Missing the Story

The OECD's Analysis of Inequality

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Executive Summary

The OECD recently published a lengthy volume examining the causes of rising inequality in most wealthy countries over the last three decades. This paper examines the study's main findings and brings in some additional evidence:

- The OECD misses most of the story of inequality because its primary focus is the ratio of the annual wage of the 90th percentile worker to the 10th percentile worker, while most of the benefits of rising inequality were concentrated much further up the income ladder. The 90th percentile worker in most countries barely got his or her share of productivity gains. This means that the analysis tells us little about what is actually driving inequality.
- The analysis of the growth in the 90-10 ratio includes some serious errors. Most importantly, it attributes much of the change in inequality to progress in technology. In contrast, our analysis shows that the impact of technology is negligible and actually trivially negative over this period.
- The OECD does find that labor market institutions, such as employment protection legislation and higher unionization rates, reduce inequality. The weakening of these protections over the last three decades is one factor leading to greater inequality. A reduction in tax rates across the OECD would also be predicted to lead to greater inequality.
- While the OECD neglects to look at the effect of the financial sector's share of GDP, our analysis shows a strong positive relationship between the size of the financial sector and the ratio of the wage of the 90th percentile worker to the 10th percentile worker. This suggests that the growth of the financial sector may have been an important factor contributing to the growth in inequality over the past 30 years.

This analysis also finds many errors in the use of data in the OECD's study, most importantly by exaggerating the number of independent observations when many of the data points are simply extrapolations. This causes the OECD to exaggerate the statistical significance of its findings.

Introduction

In the United States and many other wealthy countries, inequality has become a major political topic. The wealthy have seen their share of wealth and incomes grow substantially over the last three decades in many countries. In response, the OECD decided to examine trends in inequality and determine their causes.

It devoted a lengthy tome to this topic that was published at the end of 2011, titled *Divided We Stand: Why Inequality Keeps Rising*.[1] While this book contains much useful data and analysis, it sheds little light on the causes of inequality. Its core analysis essentially struck out in identifying any of the factors that were responsible for the increase in inequality. It does identify some factors that reduce inequality, such as unions and employment protection legislation, but it turns out that the year effect – e.g., the mere fact of it being 2006 rather than 1985 – explains *all* of the observed rise in inequality over the period examined.

Furthermore, the focus of the OECD analysis is on the increase in the ratio of the wages of the 90th percentile worker to the wages of the 10th percentile worker, which largely misses the important trend in inequality over this period, which involved a massive upward redistribution to those in the top 1 percent.

This first part of this paper discusses the OECD's key findings on the determinants of the rise in inequality, as measured by the increase in the ratio of the wages of the 90th percentile worker to the 10th percentile worker. There are some useful findings here, but the analysis is perhaps more interesting for what it doesn't find than for what it does find.

The second part shows the patterns in inequality over the last three decades using data from The World Top Incomes Database at the Paris School of Economics.[2] These data show that the increase in income at the 90th percentile in most countries is dwarfed by the increase in income at the 99th percentile, 99.9th percentile, and even the 99.99th percentile. In fact, in some OECD countries the 90th percentile worker barely kept pace with the rate of productivity growth in the economy, meaning that they were not, on net, beneficiaries of any increase in inequality. A serious analysis of increasing inequality would have to focus on the households further up the income ladder who have been the big winners in the last three decades.

1 Organization for Economic Cooperation and Development. 2011. *Divided We Stand: Why Inequality Keeps Rising*, OECD Publishing. http://www.oecd.org/els/social/inequality. Hereafter OECD.

2 Alvaredo, Facundo, Anthony B. Atkinson, Thomas Piketty and Emmanuel Saez. "The World Top Incomes Database." http://g-mond.parisschoolofeconomics.eu/topincomes.

3 One problem with the OECD analysis is that the reference point for the wage ratios is not consistent across countries. Ideally, we would like the hourly wage, since this measures pay per unit of work. While the OECD does use the hourly

What Explains Increasing Inequality?

As their main measure of inequality, the authors choose the wage of the 90th percentile worker divided by the wage of the 10th percentile worker.[3] In order to explain the variation in wages between countries and over time, they construct a cross-country panel dataset with a number of variables grouped into five categories: "trade integration," "financial integration," "technology," "labour market institutions and policies," and "other controls."

The results from their regression analysis (see **Figure 1** below), in isolation, show that trade has no statistically significant impact on wage inequality, though business research and development does increase inequality. Both increased post-secondary education and increased female employment significantly reduce inequality. Increased control of foreign direct investment appears to decrease inequality, but this effect disappears when controlling for the equalizing effects of increased unionization, increased product market regulation, increased employment protections, and higher taxes on labor. The authors write,

> The results suggest that changes in policies and institutions on the one hand and technological progress on the other are the two main forces that contribute to the annual increase in the D9/D1 wage differential…. The increased share of educated workers exerted a sizable equalising effect, offsetting about two-thirds of the rise in the D9/D1 ratio due to the combined effects of institutions and technology.[4]

They go on to suggest that "policies focusing on education can be a successful tool as the increase of average years of schooling more than balanced out the increase in wage inequality brought by technological change in OECD countries."[5]

While this last statement may be true, it does not explain the observed *increase* in inequality seen in the examined countries. In fact, the authors' results suggest that by far the largest single force contributing to the increase in inequality is an *entirely unexplained* secular trend. In other words, *given* that there has been a large increase in inequality between 1985 and 2006, policies and education matter. To see this, we perform an accounting that largely follows the OECD's methodology,[6] the results of which are presented in **Figure 2** below.

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3 One problem with the OECD analysis is that the reference point for the wage ratios is not consistent across countries. Ideally, we would like the hourly wage, since this measures pay per unit of work. While the OECD does use the hourly wage for some countries, it uses weekly, monthly, and even annual wage rates for other countries. This complicates the analysis since, for example, we could find an increase in the 90-10 ratio by these other measures simply due to the fact that more people decided to enter the labor force and work part-time. This rise in inequality would have a very different meaning from a rise in the ratio of hourly wage for workers at the 90th percentile to the hourly wage for a worker at the 10th percentile.

4 OECD, p.122.

5 OECD, p.123.

6 OECD, p.122. Specifically, we estimate the individual effect of the average annual change in each variable. For groups of variables, we estimate the sum of the individual effects. Statistical results are similar to, but vary slightly from, those implied by the results reported in the OECD study. The source data – as supplied privately by the OECD – should be identical.

