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An analysis of the effects on the top and upper middle
income shares in Ireland**

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When the Celtic Tiger relaxed its corporate tax bite: An analysis of the effects on the top and upper middle income shares in Ireland

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Abstract

In 1997, the Irish government introduced reforms to revolutionize corporate taxation, with focus on creating opportunities for tax neutrality and on reducing the standard corporate tax rate. This paper studies the relationship between this Irish corporate tax reform and income shares at the top and the upper middle of the distribution. Using the synthetic control method, findings suggest that the reforms had large positive effects on the income share of the top 1% and sizeable negative effects on the upper middle 40% of income earners. Such heterogeneous effects indicate increasing income inequality due to targeted corporate tax incentives.

Keywords: Income Inequality, Top Income Shares, Corporate Tax, Synthetic Control
JEL Codes: D63, H25, O38, O52

Section 1 | Introduction

In the 1990's and early 2000's, Ireland experienced an economic miracle with unprecedented transition from an economy based primarily on agricultural production to one that has successfully competed in the global information technology market. The Irish economy expanded at an average rate of 8.9% between 1994 and 2000, earning Ireland the title Celtic Tiger. The Taxes Consolidation Act of 1997 that promoted gradual reductions in corporate tax rates combined with additional tax incentives for corporates is likely to have attracted foreign multi-national corporations (MNCs) investing in the Irish economy and driving its growth. However, as the benefits of economic activity are unevenly shared across the income distribution, distributional concerns motivate the utilization of the synthetic control method (SCM) for case studies to examine how the corporate tax reform might have affected the income distribution in the Celtic Tiger era. The results show that the implementation of new laws regulating corporate taxation in Ireland led to a significant increase in the income shares held by the top 1% of income earners, while the income share of the upper middle 40% declined.¹ The effects indicate increasing levels of income inequality and remain stable until the financial crisis marks a structural break. The results are robust to several robustness checks.

Section 2 | Background

Today, the Republic of Ireland is effectively one of the largest tax havens globally (Tørsløv et al., 2018), with a highly tax privileged corporate sector attracting billions of shifted profits from abroad. One of the foundations leading to this status quo was laid in 1997, when the Irish government decided to reduce the standard corporate tax rate applicable to trading profits from 36% to 12.5% in 2003, applying annual reductions of four percent. Additionally, Section 110 of the Irish Taxes Consolidation

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¹ The upper middle 40% describes an income share ranging between the 50th and 90th percentiles (P50-P90).

Act was designed as a specific tax neutral scheme to create a favourable tax environment for special purpose vehicles whose taxable profits can be minimized or eliminated with appropriate structuring. For example, interest payments for loans raised to enable the Irish investment vehicle to manage or hold its assets are tax deductible (McLoughlin et al., 2015). This mechanism is especially attractive when flexible interest rates can vary with profits of the investment vehicles to neutralize taxable profits. To attain tax neutrality, foreign companies have continued to follow tax planning strategies that exploit gaps in the Irish corporate taxation to shift profits.

From a redistributive view, an erosion of corporate tax rates can be interpreted as a transfer away from public spending on public goods and services such as health and education systems and towards the pockets of trading companies, investment vehicles, and MNC's, as well as their shareholders. Hence, the benefits of lowered corporate tax rates could increase after-tax profits of corporates, thus increasing income opportunities for those individuals residing at the top of the income distribution. Alternatively, the inflow of foreign direct investment made by companies sensitive to corporate taxation, might create new high value employment opportunities in capital intensive sectors like pharmacy and financial securitization, improving chances of higher incomes for skilled labour. Indeed, Ireland's net inflows of foreign direct investment average at 13.3% as share of GDP from 1997-2015, signalling a tremendous rise compared to an exiguous 1.4% during the pre-intervention period.

Previous studies linking tax reforms and income inequality are rare (Rubolino and Waldenström, 2020); and an earlier study by Nolan (2003) exploring inequality in Ireland is only of descriptive nature. For a few selected countries, Rubolino and Waldenström (2020) find evidence that increases in the top percentile of income shares follow reductions in the top marginal income tax rates. Exploring statelevel data for the United States suggests positive effects of corporate tax cuts on top income shares (Nallareddy et al., 2018). This paper uniquely contributes to the literature by directly estimating the causal effects of the Taxes Consolidation Act on income earners at the top and the upper middle. Focusing on top income earners is of particular interest they receive the largest share of total income, driving the shape of the entire income distribution (Atkinson et al., 2011), while the upper middle 40% represents the skilled labour force.

