Public Economics | Problem Set 1

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1 Lorenz Curve and Gini Coefficient

a)

Using the data, I can draw the interpolated Lorenz Curve from the points as[1]:

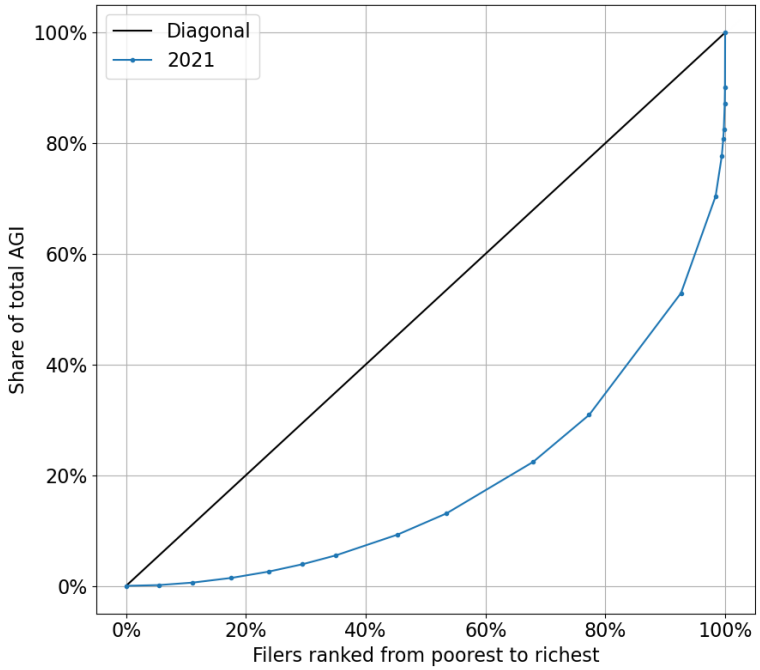

Figure 1: Lorenz curve for the AGI for 2021

From figure 1, it is visible that there in the US is a significant inequality in the adjusted gross income less deficits where the top 1% has around 25% of the total AGI.

To calculate the Gini coefficient, I find two times the area between the Lorenz curve and the 45° line. The resulting Gini coefficient for the United States in 2021 is 0.6279.

b)

Using the Lorenz curve from a), I can interpolate the income shares for the top 1% and top 10% earners.

1. The code used to generate this figure and all subsequent figures as well as calculating interpolated values and Gini coefficient is available at https://github.com/JohanOelgaard/ECON230B.git

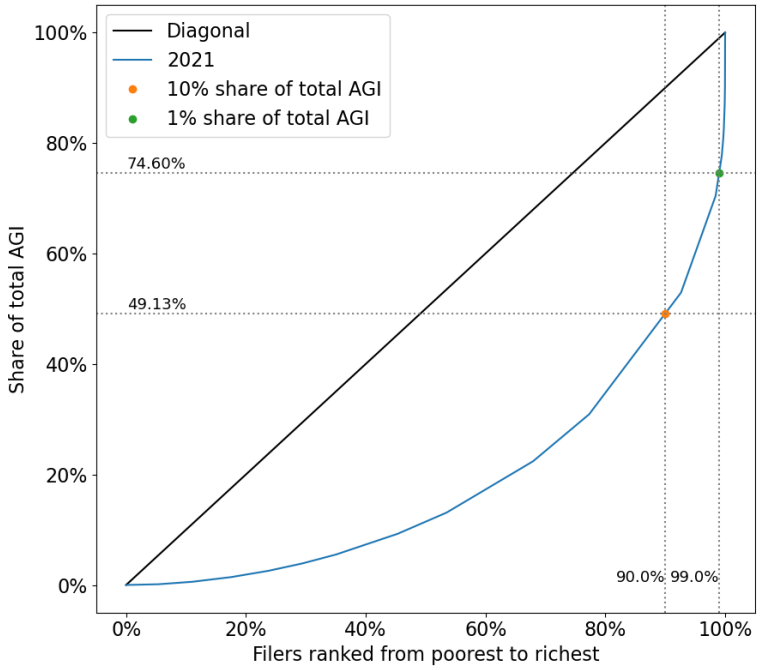

Figure 2: Top 1% and top 10% income share interpolated from the 2021 Lorenz curve