FIGURE 1
OECD Regression Analysis Results

Table 2.1. **The impact of globalisation, technological progress and regulatory reform on trends in wage dispersion**

Dependent variable: natural logarithm of D9/D1 ratio of full-time earnings

	Baseline (Trade)	With financial regulation	With technology	With institutions and policies
	(1)	(2)	(3)	(4)
Trade integration				
ln(Total trade exposure)	0.049	0.059*	0.060*	0.035
	(1.37)	(1.72)	(1.66)	(0.95)
Financial integration				
ln(FDI restrictiveness index)		−0.049***	−0.049***	−0.001
[0-1, 0 open, 1 closed]		(−3.36)	(−3.35)	(−0.04)
Technology				
ln(Business R&D/GDP)[1]			0.103**	0.097**
			(1.98)	(2.06)
Labour market institutions and policies				
ln(Union coverage rate)				−0.039*
				(−1.90)
ln(PMR)				−0.040**
				(−2.26)
EPL				−0.052***
				(−4.62)
ln(Tax wedges)				−0.112***
				(−3.66)
Other controls				
ln(% has attained post-secondary education)	−0.119***	−0.152***	−0.156***	−0.116***
	(−6.56)	(−6.91)	(−6.89)	(−4.57)
ln(female employment share)	−0.173	−0.260**	−0.273**	−0.351***
	(−1.44)	(−2.22)	(−2.30)	(−2.92)
Other[2]	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Number of observations	333	333	333	333
Number of countries	22	22	22	22
Adjusted R-squared (within)	0.45	0.48	0.48	0.55

Note: t-statistics (in parentheses) are obtained from heteroskedasticity-robust standard errors. For definition of variables, see Annex 2.A1. *, **, ***: significant at the 10%, 5% and 1% level, respectively.

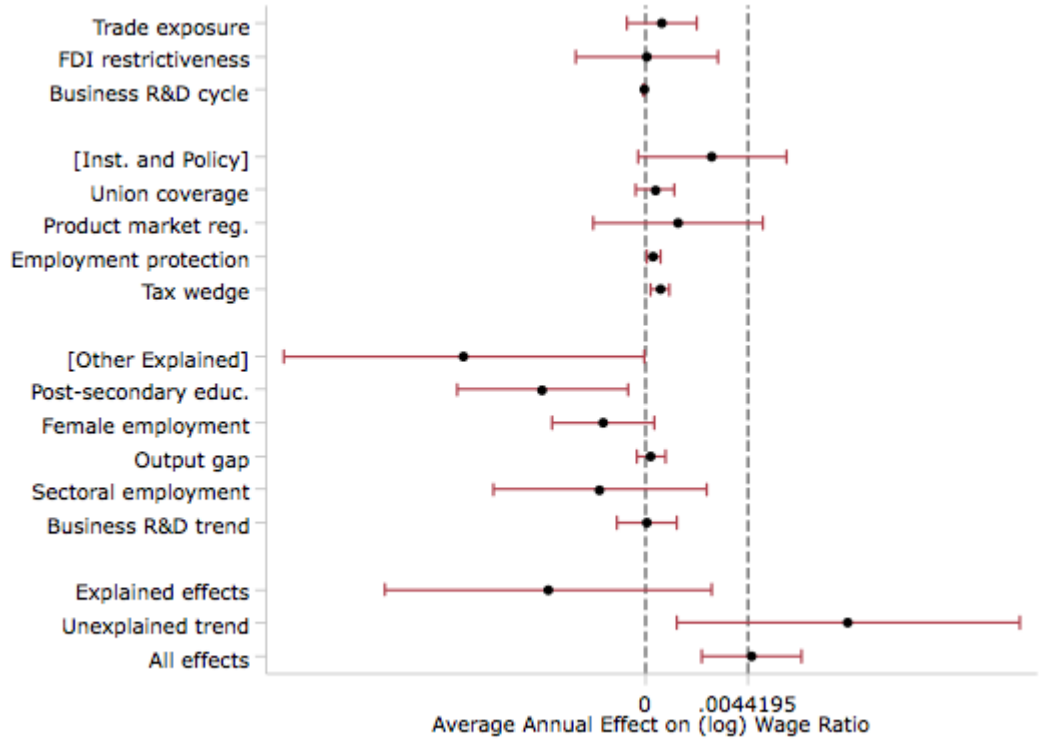
1. The variable is detrended using the Hodrick-Prescott (HP) filter (see note 6).
2. Other controls include the output gap, the sectoral share of employment (i.e. agriculture, industry and service) and the trend component of technology variable from the HP filter.

Source: See Annex 2.A1; OECD Secretariat calculations.

StatLink http://dx.doi.org/10.1787/888932537465

Source: OECD, p. 112. Also available at http://statlinks.oecdcode.org/812011111P1T006.xls

FIGURE 2
Accounting for the Increase in Inequality, 1985-2006



Note: The dependent variable is the change in the log of the ratio of the wage of the 90th percentile workers to the 10th percentile worker. Length of bars shows 95 percent confidence interval.
Source: Authors' analysis of OECD data; see Appendix Table 2 for data.

As indicated in Figure 2, the observed average annual change in the wage ratio was 0.44 percent. This implies that over 21 years, the income of the 90th percentile grew roughly 10 percent relative to the 10th percentile.

Considering all *explained* effects – the total predicted change in inequality based on the OECD's estimates of the impact of all the identified factors except the year – the model predicts a decrease in inequality over the 21-year period. On the other hand, the year effect – the mere fact of it being 2006, rather than 1985 – alone explains *all* of the average increase in wage inequality. From these results, it would be simply wrong to say we know what caused the increase in inequality.

Furthermore, though increased "technology" ("Business R&D trend" in Figure 2) appears to have a statistically significant impact on increasing inequality, it is only the cyclical component that is significant. This makes sense in the short run, as researchers are relatively well paid, and therefore more research could be associated with increasing wages at the top. The trend change in R&D was statistically insignificant, meaning that it had no measurable effect on inequality over this period. In order for the *cyclical* component of R&D to explain much of the increase in inequality, it would require unusual circumstances that do not appear in the data (*e.g.*, research cycles associating strongly across countries and peaking at the end of the period so that R&D happens to be above trend in the last year). Since this is not the case, the cyclical component of R&D has a trivial overall effect on the change in inequality over this period.