Section 3 | Methodology & Data

Using the synthetic control method developed by Abadie and Gardeazabal (2003) and expanded in Abadie et al. (2010), this study estimates the treatment effects of the Irish corporate tax reform on the income distribution in Ireland. This method compares a single treated unit with an estimated counterfactual, the synthetic control, which is a weighted combination of untreated units, called donors. Weights are obtained by minimizing the differences between the treated unit and its synthetic control in all relevant pre-intervention characteristics quantitatively described by the outcome and predictor variables. Here, I construct a synthetic Ireland that represents an evolution of the income distribution absent of reforms in corporate taxation. Differences in the income distribution between actual and synthetic Ireland after 1997 can be attributed to the Irish corporate tax reform.

To achieve a good pre-intervention fit, the pool of potential donors consists of untreated countries that are economically, culturally, and geographically most similar to actual Ireland. 20 OECD countries characterized as high-income economies with democratic governments form the donor pool. All donor countries, except Japan, are either European or practice the Anglo-Saxon capitalist model. Table 1 shows the weight assigned to each donor to construct synthetic Ireland. For the first outcome variable, the income share of the top 1% of income earners, synthetic Ireland is composed of circa 40% Austria, 27% Belgium, 1% Denmark, 12% Norway, 20% New Zealand. The second outcome variable of interest is the income share of the upper middle 40% (P50-P90), and its synthetic Ireland exhibits a similar

composition of donors. Data for both inequality measures is sourced from the World Inequality Database (www.wid.world).

Table 1:
Donor pool countries and share to construct synthetic Louisiana

Country	Weight	
	Top 1%	Mid 40%
Austria	0.401	0.271
Belgium	0.271	0.375
Denmark	0.014	0
Norway	0.116	0.289
New Zealand	0.198	0.066

Note: Only donors with non-trivial weight are shown. Donors only assigned trivial weight include Australia, Canada, Finland, France, Germany, Great Britain, Greece, Japan, Italy, Netherlands, Portugal, Spain, Sweden, Switzerland, and the US.

Table 2 shows pre-intervention averages of the outcome and predictor variables used to create the respective synthetic control.² With a deviation of only 0.15 percentage points (+1.6%), the difference of the top 1% income share between actual and synthetic Ireland is marginal, indicating a good pre-intervention fit. The income shares of the upper middle 40% are nearly identical and merely differ by 0.12 percentage points (-0.3%). The other macroeconomic predictor variables are free of disturbing mismatches and deviate in average by around 10%. Most predictor variables are taken from the World Bank (www.data.worldbank.org), while measures of real GDP per capita and capital stock come from the Penn World Tables (www.rug.nl). The debt-to-GDP ratio is drawn from the International Monetary Fund (www.imf.org/en/Data).

Table 2:
Inequality predictor means of actual and synthetic Ireland

Variables	Ireland	Synthetic Ireland	
		Top 1%	Mid 40%
Top 1% income share	0.0928	0.0913	
Mid 40% income share	0.4637		0.4650
Capital stock, logarithmized	13.0280	13.9503	14.1144
Consumer price index	0.5513	0.6003	0.6033
Trade volume share	1.0975	0.7890	0.8634
Government spending share	0.1933	0.1965	0.2024
Real GDP per capita, logarithmized	10.1897	10.3638	10.4506
Foreign direct investment share	0.0143	0.0149	0.0153
Debt-to-GDP ratio	0.7971	0.7202	0.7661
Gross capital formation share	0.2040	0.2411	0.2425
Population growth (in %)	0.4428	0.3937	0.3324
Urban population share	0.2613	0.2233	0.2155
Patent applications by residents, logarithmized	6.4699	7.1301	6.9868
Life expectation (in years)	74.3235	75.1715	75.5956
Age dependency ratio	63.9799	50.9488	51.5690
RMSPE	-	0.00274	0.003047

Note: This table shows the pre-intervention average of the outcome and predictor variables for actual and synthetic Ireland.