Based on the data presented in figure 2, I have calculated that the top 1% income share is 25.40% of the total income, while the top 10% income share is 50.87%. This indicates that the top 1% earns almost half of what everyone earns in the top 10%, revealing a significant income disparity, even among the wealthiest individuals.

c)

If we had access to the complete underlying microdata, we would have found more inequality than we currently see when we interpolate from a limited number of points, as done in sections a) and b). As we currently do a linear interpolation between points on the graph, we assume all people in the specific bin earn the same, thus failing to capture intra-bin inequality. Consequently, our linear interpolation underestimates the level of inequality because it does not consider the distribution within the bins that would see if we had access to the microdata. People with income near the top of the bin will have their incomes underestimated, while those at the lower part will have their incomes overestimated. The estimated Gini coefficient when using microdata will, therefore, be higher, and so would the income share for the top 10% and top 1% as these values are interpolated from the straight line.

If we are willing to assume a smoother distribution within the bins, we can use a Piecewise Cubic Hermite Interpolating Polynomial (PCHIP) to interpolate a smoother curve.

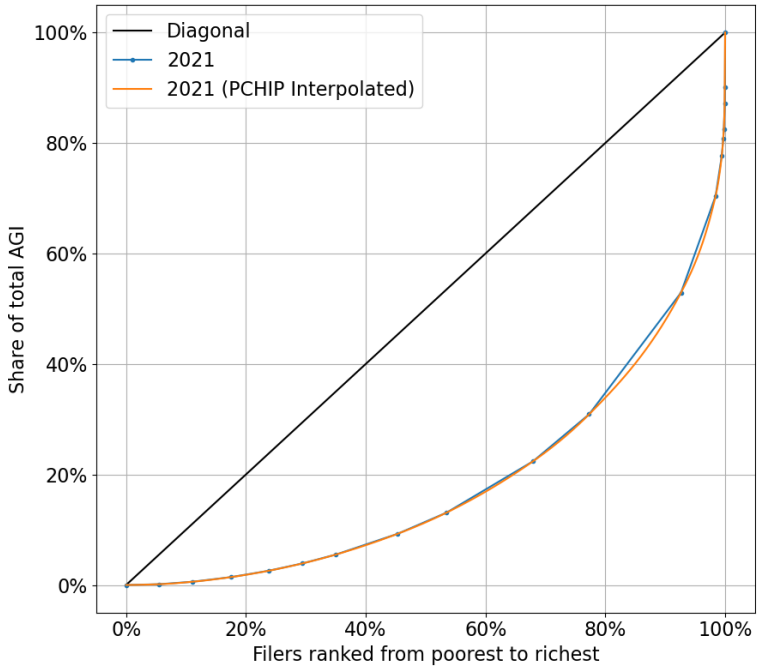

Figure 3: Interpolating the Lorenz curve using linear interpolation and PCHIP interpolation

The PCHIP interpolation shown in figure 3 is not necessarily a more accurate way to measure exact inequality. However, it shows that if we had access to the underlying microdata and could create a smoother curve, the resulting Gini coefficient would be higher, and so would the income shares for the top 10% and 1%.

d)

I start by plotting the Lorenz curve for 1993.