It appears that the OECD overstates the effect of technology on inequality. Though our elasticity estimates are very similar (0.098 compared to their 0.097) the OECD claims an average annual effect of 0.32 percent,[7] while we find an average effect of only -0.005 percent. We cannot account for this discrepancy. However, the fact that our elasticity estimates do agree closely implies the OECD's calculated impact for technology would imply a cyclical change that is hugely larger and in the opposite direction of what the data show. We therefore disagree that the study shows that technological change was an important driver of wage inequality over the period.

Rather than meeting the challenge of technological change, the importance of increasing post-secondary education may be to equalize wages by increasing competition in the higher deciles, while easing competition among lower-income workers.

On the other hand, we confirm that changes in labor market institutions and policies since 1985 likely have increased inequality – though there is a great deal of uncertainty as to what kind of effect on inequality has resulted from changes in product market regulation. According to our analysis, smaller tax wedges[8] have almost certainly increased inequality, by as much as perhaps 15 percent of the total change.[9] To a lesser extent, decreased employment protection contributed to increased inequality.

Not only does the OECD analysis fail to explain the increase in inequality, but the authors made some questionable choices in selecting their control variables. For example, the authors control for the shares of civilian employment in agriculture, industry, and services sectors. In total, these should account for 100 percent of employment. Therefore, it should be impossible to separate the effect of a change in one of the employment shares from changes in the other two. The authors of the study were only able to produce results because in practice the shares do not add up always to exactly 100 percent in the data. This indicates errors in rounding.[10] In effect, the model is not truly tying sectoral employment to inequality – rather it is relating data *errors* to changes in the wage distribution. The authors should have dropped one of the three variables in the group. In our replication of the OECD analysis, we find that each of these variables individually has a statistically significant impact on inequality, but their combined effect is not significant as their impacts largely offset each other.

The results might have looked very different if only two of the three sectoral shares had been included. Fortunately for the authors of the OECD study, dropping one share of employment has no real impact on the results. For example, when the agriculture share of employment is dropped from the model, the service share becomes only marginally significant and the industry share statistically insignificant. Additionally, dropping all three shares fails to change noticeably the other regression results. This strongly suggests that although the original analysis showed statistically

7 OECD, p.122, Figure 2.3.

8 The tax wedge is the difference in the pre-tax wage and the post-tax transfer wage, measured as a percent of the pre-tax wage.

9 It is important to remember that the income measure for many countries is not the hourly wage, but rather a measure that reflects the number of hours worked. This means that if lower tax rates on higher-end earners encouraged them to work more hours in a month or year, then this would show up as increase in inequality in the OECD measure, even if there was no change in the ratio of hourly wages.

10 In addition, there may be other errors in the data for Australia between 1985 and 1994. There, the sum for each year varies between 99.21 and 99.94 percent. By contrast, the range for all other observations is 99.99 to 100.01 percent.

significant effects, the association of sectoral employment shares with inequality was in no way meaningful.

The choice of "total trade exposure" as an independent variable in the analysis is certainly odd, given the availability of clearer measures of trade.[11] Regardless, most economists would not argue that trade between rich countries would have much impact on inequality. To their credit, the authors of the OECD study do examine alternative measures of trade – among them the ratio of imports from developing countries.[12] They find that increased imports from developing countries have an equalizing effect on wages, but only to the extent that the importing countries have strict employment protection. Increased developing-country trade with less-regulated economies has the effect of increasing inequality.

The logic here is that in the absence of strong labor market protections, imports from countries with low-paid workers can have a negative impact on the wages of workers. However, strong labor market protections can give labor markets time to adjust to the import shock and limit the downward pressure on wages.

Of greater concern, much of the data provided by the OECD is in fact sparse, with missing data interpolated. For example, the foreign direct investment regulatory restrictiveness index is very clearly interpolated for years other than 1981, 1986, 1991, 2000, and 2006.[13] About half the data for union coverage rates is interpolated. In their report, the authors state that data on post-secondary education is available only every five years between 1980 and 2000, requiring interpolation of half the observations used in the analysis. Other variables appear to be interpolated as well – including the wage ratio data – but less frequently. The infrequency of data makes the number of true country-year observations very small, but interpolation exaggerates the statistical significance of the results. Consequently, the reported level of statistical significance exaggerates the reliability of the study's findings.

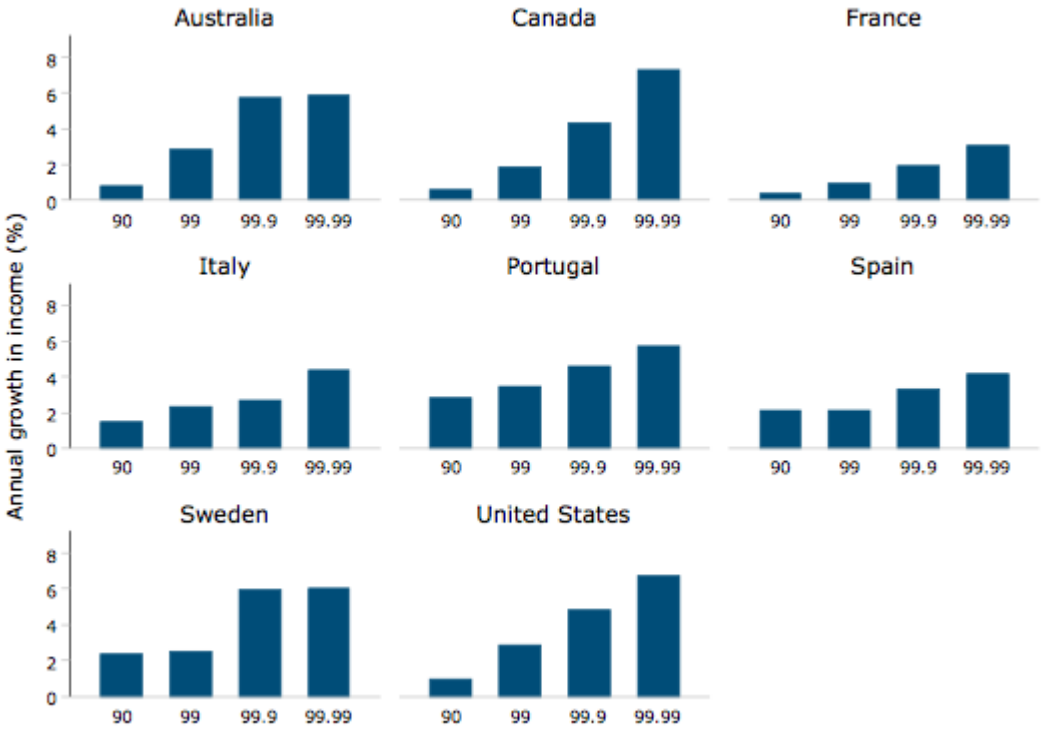
Measuring Inequality in the OECD

The authors of the OECD study employ as their measure of inequality the ratio of wages at the 90th percentile to those of the 10th percentile. However, the choice of this wage variable likely fails to capture much of the actual increase in inequality.