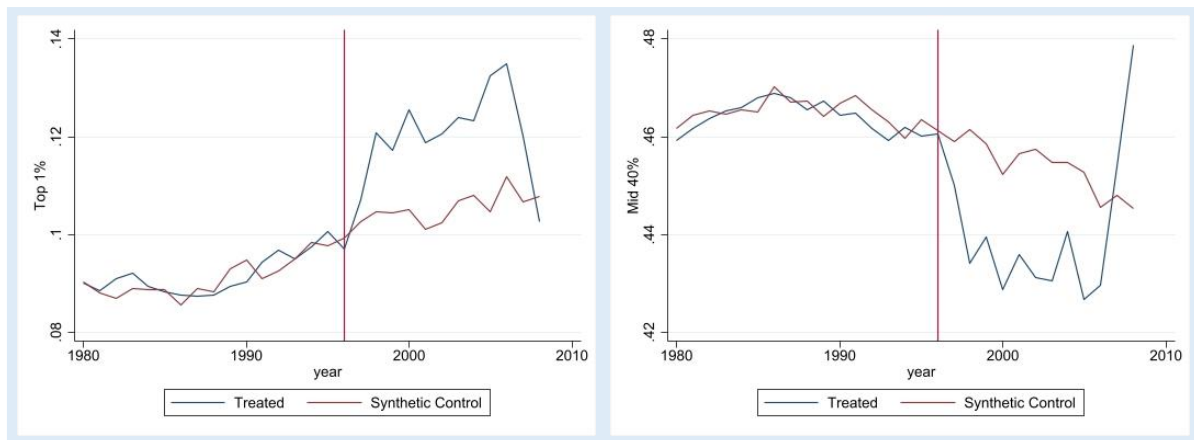
² The pre-intervention period is from 1980 to 1997.

Section 4 | Results & Robustness

Results. Main results of the SCM estimation are presented in [Figure 1](#). The Irish synthetic controls closely track the pre-intervention trends, but after the corporate tax reform, the evolution of actual and synthetic Ireland begin to substantially deviate. The estimated effects are measured as the difference between the post-intervention deviation of the respective income share in actual and synthetic Ireland. Income shares going to the top 1% immediately increased relative to its synthetic control, indicating a positive effect of the corporate tax reform on the most affluent income earners. For the income shares of the upper middle 40%, the existing gap suggests a negative effect. The effects continuously expanded until the Celtic Tiger went extinct in response to the Irish property bubble in 2007 and the financial crisis in 2008.

Figure 1:

Ireland and synthetic Ireland before and after the corporate tax reform.



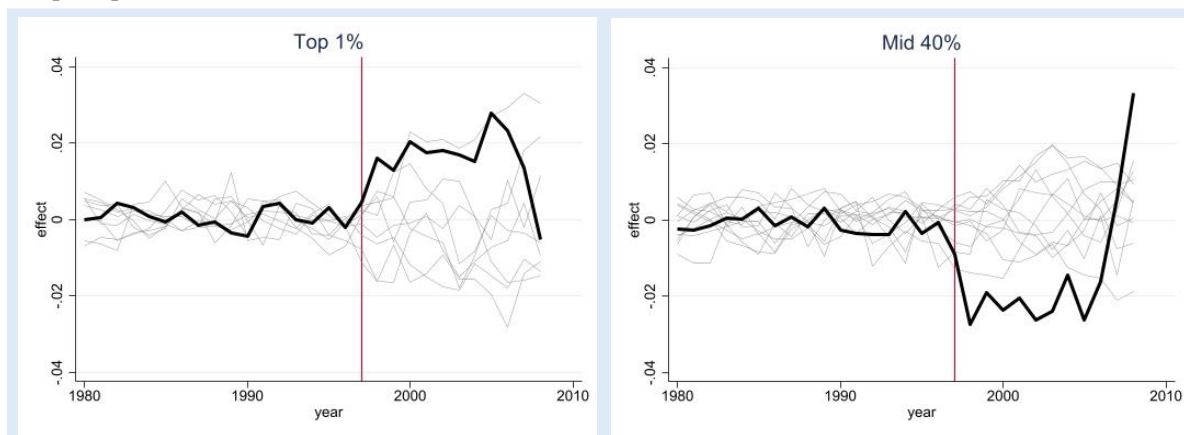
Note: Trends in the top 1% income share (left) and the upper middle 40% income share (right) in actual and synthetic Ireland.

