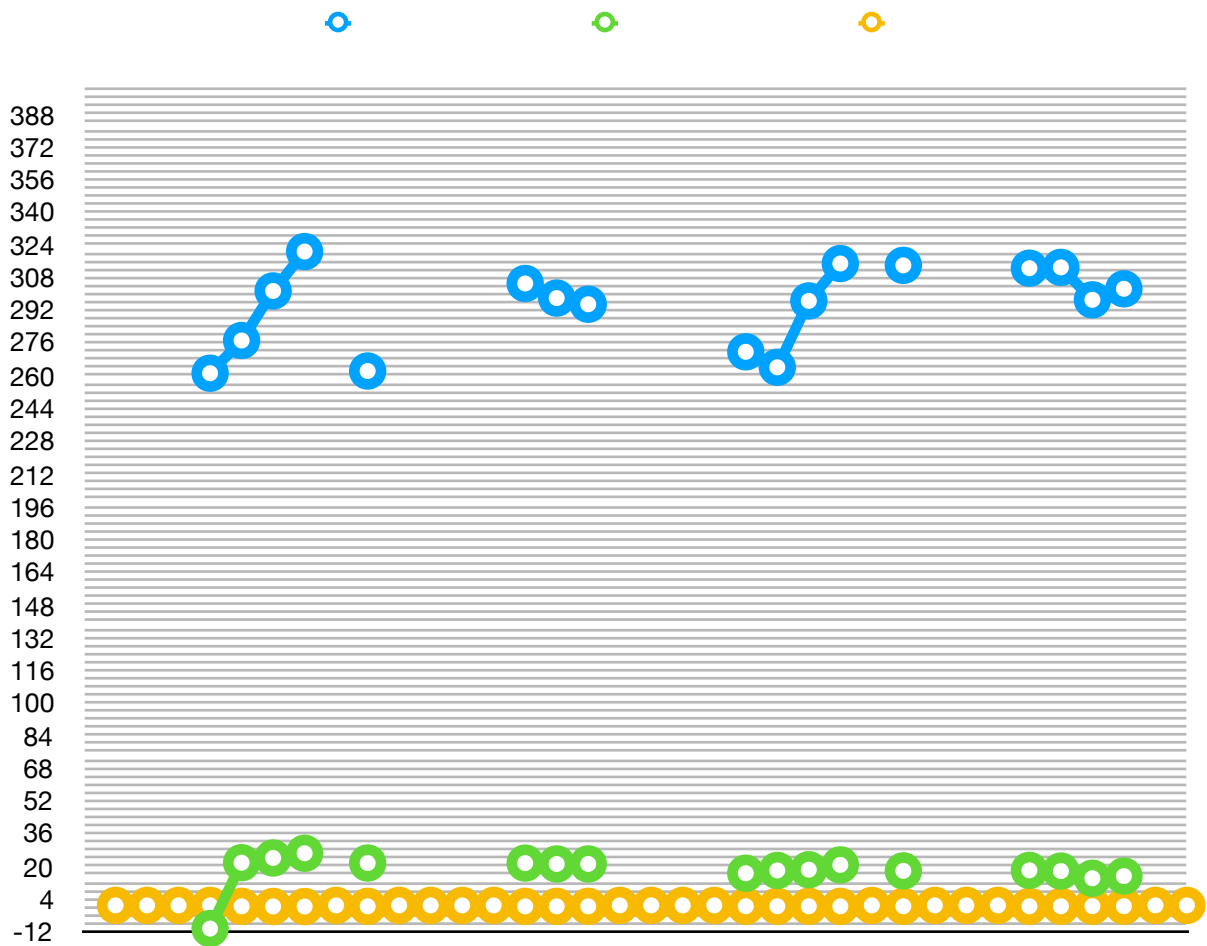
	Maximum Income	Mean Income	Minimum Income	sigma (σ)	mu (μ)
1980	3660448.997426	9882.5591	4831.792676602	1.105020590397	8.587991522820
1981	3770262.467349	9517.7915	4976.746456900	1.105020590397	8.550382862977
1982	3883370.341369	9226.5897	5126.048850607	1.105020590397	8.519309526664
1983	3999871.451610	9493.8113	5279.830316126	1.105020590397	8.547860170601
1984	4119867.595159	10075.9346	5438.225225609	1.105020590397	8.607369894179
1985	4243463.623013	9360.9126	5601.371982378	1.105020590397	8.533762812117
1986	4370767.531704	8138.2235	5769.413141849	1.105020590397	8.393791939333
1987	4501890.557655	8962.2732	5942.495536105	1.105020590397	8.490243926547
1988	4636947.274385	9728.3679	6120.770402188	1.105020590397	8.572266169557
1989	4776055.692616	10421.1455	6304.393514253	1.105020590397	8.641056989485
1990	4919337.363395	11268.8789	6493.525319681	1.105020590397	8.719264872998
1991	5066917.484296	11770.2666	6688.331079271	1.105020590397	8.762796598203
1992	5218925.008825	12025.529	6888.981011650	1.105020590397	8.784251833089
1993	5375492.759090	12858.3577	7095.650441999	1.105020590397	8.851214030970
1994	5536757.541863	13487.2477	7308.519955259	1.105020590397	8.898964650580
1995	5702860.268119	14301.5767	7527.775553917	1.105020590397	8.957589816310
1996	5873946.076162	15176.3906	7753.608820534	1.105020590397	9.01696099669
1997	6050164.458447	15724.023	7986.217085150	1.105020590397	9.052409696671
1998	6231669.392201	14478.1013	8225.803597705	1.105020590397	8.969857279050
1999	6418619.473967	14000.3214	8472.577705636	1.105020590397	8.936300312875
2000	6611178.058186	15842.0655	8726.755036805	1.105020590397	9.059888801993
2001	6809513.399931	14992.9968	8988.557687909	1.105020590397	9.004803238460
2002	7013798.801929	15751.8692	9258.214418547	1.105020590397	9.054179063976
2003	7224212.765987	16660.0582	9535.960851103	1.105020590397	9.110234156511
2004	7440939.148967	18072.8091	9822.039676636	1.105020590397	9.191628575460
2005	7664167.323436	19772.1624	10116.70086693	1.105020590397	9.281495035427
2006	7894092.343139	20780.3878	10420.20189294	1.105020590397	9.331229674053
2007	8130915.113433	22198.2429	10732.80794973	1.105020590397	9.397233163478
2008	8374842.566836	24139.7421	11054.79218822	1.105020590397	9.481079558480
2009	8626087.843841	20885.2097	11386.43595387	1.105020590397	9.336261264978
2010	8884870.479156	22941.1019	11728.02903248	1.105020590397	9.430150170930
2011	9151416.593531	24352.1474	12079.86990346	1.105020590397	9.489840060933
2012	9425959.091337	24281.4623	12442.26600056	1.105020590397	9.486933217282
2013	9708737.864077	24749.9988	12815.53398058	1.105020590397	9.506045466910
2014	10000000	25506.6084	13200	1.105020590397	9.536157597912