In fact, there has been a tremendous increase in inequality within the top 10 percent of incomes. In **Figure 3**, we see the real average annual percentage changes in income for the 90th, 99th, 99.9th, and 99.99th percentiles for several higher-income countries between 1985 and 2006.

11 See Appendix for details.
12 OECD, p.114, Table 2.2.
13 The FDI restrictiveness index is available on the OECD website for 1997, 2003, 2006, and 2010-12. See http://www.oecd.org/dataoecd/42/33/50188959.xlsx.

FIGURE 3
Increasing Inequality Within the Top Decile of Select Countries, 1985-2006

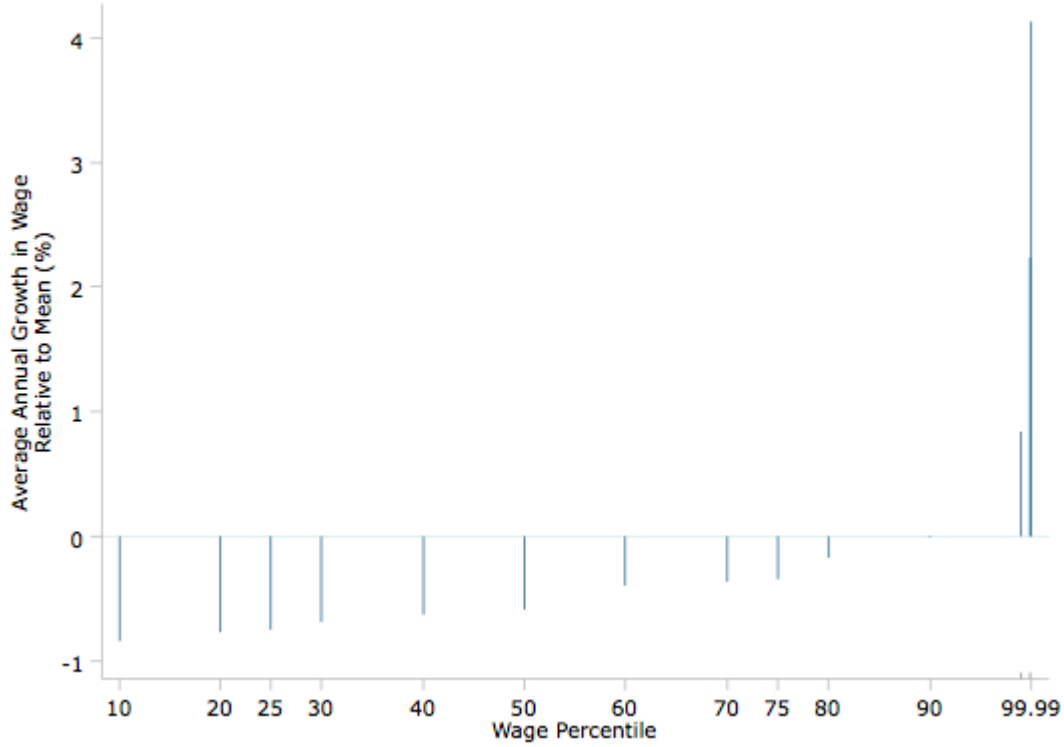


Source: Alvaredo, Facundo, Anthony B. Atkinson, Thomas Piketty and Emmanuel Saez. "The World Top Incomes Database." http://g-mond.parisschoolofeconomics.eu/topincomes.

As we see in the above figure, the incomes of the very top have grown much faster than those at the 90th percentile. Between 1985 and 2006, the income cutoff for the 90th percentile in the United States grew 22 percent – a bit more than 0.9 percent per year. By contrast, the income cutoff for the top 1/100th of 1 percent (the 99.99th percentile) grew 293 percent – more than 6.7 percent per year.

In addition, the OECD source data shows that from 1973 to 2010, below-average wage growth was experienced across the bottom 90 percent. **Figure 4** shows growth in wages at various percentiles relative to the mean.

FIGURE 4
Growth in Wages Relative to the Mean in the United States, 1973-2010



Source: The World Top Incomes Database and OECD, Distribution of gross earnings of full-time employees. http://www.oecd.org/dataoecd/9/59/39606921.xls

For earners in the bottom 90 percent, including at the 90th percentile, wage growth has been below average. The 99th percentile of earnings has grown a bit faster than the average, the 99.9th faster still, and for the 99.99th percentile, wage growth has been more than 4 percentage points faster than the average. This means that if real wages grew on average 1 percent a year, a person at the 99.99 percentile saw their income grow by 5 percent a year. The 90th percentile worker was still a loser in the inequality story in many OECD countries. The OECD effectively examined the growth in the gap between those workers who essentially held their own and those who lost a lot relative to the economy-wide average. It did not examine the growth in the gap between the winners and losers of increasing inequality.

Put another way, the very top earners have amassed a greater share of society's income, particularly in the U.S. The share of income going to the bottom 90 percent has fallen from nearly 68 percent in 1979 to a bit under 54 percent in 2010. However, of these 14 additional percentage points of total income, 8 went to just the top ½ of 1 percent and 6 to the other 9½ percent. Similarly, in 2010 the average income of the top 10 percent was 7.7 times that of the average for the bottom 90 – compared to only 4.3 times in 1979.[14]

14 If the bottom 90 percent has 67.65 percent of total income, then the earners have in total 67.65/32.35=2.1 times as much income as those in the top 10 percent. Because there are nine times as many earners in the bottom than the top, the average earnings in the top must be 9/2.1=4.3 as great.