Testing for statistical validity of these treatment effects involves performing “in-space” placebo tests and running permutation tests as suggested by [Cavallo et al. \(2013\)](#). The placebo test artificially assigns the intervention to originally untreated countries in the donor pool and iteratively applies the synthetic control estimation to each of them as if the intervention had occurred there. All estimated placebo effects and the effects experienced by synthetic Ireland form a sampling distribution of comparable treatment effects for each given post-intervention year that can be ranked by absolute values. The p-values indicate the proportion of placebo effects larger than the treatment effects for Ireland. This procedure has the advantage to gauge the evolution of statistical significance associated with the estimated effects overtime. Notably, deviations of estimated effects in the post-intervention period are more likely to grow with increasing root mean square errors (RMSPE) in the pre-intervention period ([Absher et al., 2020](#)). This would cause p-values to be too conservative. To adjust the poor goodness of fit in the pre-intervention period, I restrict the set of placebos and exclude countries with an RMSPE two times greater than Ireland’s RMSPE in the pre-intervention period. This conditioning has the disadvantage to limit the number of donors in the original pool, which reduces the power of statistical inference. Thus, the statistical inference should be based on standardized p-values that are obtained by dividing all the effects by their corresponding RMSPE ([Absher et al., 2020](#)).

For the top 1% and the upper middle 40%, differences between the donor country and its corresponding synthetic control are displayed in [Figure 2](#). The in-space placebo analysis shows that the rise of top 1% income shares in Ireland is mostly larger than in other countries, except from Canada. However, the differences between actual and synthetic Ireland and between actual and synthetic Canada are comparable in size, with a better goodness of fit in the pre-intervention period observed in Ireland. The estimated effects of the upper middle 40% are constantly ranked highest. Combined evidence

suggests that Ireland is an outlier in the distribution of placebo effects, with an unusual, perceivable gap unlikely to be explained by a fortuitous event.

Figure 2:
In-space placebo tests



Note: The black line is the difference between the actual and synthetic income share of the top 1% (left) and the upper middle 40% (right) in Ireland. Lines coloured in grey represent the placebo tests using donor countries with an RMSPE of at most two times higher than Ireland's in pre-intervention period.

Table 3 summarizes the estimated effects of the corporate tax reform on the Irish income shares of the top 1% and the upper middle 40% and provides, for each post-intervention year, information about the statistical significance. Three forms of p-values are reported including the restricted normal p-value, the restricted standardized p-value, and the unrestricted standardized p-value.

In 1998, the first complete year of the new corporate tax laws in operation, Ireland's top 1% income share is 1.61 percentage points above its synthetic control, while the actual income share of the upper middle 40% of the Irish income earners is 2.73 percentage points lower. For the following period from 1999 to 2006, however, the positive effects on the top 1% grow in size, with restricted and unrestricted standardized p-values remaining statistically significant at the 1% level. The restricted p-values show a maximum probability that the effects happen by chance of 12.5% which is close to conventional significance levels. Over the same time horizon, the negative effects on the upper middle 40% stabilize and average at minus 2.12 percentage points, describing a gap of almost 5% between actual and synthetic Ireland. Across all three types of p-values, these estimated effects possess statistical significance at the 1% level.³ After 2007, the significance of the gap between Ireland's actual and synthetic top 1% income share disappears entirely. In 2007, this is also true for the upper middle 40%. This abrupt ending is probably precipitated by Irish housing bubble in 2007. And, in 2008, the estimated effect turns positive with statistical relevance most likely in response to the financial crisis. Overall, the results obtained from the performed placebo and permutation tests propose a high level of significance of the estimated effects of the corporate tax reform on the Irish income distribution at its very top and its upper middle.

³ The restricted p-value in 2004 is the only exception.

Table 3:

Effects on income shares of the top 1% and the upper middle 40% in Ireland.