Determining ideal share in Malaysia

Year	sigma (σ)	Ideal bottom 90%	Ideal top 10-1%	Ideal top 1%
1980	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1981	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1982	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1983	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1984	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1985	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1986	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1987	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1988	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1989	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1990	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1991	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1992	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1993	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1994	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1995	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1996	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1997	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1998	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
1999	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2000	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2001	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2002	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2003	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2004	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2005	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2006	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2007	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2008	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2009	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2010	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2011	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2012	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2013	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814
2014	1.10502059039731	0.570061591934544	0.008202862724652	0.000300272144814

Nonideal inequality coefficient — Malaysia

	Top 1%	Ideal top	Top 1%	Top10%	Ideal top	10-1% ψ	Bottom 5%	Ideal bot	Bottom 5%
1980		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
1981		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
1982		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
1983	0.07870	0.00030	261.102	-0.07870	0.00820	-10.5944	1	0.57006	0.75419
1984	0.08350	0.00030	277.108	0.18574	0.00820	21.6442	0.73074	0.57006	0.28186
1985	0.09079	0.00030	301.367	0.20460	0.00820	23.9429	0.70460	0.57006	0.23601
1986	0.09657	0.00030	320.627	0.22353	0.00820	26.2505	0.67989	0.57006	0.19266
1987		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
1988	0.07902	0.00030	262.186	0.18437	0.00820	21.4770	0.73659	0.57006	0.29213
1989		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
1990		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
1991		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
1992		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
1993	0.09188	0.00030	305.006	0.18416	0.00820	21.4514	0.72394	0.57006	0.26994
1994	0.08974	0.00030	297.871	0.18050	0.00820	21.0053	0.72975	0.57006	0.28012
1995	0.08883	0.00030	294.850	0.18066	0.00820	21.0247	0.73049	0.57006	0.28143
1996		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
1997		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
1998		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
1999		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
2000	0.08184	0.00030	271.578	0.14340	0.00820	16.4824	0.77474	0.57006	0.35905
2001	0.07957	0.00030	264.006	0.15460	0.00820	17.8478	0.76581	0.57006	0.34339
2002	0.08932	0.00030	296.478	0.15757	0.00820	18.2100	0.75309	0.57006	0.32108
2003	0.09481	0.00030	314.773	0.17689	0.00820	20.5645	0.72829	0.57006	0.27756
2004		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
2005	0.09454	0.00030	313.879	0.15279	0.00820	17.6270	0.75265	0.57006	0.32030
2006		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
2007		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
2008		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
2009	0.09413	0.00030	312.482	0.15495	0.00820	17.8904	0.75091	0.57006	0.31725
2010	0.09425	0.00030	312.890	0.15208	0.00820	17.5407	0.75365	0.57006	0.32206
2011	0.08948	0.00030	297.013	0.12328	0.00820	14.0292	0.78723	0.57006	0.38096
2012	0.09110	0.00030	302.402	0.13208	0.00820	15.1025	0.77680	0.57006	0.36267
2013		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419
2014		0.00030	-1	0	0.00820	-1	1	0.57006	0.75419