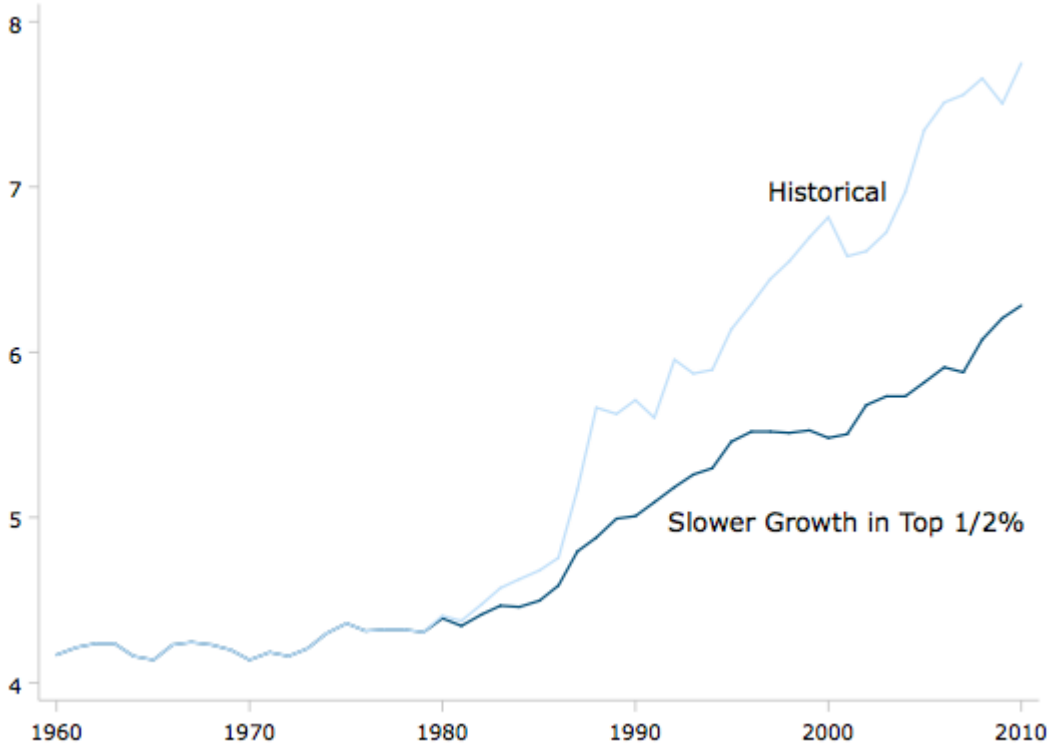
To illustrate the significance of this increase in inequality, let us redistribute some of the *disproportionate* income gains of the top ½ of 1 percent. Suppose that as a result of this change, inequality between the top ½ of 1 percent and the next ½ of 1 percent remained unchanged, even as the 1 percent as a whole took a larger share. The second ½ of 1 percent saw their share rise from 2.65 to 4.05 percent – a 53 percent increase in their *share*. Reducing the increase in the share of the top ½ of 1 percent from their actual 148 percent to match the 53 percent of the next ½ of 1 percent would have resulted in an increase in their share from 5.39 to 8.24 percent (instead of their actual increase to 13.37 percent) (see **Table 1**). This would imply that the ratio of incomes between the top and bottom halves of the 1 percent would remain steady, but still grow faster than the next 9 percent, let alone the bottom 90 percent.

TABLE 1
Wage Ratio of 90th percentile to 10th percentile under Alternate Scenario

	1979	2010	Growth in share	2010 with Redistribution	Growth in share
		Income Shares (percent)			
Top ½ of 1%	5.39	13.37	148	8.24	53
Next ½ of 1%	2.65	4.05	53	4.05	53
Next 9%	24.31	28.84	19	29.84	19
Bottom 90%	67.65	53.74	-21	58.87	-13
		Income Ratios			
Top ½ to Next ½.	2.0	3.3		2.0	
Top 10 to Bottom 90	4.3	7.7		6.3	

In this alternative scenario, the share of the bottom would still fall, but not as far as it had historically. As we see in the table above, the average income in the top 10 percent would grow to only 6.3 times that of the average in the bottom 90 percent. Without touching the incomes of the 90th through 99.5th percentiles, this rebalancing of income growth eliminates 40 percent of the increase in inequality between the top 10 and bottom 90 percent. **Figure 5** shows the results of this redistribution starting from 1979.

FIGURE 5
Change in the Wage Ratio of 90th percentile to 10th percentile under Alternate Scenario

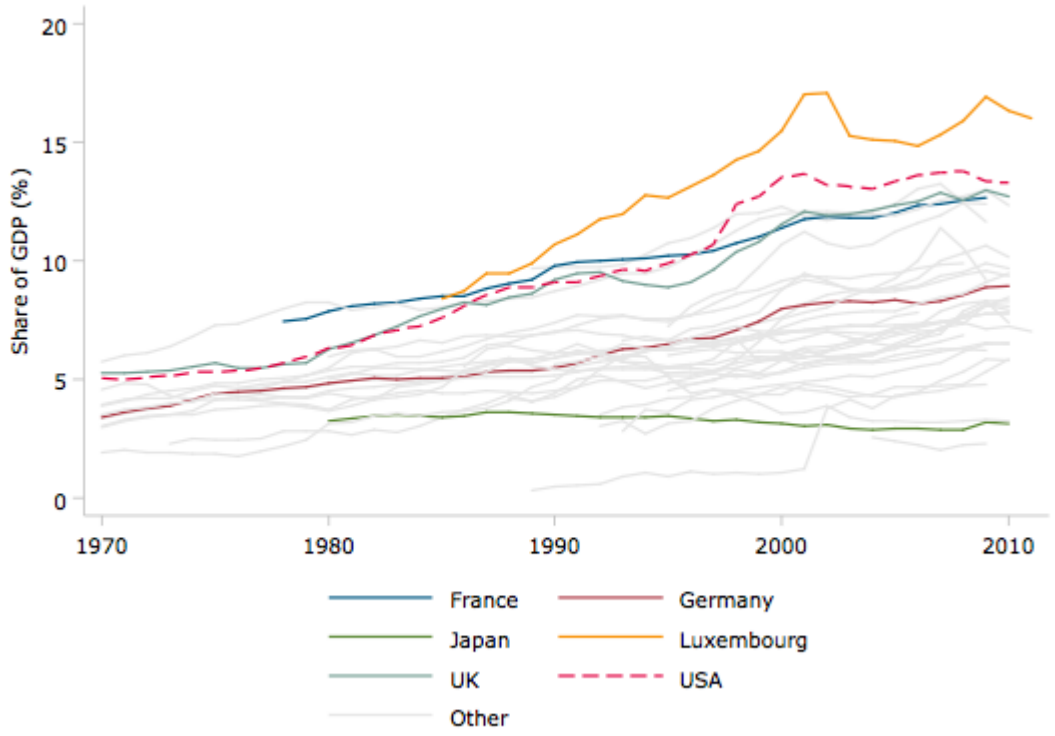


So it is clear that gains to the very high earners as opposed to the merely high earners form a substantial part of the growth in inequality and that the gains are sufficiently large as to explain an important share of the increase in the 90/10 wage ratio. It is therefore important to consider policies that may benefit very high earners in particular.