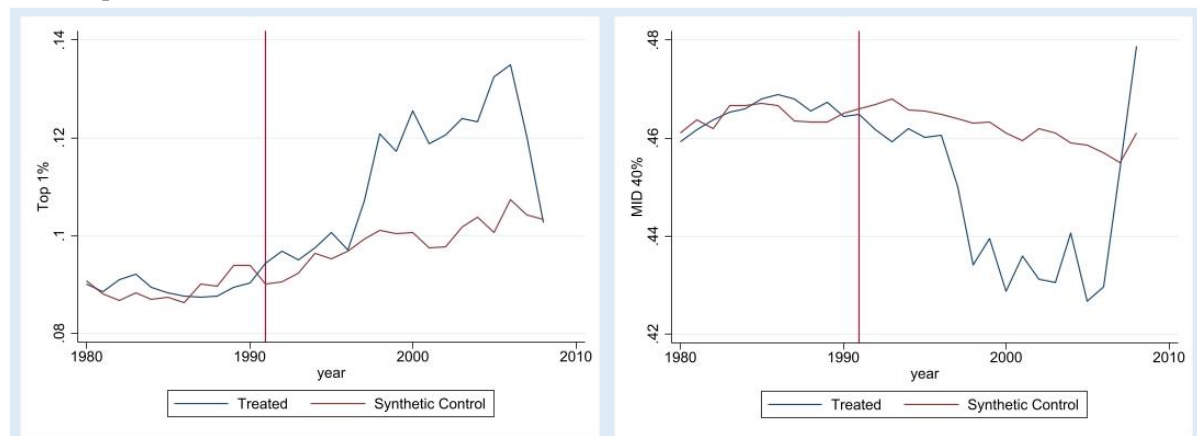
Year	Top 1%				Mid 40%			
	Effect	p-value	std. p-value	std. p-value	Effect	p-value	std. p-value	std. p-value
1997	0.0045	0.25	0.125	0.2	-0.0090	0.091	0.000	0
1998	0.0161	0	0	0	-0.0273	0.000	0.000	0
1999	0.0130	0.125	0	0	-0.0191	0.000	0.000	0
2000	0.0204	0.125	0	0	-0.0236	0.000	0.000	0
2001	0.0176	0.125	0	0	-0.0205	0.000	0.000	0
2002	0.0182	0.125	0	0	-0.0263	0.000	0.000	0
2003	0.0170	0.375	0	0	-0.0240	0.000	0.000	0
2004	0.0153	0.25	0	0	-0.0143	0.182	0.000	0
2005	0.0278	0	0	0	-0.0261	0.000	0.000	0
2006	0.0231	0.25	0	0	-0.0160	0.000	0.000	0
2007	0.0136	0.5	0.25	0.15	0.0058	0.636	0.636	0.5
2008	-0.0052	1	0.875	0.75	0.0333	0.000	0.000	0
# Countries	-	8	8	20	-	11	11	20

Note: Each effect results from the gap between actual and synthetic Ireland. The calculation of p-values excludes donor countries with an RMSPE two times higher than Ireland's in pre-intervention period. The donor pool of standardized p-values remains unrestricted. The number of countries involved calculating the p-values is also reported.

Robustness. Three robustness checks are applied to further give support to the main results. The first is an in-time placebo test, where the year of Irish corporate tax reform is intentionally and falsely assigned to 1992, five years before the actual structural change. That placebo test in time considers a placebo tax reform effect from 1992 to 1997. [Figure 3](#) presents the results of this falsification exercise for both income shares, illustrating little divergence between actual and synthetic Ireland in the five years after 1992. For the top 1%, the actual income share is marginally above its synthetic control, whereas the actual income share of the upper middle 40% ranges slightly below the one of synthetic Ireland. The lack of statistically significant effects in this timely counterfactual scenario, reinforces robustness of the main results.

Figure 3:

In-time placebo tests.