Blue — Top 1 %
 Green — Top 10-1%
 Yellow — Bottom 90%

5. *Denmark*

General Statistics

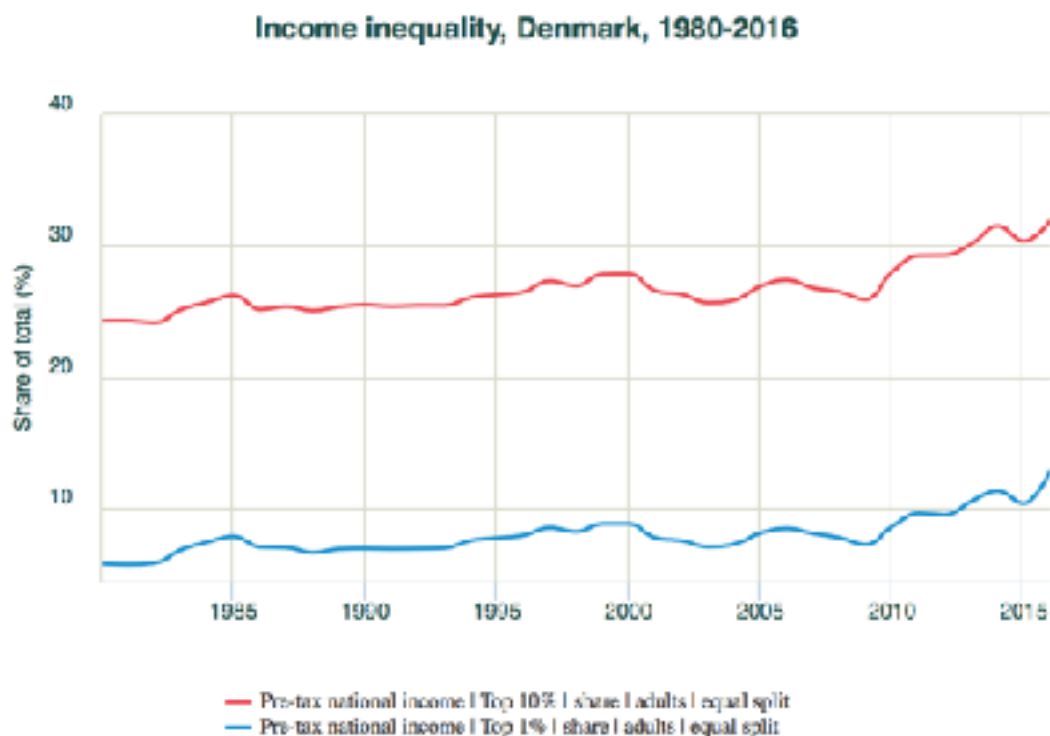


Figure 6. Pre-tax national income share for top 1% and top 10% in Denmark
Source: WID.World. See wid.world/country/denmark for data series

Like most of the Nordic countries, Denmark has a relatively smaller income inequality gap. It has one of the lowest degrees of income inequality in the world. According to a Organization for Economic Cooperation and Development (OECD) study in 2015, its richest ten percent earn 5.2 times more than the poorest ten percent, the lowest ratio among all OECD nations.

Such low level of inequality can be partly explained by the breadth of the redistributive system in Denmark, as the strong welfare system plays a crucial role in mitigating the impact of market income inequality on

disposable income inequality (i.e. market income after taxes and transfers). That said, even the level of market income inequality is relatively low compared to many OECD countries.

However, income inequality in Denmark has been increasing around the same pace as the OECD average. This is reportedly due to reforms over the past 15 years have led to a 20 percent increase in inequality between 2005 and 2015 (Development finance international and OXFAM 2018).

Calculations

Next, we will be extracting data from WID and finding:

- 1) Actual income shares of top 1%, top 10%-1%, and bottom 90%
- 2) Maximum, mean and minimum income shares
- 3) Mu (μ) and sigma (σ) using the formulas given:

$$\sigma \approx (\ln(\text{maximum income}) - \ln(\text{minimum income})) / 6$$

$$\mu = \ln(\text{average income}) - (\sigma^2 / 2)$$

- 4) Ideal share of income distribution
- 5) Nonideal inequality coefficient ψ , which is defined as
 $\psi = (\text{actual share} / \text{ideal share}) - 100\%$

Actual income shares of top 1%, top 10%-1%, and bottom 90% in Denmark

	Top 1%	Top10%-1%	Top10%	Bottom 90%
1980	0.0571	0.1854	0.2425	0.7575
1981	0.0566	0.186	0.2426	0.7574
1982	0.0577	0.1834	0.2411	0.7589
1983	0.0676	0.1834	0.251	0.749
1984	0.0736	0.1829	0.2565	0.7435
1985	0.0779	0.1837	0.2616	0.7384
1986	0.0697	0.1814	0.2511	0.7489
1987	0.0693	0.184	0.2533	0.7467
1988	0.0655	0.1847	0.2502	0.7498
1989	0.0682	0.1849	0.2531	0.7469
1990	0.0686	0.1859	0.2545	0.7455
1991	0.0683	0.1851	0.2534	0.7466
1992	0.0685	0.1856	0.2541	0.7459
1993	0.0689	0.1851	0.254	0.746
1994	0.0748	0.1853	0.2601	0.7399
1995	0.0768	0.1854	0.2622	0.7378
1996	0.0788	0.1858	0.2646	0.7354
1997	0.0845	0.1883	0.2728	0.7272
1998	0.0815	0.1877	0.2692	0.7308
1999	0.0874	0.1906	0.278	0.722
2000	0.0874	0.1908	0.2782	0.7218
2001	0.0769	0.1885	0.2654	0.7346
2002	0.0747	0.1879	0.2626	0.7374
2003	0.0699	0.1862	0.2561	0.7439
2004	0.072	0.1861	0.2581	0.7419
2005	0.0805	0.1884	0.2689	0.7311
2006	0.0839	0.1896	0.2735	0.7265
2007	0.0801	0.1874	0.2675	0.7325
2008	0.0769	0.1876	0.2645	0.7355
2009	0.0716	0.1869	0.2585	0.7415
2010	0.0855	0.1944	0.2799	0.7201
2011	0.0954	0.1969	0.2923	0.7077
2012	0.0941	0.1984	0.2925	0.7075
2013	0.1047	0.1964	0.3011	0.6989
2014	0.1126	0.2021	0.3147	0.6853