The OECD study does devote a chapter to inequality within the top decile, chiefly oriented toward tax policy. However, the authors miss this connection to broader inequality. To the extent that inequality at the very top reflects a redistribution from the larger populace, the 90/10 wage ratio will increase, implying more inequality by the OECD's measure, if the 90th percentile is merely better able to shield itself against redistribution than workers at the 10th percentile of wage distribution.

Finally, increasing financial intermediation, for example, has resulted in highly concentrated income gains. The share of GDP going to compensation in this sector has grown tremendously in recent decades, as seen in **Figure 6**.

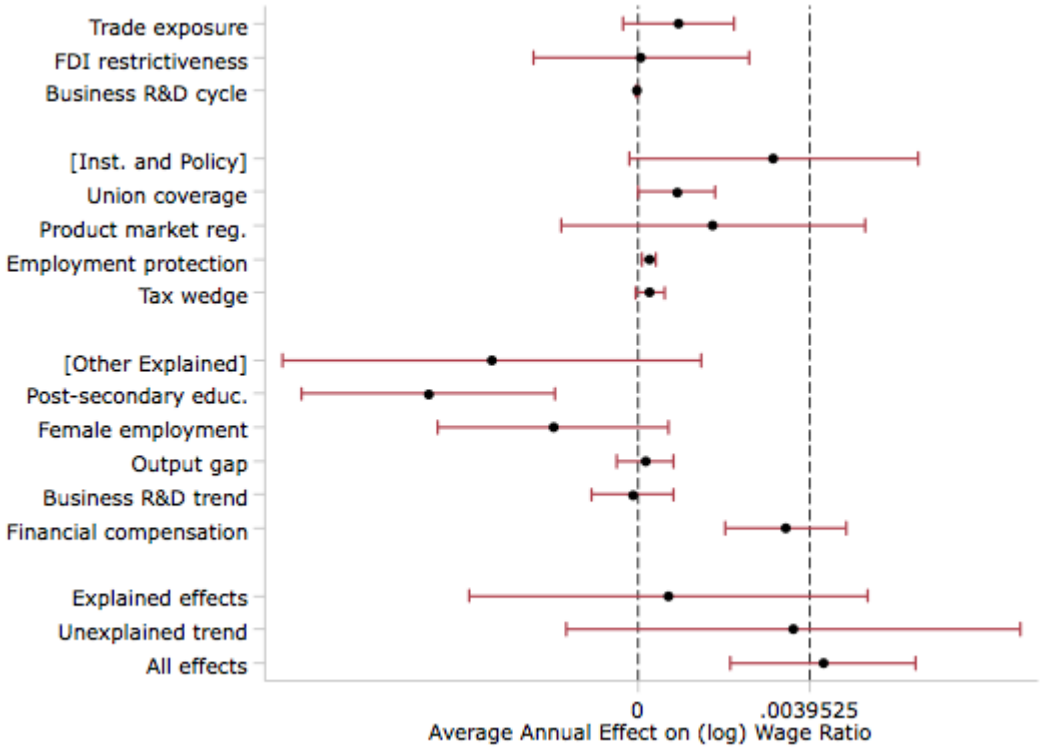
FIGURE 6
Compensation of Employees in Financial Intermediation in All OECD Countries



Source: OECD StatExtracts, http://stats.oecd.org/ .

As a preliminary investigation into the effect of increased compensation, we add this data to that provided by the OECD. In **Figure 7** we see the estimated effects, having included in their model (log) financial compensation as a share of GDP in place of the meaningless sectoral shares.

FIGURE 7
Effects Including Financial Intermediation and Year Trends



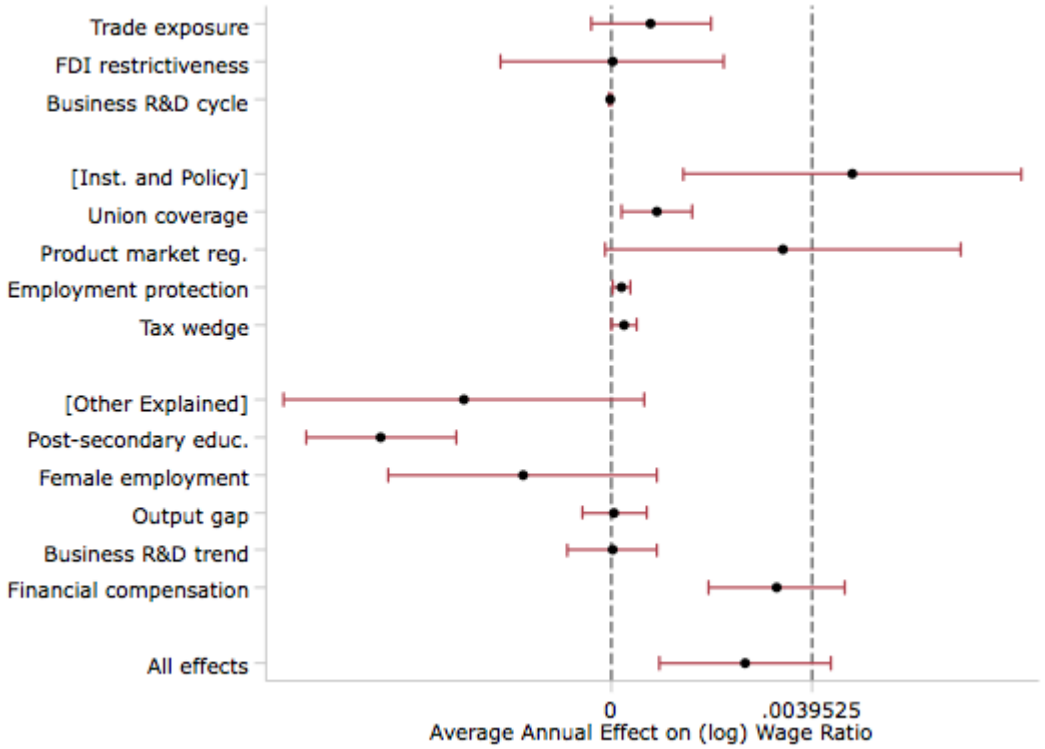
Note: The dependent variable is the change in the log of the ratio of the wage of the 90th percentile workers to the 10th percentile worker. Length of bars shows 95 percent confidence interval.
Source: Authors' analysis of OECD data.