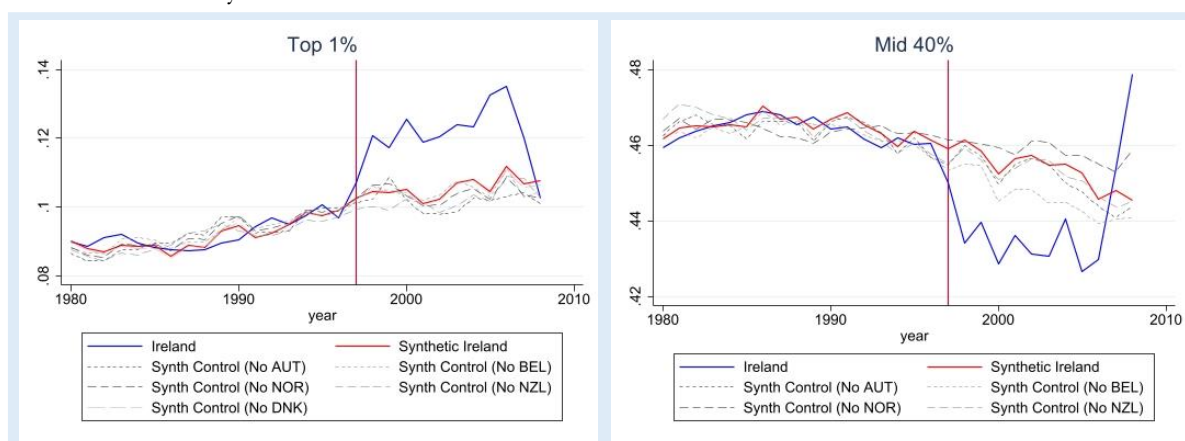


Note: This test assigns a falsely timed intervention to 1992, five years before the actual Irish corporate tax reform.

Next, a leave-one-out analysis, as proposed by [Abadie et al. \(2015\)](#), is applied to test sensitivity of the main results when countries with a positive weight are iteratively excluded from the donor pool. The test constructs several new synthetic controls, each with a specific country removed. If some of the new synthetic controls do not come close to matching the original synthetic Ireland, it stands to reason

that the removed country is driving the results. As apparent from [Figure 4](#), for the top 1%, all restricted synthetic controls closely match to each other and with the original synthetic Ireland, providing plausible evidence that none of the countries removed drives the results. Regarding the upper middle 40%, the synthetic controls are reasonably similar to each other. The only concern comes from the smaller effects estimated when Belgium, the country with the largest weight in the original synthetic Ireland, is excluded. Nevertheless, in that case, only the estimated effect in 2004 is close to actual Ireland, while the evolution of the synthetic control still mirrors the other synthetic controls. This means that Belgium does not drive the evolution of the synthetic control but might lead to higher estimated effects. Thus, it is likely that the main results present upper bound estimates.

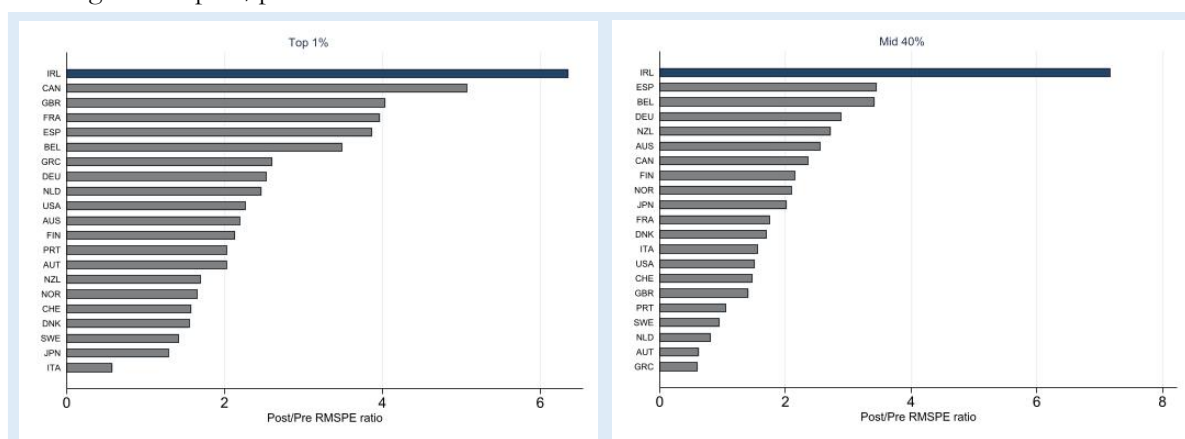
Figure 4:
Leave-one-out analysis.