Maximum, mean and minimum income shares of Denmark

	Maximum Income	Mean Income	Minimum Income
1980	763854.128141021	25744.4023	11216.2980241019
1981	786769.751985252	24935.6973	10863.9621575364
1982	810372.84454481	25466.2092	11095.0951046677
1983	834684.029881154	26169.3909	11401.4566748602
1984	859724.550777589	27041.1194	11781.2505631845
1985	885516.287300916	28011.2709	12203.9252955682
1986	912081.775919944	29650.2174	12917.9800316363
1987	939444.229197542	29439.9075	12826.3524036832
1988	967627.556073468	28870.5891	12578.3122755578
1989	996656.382755672	28798.7158	12546.9985808998
1990	1026556.07423834	29010.3865	12639.2190809722
1991	1057352.75646549	29064.8874	12662.9639840333
1992	1089073.33915946	29857.8673	13008.4487531834
1993	1121745.53933424	29681.8417	12931.7580781985
1994	1155397.90551427	31083.3352	13542.3595049343
1995	1190059.8426797	31660.1325	13793.6580334807
1996	1225761.63796009	32566.1658	14188.3978061948
1997	1262534.48709889	33494.1857	14592.7166810089
1998	1300410.52171186	34147.3375	14877.2812693962
1999	1339422.83736321	35113.4886	15298.2131111083
2000	1379605.52248411	36035.8916	15700.0848199856
2001	1420993.68815863	36378.0597	15849.1603098423
2002	1463623.49880339	36639.5762	15963.0975831974
2003	1507532.20376749	36865.8262	16061.6699795724
2004	1552758.16988052	38463.255	16757.6363214705
2005	1599340.91497693	40155.7408	17495.0170115773
2006	1647321.14242624	41870.5508	18242.1238890483
2007	1696740.77669903	41431.1977	18050.7069258581
2008	1747643	41284.1158	17986.6264160398
2009	1800072.29	38797.361	16903.1993228551
2010	1854074.4587	40154.8712	17494.6381450319
2011	1909696.692461	40234.3871	17529.2815607796
2012	1966987.59323483	40142.1437	17489.0930392867
2013	2025997.22103188	40854.7892	17799.5777893457
2014	2086777.13766283	41760.7509	18194.2863674362