As we can see, the results are largely similar to those produced previously. However, financial compensation has now explained a large portion of the year effect, which is now not statistically different from zero.

Furthermore, by dropping the year indicators from the model, we see in **Figure 8** that the increase in inequality is largely explained by an increase in compensation to financial intermediaries.[15] Importantly, the effect of changes in institutions and policies are seen to increase inequality – including declines in union coverage and weakened product market regulation. These effects were partly offset by increased post-secondary education, and (though not statistically significant) an increased share of females in civilian employment.

15 This is true even when controlling for the financial intermediation share of output, which may be equalizing, if not statistically significant. Controlling for compensation, increased output might be expected to be equalize wages. See Appendix for results.

FIGURE 8
Effects Including Financial Intermediation, Excluding Year Trends



Note: The dependent variable is the change in the log of the ratio of the wage of the 90th percentile workers to the 10th percentile worker. Length of bars shows 95 percent confidence interval.
Source: Authors' analysis of OECD data.

Of course, these extended models still rely on some interpolated data series, and therefore the results ought to be treated with similar skepticism as to the OECD's model. Nevertheless, these results suggest that the financial sector itself, rather than foreign inflows, may be an important factor. Similarly, consideration of policies that encourage inequality – say, expansion of patent rents or trade protection for high-income professionals, such as doctors and lawyers, are factors not considered in the study. Patent and professional protection within healthcare has strained the system of employer-based coverage in the United States. Maintenance of employer-based coverage in the face of extraordinary increases in insurance prices requires disproportionate wage restraint at the bottom of the income scale.[16]

In short, the gains to the very high earners, as opposed to the merely high earners, form a substantial part of the growth in inequality. The relative wages of the 90th and 10th percentiles are insufficient to describe the changes over the last 30 years.

16 Suppose an employer is ready to compensate worker A $20,000 plus $5000 in insurance and worker B $80,000 plus $5000 in insurance. If the price of insurance doubles, and each worker must take corresponding cuts in pay, then A's wage falls by 25 percent, compared to 6.25 percent for worker B. In effect, the wage of B rises from 4 times that of A to 5 times that of A.

Conclusion

The OECD study on inequality appears to overstate the significance of its results. In particular, the focus on technology, in the form of business R&D, appears to be particularly misplaced. Consequently, the authors fail to explain the increase in the wage ratio between the 90th and 10th percentile of earners.

Our analysis finds that changes in inequality in recent decades are driven in large part by increasing income shares at the very top – higher than the 90th percentile. Although the authors consider inequality within the top decile, important policies directed to the very top may drive income inequality below the 90th percentile.

Our analysis suggests that the financial sector is an important part of that picture. Many of the highest incomes in the United States and other countries are earned by people in the financial sector. Insofar as the financial sector is able to pull away more resources than it contributes to the economy, these earnings will come at the expense of people outside the sector, contributing to their relative decline in income.

Appendix

Regression Results

Appendix Table 1 shows the results of the various statistical analyses of wage inequality. Column 1 shows the regression results as reported by the OECD while column 2 shows our results based on the underlying data provided to us. Columns 3-5 show the results of models including financial sector compensation as an additional explanatory variable.

APPENDIX TABLE 1
Regression Results

	OECD		With Finance		
	Reported	Reproduced			
	(1)	(2)	(3)	(4)	(5)
Trade exposure	0.035	0.063	0.080	0.069	0.079
	(0.95)	(0.98)	(1.50)	(1.39)	(1.57)
FDI restrictiveness	-0.001	-0.002	-0.002	-0.0006	-0.003
	(-0.04)	(-0.05)	(-0.05)	(-0.02)	(-0.11)
R&D cycle	0.097*	0.098*	0.111*	0.079#	0.069
	(2.06)	(2.21)	(2.21)	(1.74)	(1.47)
Union coverage	-0.039#	-0.041	-0.071#	-0.072*	-0.084**
	(-1.90)	(-1.13)	(-2.05)	(-2.67)	(-3.08)
Product market reg.	-0.040*	-0.027	-0.032	-0.064#	-0.058#
	(-2.26)	(-0.81)	(-1.02)	(-2.01)	(-1.96)
Employment protection	-0.052*	-0.051*	-0.058**	-0.050*	-0.050*
	(-4.62)	(-2.64)	(-3.15)	(-2.65)	(-2.79)
Tax wedge	-0.112**	-0.164**	-0.070	-0.065*	-0.077#
	(-3.66)	(-3.50)	(-1.69)	(-2.10)	(-2.08)
Post-secondary educ.	-0.116**	-0.102*	-0.111**	-0.104**	-0.081**
	(-4.57)	(-2.49)	(-3.44)	(-6.39)	(-3.15)
Female employment	-0.351**	-0.356	-0.402	-0.355	-0.298
	(-2.92)	(-1.68)	(-1.53)	(-1.37)	(-1.06)
Output gap	Not	0.002	0.001	0.0005	-0.0004
	reported	(0.88)	(0.50)	(0.21)	(-0.19)
R&D trend	Not	0.006	-0.010	0.002	0.006
	reported	(0.14)	(-0.30)	(0.07)	(0.22)
Financial compensation			0.197**	0.188**	0.208**
			(5.06)	(5.07)	(7.18)
Financial output					-0.110
					(-1.48)
Sectoral effects?	Yes	Yes	No	No	No
Year effects?	Yes	Yes	Yes	No	No
N	333	333	310	310	310
R2 (within)	0.55 (adj.)	0.57	0.58	0.51	0.52

Effect Data

Appendix Table 2 below corresponds to that of Figure 2. Similar to the OECD accounting, the average annual change in each variable is multiplied by the appropriate regression coefficient to determine the average effect of the variable on the wage ratio.