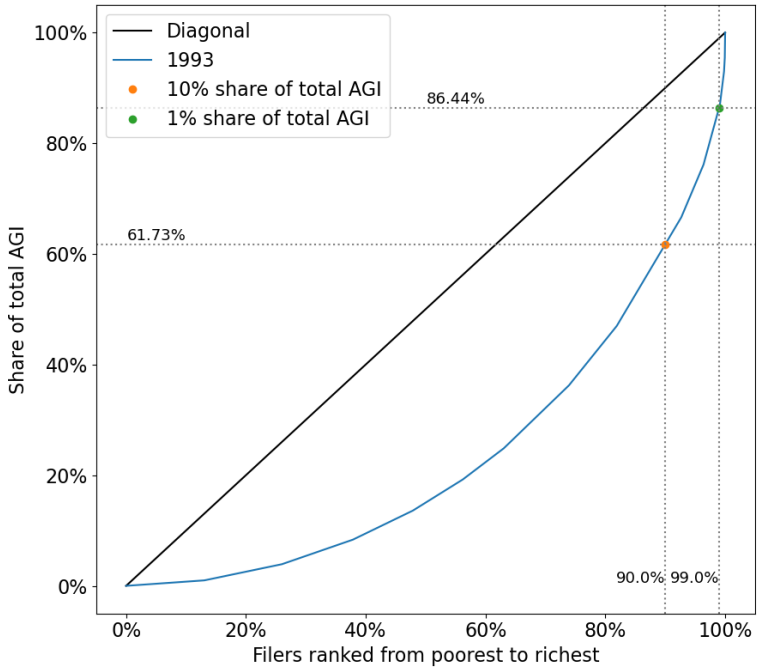

Figure 4: Top 1% and top 10% income share interpolated from the 1993 Lorenz curve

Figure 4 shows that in 1993, the income share for the top 10% was 38.27%, while the income share for the top 1% was 13.56%. This means that the income of the top 1% accounts for approximately one-third of the total income for the top 10%. The calculated Gini coefficient for the US in 1993 was 0.5296.

e)

In sections a)-d), I looked at the Lorenz curves for the adjusted gross income less deficits for 1993 and 2021. From plotting the curves together in figure 5, it is apparent that the Lorenz curve for 1993 is indeed closer to the 45° line than the Lorenz curve for 2021.

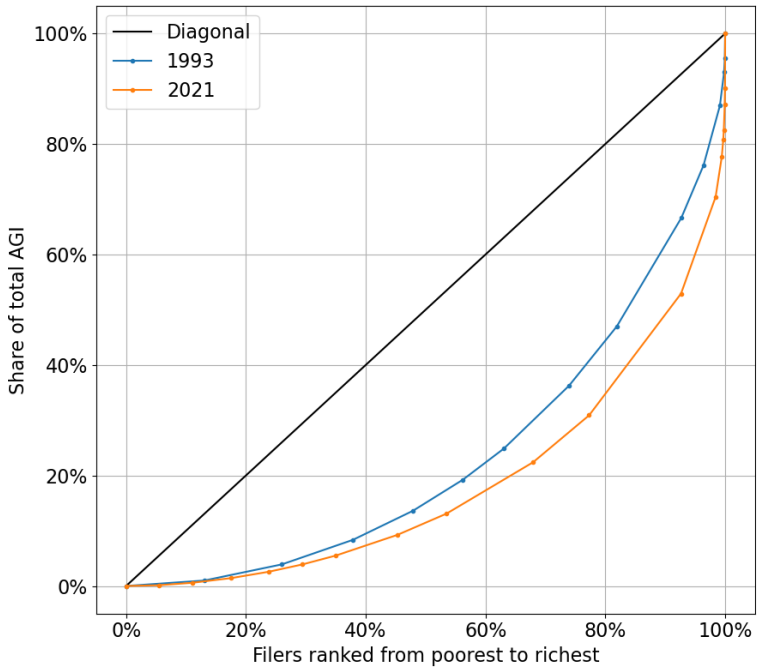

Figure 5: Comparing the 1993 and the 2021 Lorenz Curve

This is also what the calculated numbers point to, with a Gini in 1993 of 0.5296 compared to a Gini in 2021 of 0.6279. What is further interesting to see is the development in the top 1%'s and the top 10%'s share of income. The top 1% had an income share of 13.56% in 1993 and 25.40% in 2021, an increase of $\sim 12\%$. If we look at the top 10% share, this has increased from 38.27% in 1993 to 50.87% in 2021 – again $\sim 12\%$. Thus, the increase in inequality that these the results from a)-d) point towards is primarily driven by an increase in income share among just the top 1%.

Thus, I find mathematical evidence that the incomes of the top 1% have increased more than the rest of the incomes of the rest of the population. However, it is important to note that this is not definite proof of increased inequality over the past 30 years, as we have only looked at two specific years that could be outliers. Moreover, we have only considered income inequality for a given year, not lifetime income or wealth inequality. Although it is unlikely, our evidence does not rule out the possibility of significant mobility between income deciles each year, leading to low inequality when examining lifetime income.