Determining mu (μ) and sigma (σ)-1-1

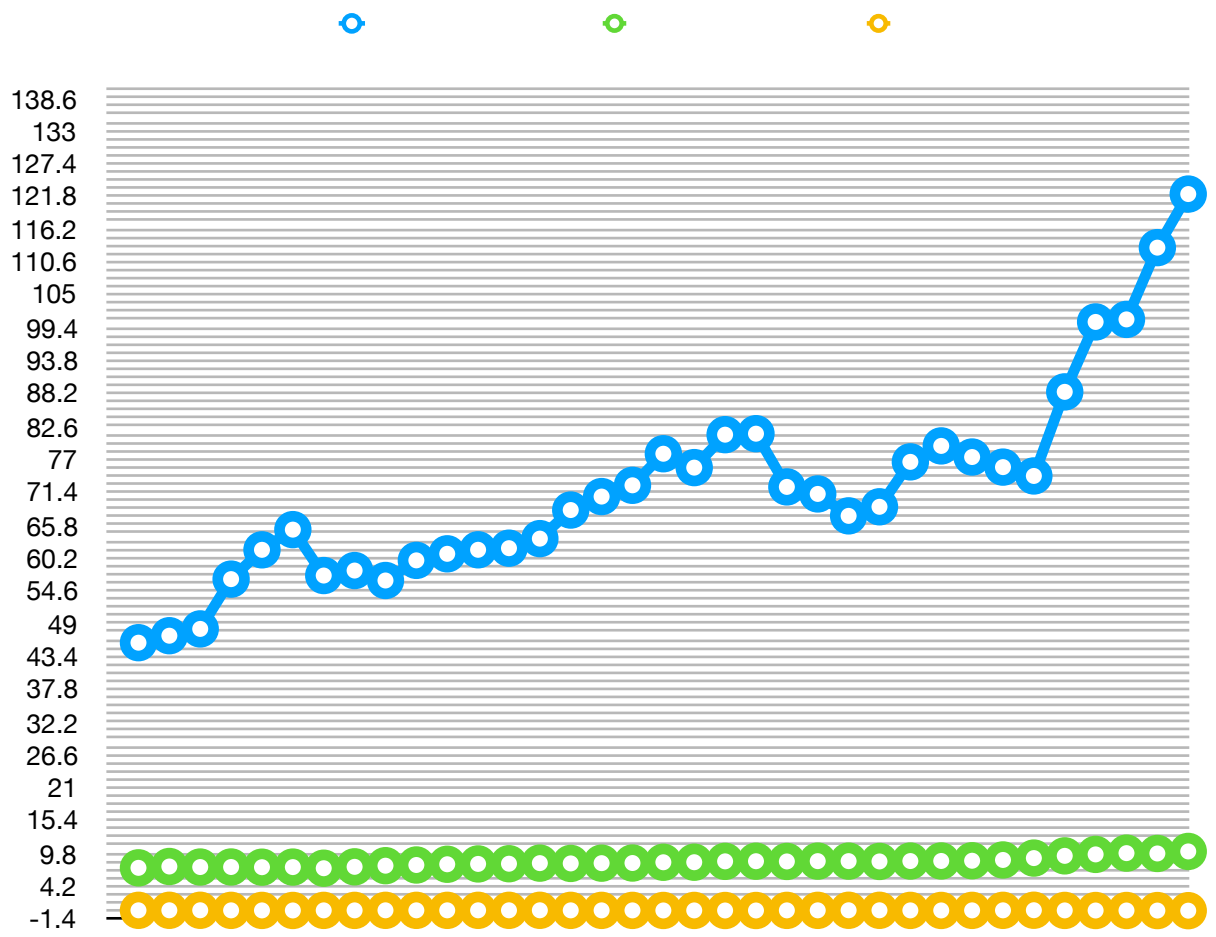
	Maximum Income	Mean Income	Minimum Income	sigma (σ)	mu (μ)
1980	763854.1281410	25744.4023	11216.29802410	0.703501489651	9.908515323081
1981	786769.7519852	24935.6973	10863.96215753	0.713747425650	9.869337988485
1982	810372.8445448	25466.2092	11095.09510466	0.715165219245	9.889377077565
1983	834684.0298811	26169.3909	11401.45667486	0.715552020029	9.916338373827
1984	859724.5507775	27041.1194	11781.25056318	0.715017119283	9.949489186795
1985	885516.2873009	28011.2709	12203.92529556	0.714068867477	9.985415066555
1986	912081.7759199	29650.2174	12917.98003163	0.709518251800	10.04551666178
1987	939444.2291975	29439.9075	12826.35240368	0.715631103133	10.03404249296
1988	967627.5560734	28870.5891	12578.31227555	0.723812195696	10.00862663039
1989	996656.3827556	28798.7158	12546.99858089	0.729154096547	10.00225322659
1990	1026556.074238	29010.3865	12639.21908097	0.732860042726	10.00686727890
1991	1057352.756465	29064.8874	12662.96398403	0.737473692094	10.00535238278
1992	1089073.339159	29857.8673	13008.44875318	0.737913902604	10.03194518140
1993	1121745.539334	29681.8417	12931.75807819	0.743825852643	10.02165229771
1994	1155397.905514	31083.3352	13542.35950493	0.741062926075	10.06983997869
1995	1190059.842679	31660.1325	13793.65803348	0.742924991511	10.08684474701
1996	1225761.637960	32566.1658	14188.39780619	0.743148850052	10.11489406284
1997	1262534.487098	33494.1857	14592.71668100	0.743392321752	10.14281106953
1998	1300410.521711	34147.3375	14877.28126939	0.745099996201	10.16085289492
1999	1339422.837363	35113.4886	15298.21311110	0.745376341719	10.18854768083
2000	1379605.522484	36035.8916	15700.08481998	0.745981128188	10.21402678785
2001	1420993.688158	36378.0597	15849.16030984	0.749332527438	10.22097149806
2002	1463623.498803	36639.5762	15963.09758319	0.753065138524	10.22533070069
2003	1507532.203767	36865.8262	16061.66997957	0.756965600640	10.22854182139
2004	1552758.169880	38463.255	16757.63632147	0.754822339801	10.27258026661
2005	1599340.914976	40155.7408	17495.01701157	0.752571799505	10.31733853625
2006	1647321.142426	41870.5508	18242.12388904	0.750528713051	10.36069133937
2007	1696740.776699	41431.1977	18050.70692585	0.757213275137	10.34510347163
2008	1747643	41284.1158	17986.62641603	0.762732466180	10.33735269215
2009	1800072.29	38797.361	16903.19932285	0.778013198521	10.26345523929
2010	1854074.4587	40154.8712	17494.63814503	0.777207744026	10.29847309835
2011	1909696.692461	40234.3871	17529.28156077	0.781804498998	10.29686817213
2012	1966987.593234	40142.1437	17489.09303928	0.787113513197	10.29040818517
2013	2025997.221031	40854.7892	17799.57778934	0.789107095973	10.30643432763
2014	2086777.137662	41760.7509	18194.28636743	0.790378084409	10.32736344555