APPENDIX TABLE 2
Estimated Contributions to Changes in Wage Ratio

Variable	Mean Annual Change	Estimated Effect on log Wage Ratio per Year	95% Confidence Interval (on effect) Low	High
Observed wage ratio (log)	0.0044			
Predicted wage ratio (log)	0.0047			
Trade exposure (log)	0.011	0.0007	-0.0008	0.0022
FDI restrictiveness (log)	-0.039	0.000	-0.003	0.003
Business R&D (cycle % GDP, log)	-0.00051	-0.00005*	-0.00009	-0.00000
- Institutions and Policies		0.0029#	-0.0003	0.0061
Union coverage rate (%, log)	-0.011	0.0004	-0.0004	0.0013
Product market regulation (log)	-0.052	0.001	-0.002	0.005
Employment protection	-0.0073	0.0004*	0.0001	0.0007
Tax wedge (%, log)	-0.0040	0.0007**	0.0003	0.0010
- Other		0.001	-0.003	0.005
Post-secondary education (%, log)	0.043	-0.004*	-0.009	-0.001
Female employment share (%, log)	0.0050	-0.002	-0.004	-0.000
Output gap (% GDP)	0.11	0.0003	-0.0004	0.0009
Agricultural employment share (%)	-0.18	-0.016*	-0.031	-0.002
Industry employment share (%)	-0.31	-0.02*	-0.05	0.00
Services employment share (%)	0.49	0.04*	-0.00	0.07
Business R&D (trend % GDP, log)	0.016	0.000	-0.001	0.001
Year effect	0.048	0.009*	0.001	0.016
- All sectoral employment shares		-0.002	-0.007	0.002
- Business R&D and Institutions		0.003#	-0.000	0.006
- Explained Effects		-0.004	-0.011	0.003
- All Effects (explained + year)		0.005**	0.002	0.007

Total Trade Exposure

The OECD has several measures of trade integration. The first is export intensity – the share of GDP that is exported. Next is import penetration – the share of domestic demand (GDP minus trade balance) that is filled by imports. Each of these measures makes sense. The OECD's preferred measure is trade exposure – defined as "a weighted average of import penetration and export intensity."

Unfortunately, even if both import penetration and export intensity increase, it may be that trade exposure falls. As an extreme case, we have Luxembourg, shown in **Appendix Table 3**. Between 1992 and 2007, its export share of GDP rose from 100.4 percent to 175.9 percent. Over the same period, imports rose from to 84.1 to 143.6 percent of GDP. Yet total trade exposure fell from 100.0 percent down to 14.8.

APPENDIX TABLE 3
Select Measures of Trade Openness, Luxembourg 1992-2007

	Exports/GDP	Imports/GDP	Import penetration	Trade exposure
1992	100.4%	84.1%	100.5%	100.0%
2007	175.9%	143.6%	212.2%	14.8
log change	+0.561	+0.536	+0.747	-1.907

Source: OECD StatExtracts, http://stats.oecd.org/ .

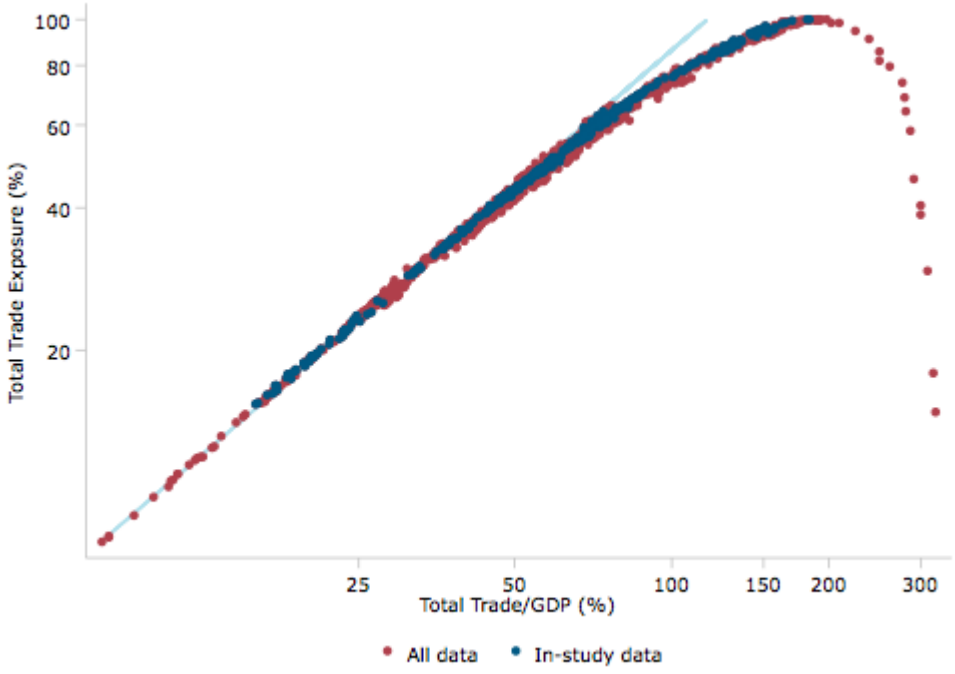
If this measure is to be believed, Luxembourg in 1992 was as exposed to trade as a country can get, yet in 2007 was as closed as China was in the early 1980s. The reason for this odd result is that the OECD actually calculates trade exposure as

$$TTX = \frac{X}{Y} + \left(1 - \frac{X}{Y}\right)\frac{M}{Y - X + M}$$

where X is exports, M is imports, and Y is GDP. Thus, the OECD increasingly penalizes import penetration when exports exceed GDP and therefore makes little sense for smaller, more open economies.

Fortunately, Luxembourg is an extreme case and is not one of the countries considered in the OECD study, so the use of trade exposure is not as problematic as this would appear. In fact, for the study sample, trade exposure relates very strongly to total trade (imports plus exports) as a share of GDP, as seen in **Appendix Figure 1** below. It is not obvious why the OECD would prefer this unusual measure.

APPENDIX FIGURE 1
Total Trade and Exposure



Source: OECD StatExtracts, http://stats.oecd.org/ .