2 Chasing Natural Experiments within a Country

a)

I have chosen the 2021 tax reform in the Czech Republic as described in the 2022 OECD report[2] pages 273-274. In January 2008, the Czech Republic abolished their progressive tax system in favour of a 15% flat tax rate. As of January 2021, they abandoned this and reintroduced a progressive tax system with a marginal tax rate of 23% at the top. The gross income up to the social security payment cap of CZK 1,701,168 (2021 threshold, USD ∼70,000) for 2021 will still be subject to the 15% rate, while gross income exceeding CZK 1,701,168 will be subject to a 23% tax rate.

Additionally, they changed the tax base from using a "super-gross salary" model that included social security and health insurance payments paid by the employer to just the gross income. This means most of the population experienced a tax reduction from this, though no change in the marginal tax.

b)

As this is quite an extensive tax reform that affects both the top and bottom, there are several ways to use this as a natural experiment to study labour supply. I will focus on the effect of the change in marginal tax rate among the wealthiest population in the Czech Republic and thus look at the intensive margin and the intensive elasticity. As the tax base and thus also the tax for the lower incomes are reduced, one could also look at the extensive margin of the labour supply and the participation elasticity.

To estimate the effect of the higher marginal tax rate, I will use a similar approach as Saez 2010[3] and utilise the kink introduced into the tax system to examine the bunching around this kink. Subsequently, after calculating the excess mass around the kink, I can calculate the income elasticity as: the excess mass around the kink, I can calculate the income elasticity as

$$\varepsilon = \frac{dz/z}{dt/(1-t)} \tag{1}$$

I note that as the marginal tax rate jump is 8%, there will be an income effect. Thus, I cannot estimate pure compensated elasticity; instead, I can estimate a mix of compensated and uncompensated elasticity from this. To determine the excess mass around the kink, I will use data from before the tax reform to estimate the contrafactual density.

Using this method, I assume that the gross incomes of the taxpayers in question are actually a direct product of their labour supply and that they, thus, can adjust their supply properly. If this is not the case, there will likely be little bunching around the kink as incomes are more fixed. Additionally, to properly estimate the densities, I would either have to assume no trend increase in the salaries or remove this trend. However, to do so, I would assume that wages around the kink have grown at the same pace as wages in general.

c)

To perform this study, I would need data to calculate the general salary increase, then take the upper tax bracket limit of CZK 1,701,168 and calculate where this limit would have been five

2. OECD, *Taxing Wages 2022*, Type: doi:https://doi.org/10.1787/f7f1e68a-en (2022), https://www.oecd-ilibrary.org/content/publication/f7f1e68a-en.

3. Emmanuel Saez, "Do Taxpayers Bunch at Kink Points?" [In en], *American Economic Journal: Economic Policy* 2, no. 3 (August 2010): 180–212, ISSN: 1945-7731, 1945-774X, accessed March 3, 2024, https://doi.org/10.1257/pol.2.3.180, https://pubs.aeaweb.org/doi/10.1257/pol.2.3.180.

years prior. With this, I would need the cross-sectional gross income data for all individuals with incomes in the range CZK ±100,000 from the limit for the five years prior and the following years, i.e. the years 2016-2023.

This would give five years of data to estimate a contrafactual distribution and the years following to see the immediate effect and if the adjustment increases over time.

As I would need it on an individual level to estimate densities, the data is not publicly available. However, I could likely get access to the data through either the Czech Republic, the Financial Administration, or the Czech Statistical Office.

d)

I have looked into if others have already looked at the effects of this tax reform. I have found one paper in depth describing the effect of the tax reform on the effective tax rate.[4] However, I have not found any papers looking into the labour supply effects of it.

4. Michal Krajňák, "Evaluation the impact of the personal income tax reform in the Czech Republic in 2021 on effective tax rate and tax progressivity," *Journal of Tax Reform* 7, no. 2 (2021): 134–145, https://EconPapers.repec.org/RePEc:aiy:jnljtr:v:7:y:2021:i:2:p:134-145.