Determining ideal share in Denmark

Year	sigma (σ)	Ideal bottom 90%	Ideal top 10-1%	Ideal top 1%
1980	0.70350148965152	0.71838484428959	0.022345905801975	0.001223378696264
1981	0.71374742565091	0.714916015778542	0.021822623433690	0.001182516502668
1982	0.71516521924502	0.714434412819666	0.021751017225167	0.001176961637159
1983	0.71555202002913	0.714302955264211	0.021731515441487	0.001175450319167
1984	0.715017111928309	0.714484738235784	0.021758487979475	0.001177540768035
1985	0.71406886747721	0.714806860818874	0.021806371846230	0.001181255004862
1986	0.70951825180043	0.716350297172167	0.022037376918579	0.001199229156380
1987	0.71563110313300	0.714276074650392	0.021727529996225	0.001175141542508
1988	0.72381219569666	0.711488815198099	0.021318489296875	0.001143597152244
1989	0.72915409654720	0.709661967845306	0.021054857178620	0.001123420631817
1990	0.73286004272634	0.708391417623535	0.020873552944709	0.001109615360456
1991	0.73747369209430	0.706806057023639	0.020649651147789	0.001092646039240
1992	0.73791390260438	0.706654581527592	0.020628392063117	0.001091039409112
1993	0.74382585264308	0.704616787578577	0.020344640753127	0.001069671454435
1994	0.74106292607524	0.705569953235245	0.020476845001914	0.001079609465572
1995	0.74292499151112	0.704927726276897	0.020387668316339	0.001072902521080
1996	0.74314885005258	0.70485047396869	0.020376969181608	0.001072098786094
1997	0.74339232175200	0.704766442700482	0.020365337942817	0.001071225259361
1998	0.74509999620176	0.704176750572692	0.020283912929837	0.001065116789035
1999	0.74537634171987	0.704081272425621	0.020270761716747	0.001064131289827
2000	0.74598112818808	0.703872267658421	0.020242004781012	0.001061977426119
2001	0.74933252743894	0.702712850670489	0.020083262724012	0.001050114166561
2002	0.75306513852468	0.70141911739494	0.019907682991534	0.001037044646475
2003	0.75696560064048	0.700064477223198	0.019725572924507	0.001023546971475
2004	0.75482233980193	0.700809181413202	0.019825468133694	0.001030943711789
2005	0.75257179950593	0.701590256844439	0.019930815923445	0.001038763444925
2006	0.75052871305188	0.702298528389895	0.020026855337670	0.001045909435219
2007	0.75721327513773	0.699978365412498	0.019714056100956	0.001022695352416
2008	0.76273246618033	0.698056551137679	0.019458862221367	0.001003885684357
2009	0.77801319852198	0.692707093701524	0.018766631536187	0.000953452294240
2010	0.77720774402683	0.692990105854962	0.018802599261787	0.000956051457847
2011	0.78180449899852	0.691373406544744	0.018598100611993	0.000941304888767
2012	0.78711351319767	0.689501577139169	0.018364229661838	0.000924533516830
2013	0.78910709597301	0.688797415528035	0.018277046036486	0.000918306939959
2014	0.79037808440953	0.688348123283431	0.018221643808637	0.000914357387244

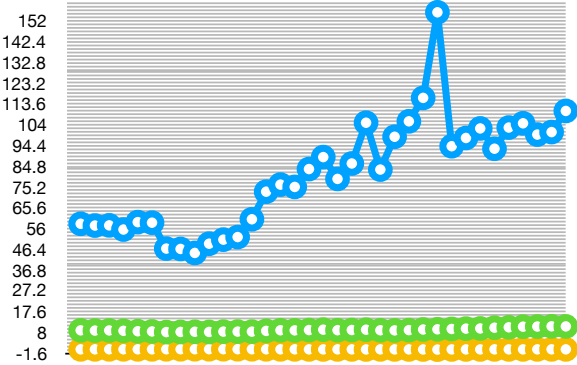
Nonideal inequality coefficient — Denmark

	Top 1%	Ideal top	Top 1%	Top10%	Ideal top	10-1% q	Bottom 5%	Ideal bot	Bottom 5%
1980	0.0571	0.00122	45.6740	0.1854	0.02234	7.29682	0.7575	0.71838	0.05444
1981	0.0566	0.00118	46.8640	0.186	0.02182	7.52326	0.7574	0.71491	0.05942
1982	0.0577	0.00117	48.0245	0.1834	0.02175	7.43178	0.7589	0.71443	0.06223
1983	0.0676	0.00117	56.5098	0.1834	0.02173	7.43935	0.749	0.71430	0.04857
1984	0.0736	0.00117	61.5031	0.1829	0.02175	7.40591	0.7435	0.71448	0.04061
1985	0.0779	0.00118	64.9468	0.1837	0.02180	7.42414	0.7384	0.71480	0.03300
1986	0.0697	0.00119	57.1206	0.1814	0.02203	7.23146	0.7489	0.71635	0.04543
1987	0.0693	0.00117	57.9716	0.184	0.02172	7.46851	0.7467	0.71427	0.04539
1988	0.0655	0.00114	56.2754	0.1847	0.02131	7.66384	0.7498	0.71148	0.05384
1989	0.0682	0.00112	59.7074	0.1849	0.02105	7.78182	0.7469	0.70966	0.05247
1990	0.0686	0.00110	60.8232	0.1859	0.02087	7.90600	0.7455	0.70839	0.05238
1991	0.0683	0.00109	61.5088	0.1851	0.02064	7.96383	0.7466	0.70680	0.05630
1992	0.0685	0.00109	61.7841	0.1856	0.02062	7.99730	0.7459	0.70665	0.05553
1993	0.0689	0.00106	63.4123	0.1851	0.02034	8.09821	0.746	0.70461	0.05873
1994	0.0748	0.00107	68.2843	0.1853	0.02047	8.04924	0.7399	0.70556	0.04865
1995	0.0768	0.00107	70.5815	0.1854	0.02038	8.09373	0.7378	0.70492	0.04663
1996	0.0788	0.00107	72.5006	0.1858	0.02037	8.11813	0.7354	0.70485	0.04334
1997	0.0845	0.00107	77.8816	0.1883	0.02036	8.24610	0.7272	0.70476	0.03183
1998	0.0815	0.00106	75.5174	0.1877	0.02028	8.25363	0.7308	0.70417	0.03780
1999	0.0874	0.00106	81.1327	0.1906	0.02027	8.40270	0.722	0.70408	0.02544
2000	0.0874	0.00106	81.2993	0.1908	0.02024	8.42594	0.7218	0.70387	0.02547
2001	0.0769	0.00105	72.2301	0.1885	0.02008	8.38592	0.7346	0.70271	0.04537
2002	0.0747	0.00103	71.0316	0.1879	0.01990	8.43856	0.7374	0.70141	0.05129
2003	0.0699	0.00102	67.2919	0.1862	0.01972	8.43952	0.7439	0.70006	0.06261
2004	0.072	0.00103	68.8389	0.1861	0.01982	8.38691	0.7419	0.70080	0.05863
2005	0.0805	0.00103	76.4959	0.1884	0.01993	8.45269	0.7311	0.70159	0.04206
2006	0.0839	0.00104	79.2172	0.1896	0.02002	8.46728	0.7265	0.70229	0.03446
2007	0.0801	0.00102	77.3224	0.1874	0.01971	8.50590	0.7325	0.69997	0.04646
2008	0.0769	0.00100	75.6023	0.1876	0.01945	8.64085	0.7355	0.69805	0.05363
2009	0.0716	0.00095	74.0955	0.1869	0.01876	8.95916	0.7415	0.69270	0.07043
2010	0.0855	0.00095	88.4303	0.1944	0.01880	9.33899	0.7201	0.69299	0.03912
2011	0.0954	0.00094	100.348	0.1969	0.01859	9.58710	0.7077	0.69137	0.02361
2012	0.0941	0.00092	100.781	0.1984	0.01836	9.80361	0.7075	0.68950	0.02610
2013	0.1047	0.00091	113.014	0.1964	0.01827	9.74571	0.6989	0.68879	0.01466
2014	0.1126	0.00091	122.146	0.2021	0.01822	10.0912	0.6853	0.68834	-0.00442