Note: The grey dashed lines are synthetic controls iteratively excluding countries with the positive weight.

Another way to evaluate the magnitude of actual Ireland's gap relative to those of the placebo countries is by taking the ratio between the post-intervention RMSPE and the pre-intervention RMSPE. The intuition behind is that larger post-intervention RMSPEs are less indicative if the synthetic control fails to adequately reproduce the evolution of the outcome variable in the pre-intervention period ([Abadie et al., 2015](#)). The post/pre-RMSPE ratio penalizes a poorly matching pre-intervention trends and close trends after the intervention. [Figure 5](#) displays an Ireland ranked highest for both income shares of interest, with less than 5% ($1/21=0.0476$) probability of randomly picking such a high value from the donor pool. The combined evidence consistently suggests a marked distinction in the time trend before and after the Irish corporate tax reform.

Figure 5:
Rankings of the post/pre-RMSPE ratios.



Note: The ranking is in descending order, with number one at the top.

Section 5 | Conclusion

With the passing of the Taxes Consolidation Act in 1997, the Celtic Tiger significantly lessened its corporate tax bite, potentially accelerating the unequal sharing of benefits generated in midst of an already flourishing economy. Applying the synthetic control method, this paper is the first to advance the understanding of a causal relationship between this Irish corporate tax reform and the income distribution. The SCM estimation finds statistical evidence for positive effects on the top 1% income shares in the years after the new regulations were at play, while negative effects are estimated for the income shares of the upper middle 40%. In relation to the pre-intervention means, the magnitude of the effects is economically highly relevant. For example, the top 1% income shares in 1998, 2000, and 2005 would have been 17.4%, 22.0%, and 30.0% lower, respectively, in an Ireland without a corporate tax reform compared to actual Ireland. Treatment effects for both income shares were immediately perceptible and mostly remained statistically significant over the following decade. It was only the financial crisis that imposed a structural break that confounds further inference beyond 2008. Overall, the results suggest that the gap between income earners at the top and in the upper middle 40% of the income distribution has widened due to reformed corporate taxation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Abadie, A., & Gardeazabal, J. (2003). The Economic Costs of Conflict: A Case Study of the Basque Country. *American Economic Review*, 93 (1), pp. 113-132.
- Abadie, A., Diamond, A., & Hainmueller, J. (2010). Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program. *Journal of the American Statistical Association*, 105 (490), pp. 496-505.
- Abadie, A., Diamond, A., & Hainmueller, J. (2015). Comparative Politics and the Synthetic Control Method. *American Journal of Political Science*, 59 (2), pp. 495-510.
- Absher, S., Grier, K., & Grier, R. (2020). The economic consequences of durable left-populist regimes in Latin America. *Journal of Economic Behavior and Organization*, 177, pp. 787-817.
- Atkinson, A. B., Piketty, T., & Saez, E. (2011). Top Incomes in the Long Run of History. *Journal of Economic Literature*, Vol. 49, No. 1, pp.3-71, DOI: 10.1257/jel.49.1.3.
- Cavallo, E., Galiani, S., Noy, I., & Pantano, J. (2013). Catastrophic Natural Disasters and Economic. *The Review of Economics and Statistics*, 95 (5), pp. 1549-1561.
- McLoughlin, S., Hedigan, M., & Callaghan, K. (2015). Coming to Europe—Structuring CLOs with Irish Issuers. *The Journal of Structured Finance*, 21 (2), pp. 39-44.
- Nallareddy, S., Rouen, E., & Suárez Serrato, J. (2018). Do Corporate Tax Cuts Increase Income Inequality? *NBER Working Papers*, 24598, pp. 1-52.
- Nolan, B. (2003). Income Inequality during Ireland's Boom. *Studies: An Irish Quarterly Review*, 92 (366), pp. 132-142.
- Rubolino, E., & Waldenström, D. (2020). Tax Progressivity and Top Incomes: Evidence from tax reforms. *The Journal of Economic Inequality*, 18, pp. 261-289.
- Tørsløv, T. R., Wier, L. S., & Zucman, G. (2018). The Missing Profits of Nations. *NBER Working Paper*, 24701, pp. 1-56.