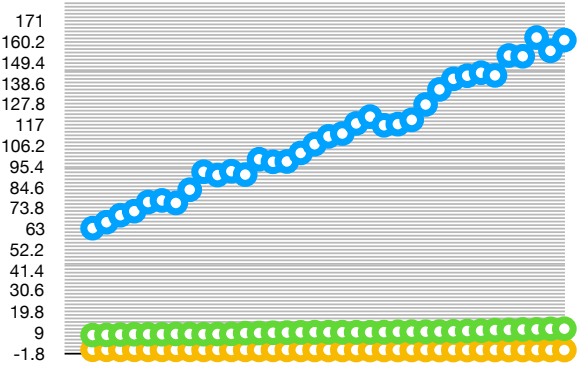


Blue — Top 1 %
 Green — Top 10-1%
 Yellow — Bottom 90%

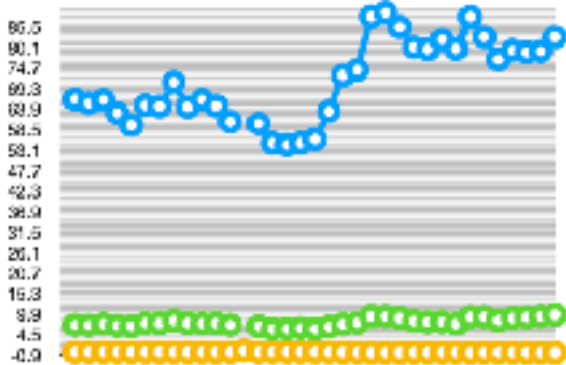
Comparison and analysis of income shares



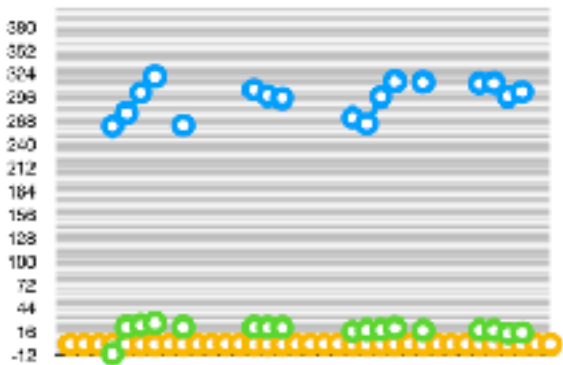
NORWAY



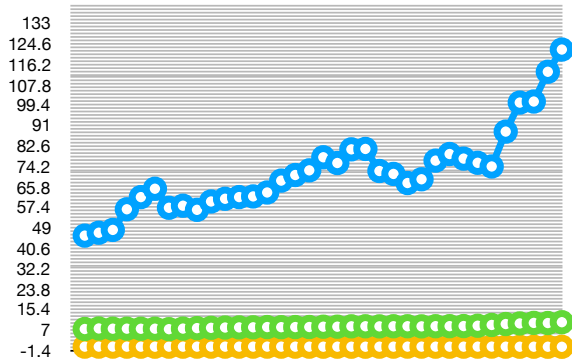
USA



SINGAPORE



MALAYSIA



DENMARK

Legend:
Blue — Top 1 %
Green — Top 10-1%
Yellow — Bottom 90%

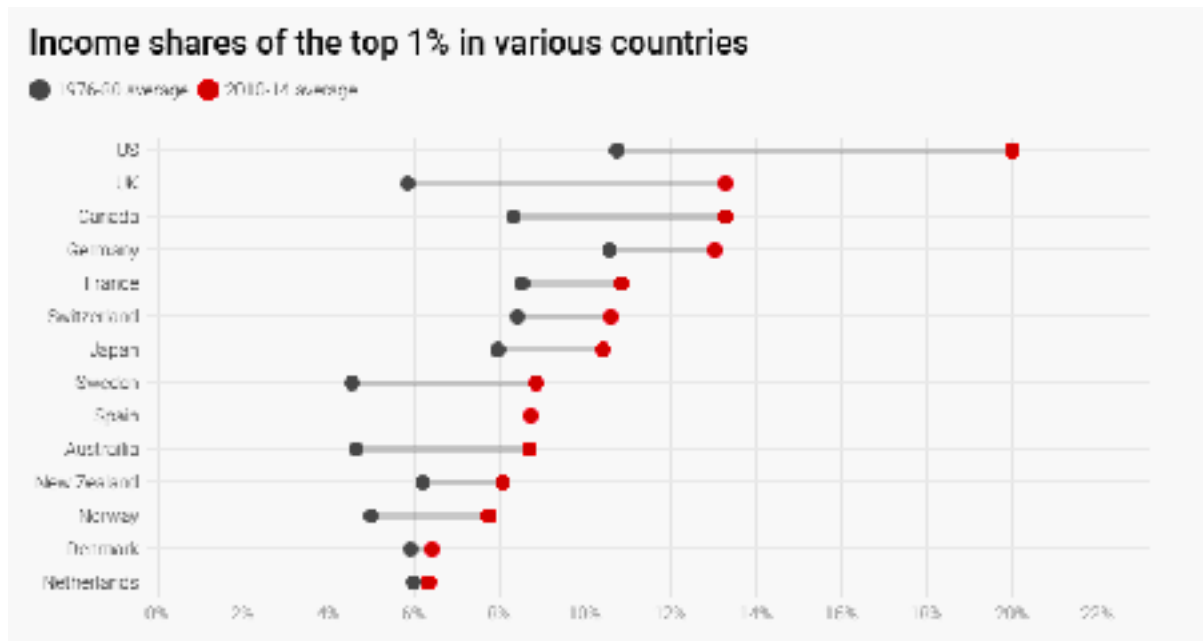


Image: The Conversation / World Wealth and Income Database

From the models above, we can see that in the past two decades, all the countries listed have experienced an increase in non-ideal inequality. This is further supported by a global study on income shares of the top 1% in various countries, whereby all countries shown to have increased in their top 1% income shares between 2010-2014 as compared to 1976-1980.

Nordic countries (in our case, Norway and Denmark) seem to have a fairer income equality than other countries. This is more obvious using a wider range of years, where Norway and Denmark have a significant overall decrease in their non-ideal inequality coefficients.



Vukuzenzele / Sweet Home, Cape Town, South Africa

Image: Johnny Miller / Unequal Scenes

While doing research on widening income inequality gaps, we came across the issue of urban poverty. As our project does not include less developed countries, it would be interesting to know how urbanisation may increase income inequality in a nation's transition to become more developed.

On the other hand, we postulate that the income inequality in various OECDs may be due to multiple factors such as failure in taxation policies, corruption, lack of strong trade unions and many more, each specific to a particular country.

1. Taxation

One key political factor is government policy, especially taxation. Countries that have made the biggest reductions to their top rates of income tax have seen the largest increases in the income shares of the people at the top of the income pyramid.

Norway, for instance, applies a tax of 0.85 percent on all net wealth above \$178,000—a low enough threshold that most small-business owners must pay it. USA, a more unequal country, however, has a top rate that is 50% lower in 2010 as compared to 1970s. At the company level, CEO pay tends to be much higher when the top income tax bracket is lower.

United States takes in much less tax revenue as a proportion of the overall economy than its OECD peers: At 26 percent of its GDP, the overall U.S. tax haul is near the bottom of OECD countries¹.

Tax policy plays a pivotal role in explaining top-end income inequality. Failure to establish fair taxation policies that maximises entropy under non-ideal situations may be a reason to the expanding income gap.

¹ Andrew Chatzky: Inequality and Tax Rates: A Global Comparison

<https://www.cfr.org/backgrounder/inequality-and-tax-rates-global-comparison>

2. Corruption

The Nordic countries of Denmark, Finland, Sweden, and Norway all ranked in the top 10 of least corrupt countries in the 2018 Corruption Perceptions Index from Transparency International while Iceland ranked in the top 20. United States ranked 22 and Malaysia ranked 61. Although correlation is not causation, it is consistent with the results we derived.

Singapore, however, ranks 3rd in the index, which is inconsistent with our hypothesis due to its high Gini index and non-ideal inequality coefficients. Hence, in the case of Singapore, it is likely that there are more important factors such as globalisation, strong commitment to meritocracy, and manpower policies towards attracting foreign talent.

3. Lack of strong trade unions

A trade union is an association of employees in one or several enterprises generally working within the same industry. Most trade unions are affiliated to a national federation, which is typically affiliated to a main confederation of employees.

Strong trade unions act as a power check on top income shares. They can push for egalitarian policies and bargain to increase wages in firms while reducing the amount of revenue going to executive compensation and shareholder dividends.

According to Gomez, Rafael and Tzioumis, Konstantinos (2006), unionisation decreased the compensation of top US executives by 12%. Yet, unions are on the decline in the U.S., and have been for a long time. In 2017, only 6.5 percent of private-sector workers in the U.S. belonged to one².

In contrast, unions are much stronger in Nordic countries than in the U.S. They are also very much different, valuing competitiveness over protectionism.

² US Bureau of Labour Statistics — Union Members Summary

<https://www.bls.gov/news.release/union2.nr0.htm>