Did Latvia's Flat Tax Reform Improve Growth?

Bibek Adhikari and James Alm*

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* Bibek Adhikari, Department of Economics, 206 Tilton Hall, Tulane University, New Orleans, LA 70118 (email badhikar@tulane.edu). James Alm, Department of Economics, 208 Tilton Hall, Tulane University, New Orleans, LA 70118 (phone +1 504 862 8344; fax +1 504 865 5869; email jalm@tulane.edu). We are grateful to Stefano Barbieri, Raj Chetty, Keith Finlay, Michael Gallagher, Seth Giertz, Steven Sheffrin, and Jay Shimshack for helpful comments and discussions. We are especially grateful to Alan Barreca, Michael Darden, and Dan Teles for very detailed and insightful suggestions. This paper is a significantly shortened version of a paper presented at the November 2013 Annual Meetings of the National Tax Association in Tampa, FL and the January 2014 Allied Social Science Association Meetings in Philadelphia, PA.

INTRODUCTION

Estonia introduced a flat rate income tax system in 1994. Within a decade, several other countries in Eastern and Central Europe had followed suit (Latvia, Lithuania, Russia, Serbia, Slovak Republic, and Ukraine), and there are now more than 30 jurisdictions around the world with some form of a flat income tax, including countries in Latin America and the Caribbean (Grenada, Belize, Paraguay, and Trinidad and Tobago) and in Asia (Iraq, Mongolia, and Timore Leste).

A major argument put forward by advocates of a flat tax reform is the effect that such a reform would have on economic growth, due to its supposed effects on work, saving, entrepreneurial activity, capital formation, and the like (Hall and Rabushka, 2007). However, demonstrating these growth effects from actual country experience has proved elusive.

This paper analyzes the impact of flat tax reform on economic growth using synthetic control methods (SCM), focusing especially on the impact of the flat tax in one of the earliest countries to introduce the reform, Latvia. We compare the difference in GDP per capita and its growth rate before and after the reform for Latvia to a weighted average of similar but "untreated" (e.g., no tax reform) countries. We find positive and statistically significant impacts of tax reform in Latvia. (See Adhikari and Alm (2014) for a complete analysis of Latvia and 7 other Eastern and Central European countries that adopted flat tax systems between 1995 and 2005 (Estonia, Russia, Slovak Republic, Ukraine, Georgia, Romania, and Turkmenistan).)

LATVIA'S TAX SYSTEM

Before the flat tax reform in 1997, Latvia had a progressive income tax with rates that ranged from 15 percent to 35 percent. The 1997 reform introduced a flat income tax at the rate of 25 percent, and as of January 2014 the rate is still 25 percent. Note that there is some confusion regarding the exact date of the flat tax implementation in Latvia, either 1995 or 1997. However, according to Keen, Kim, and Varsano (2008) Latvia reformed its income tax in 1994 with the basic rate at 25 percent and the top marginal rate of 35 percent, which later was reduced to 10 percent. It was only in 1997 that Latvia moved to a single tax rate from the preceding two tax rates. The corporate income tax rate at the time of reform was 25 percent, but it was later reduced to 15 percent. The value of personal allowances was slightly reduced during the reform, with new allowances set at approximately 19 percent of per capita income. Dividend and interest income were exempt both before and after the reform.

SYNTHETIC CONTROL METHODS

Synthetic control methods are a data-driven way of finding the “appropriate” counterfactual in generalized Difference-in-Differences (DID) estimation. DID estimation consists of identifying a specific “treatment” (in our case, flat tax reform), and then comparing the difference in outcomes before and after the treatment for the treated country to the difference in outcomes before and after the treatment for the untreated countries. The synthetic control method (SCM) was developed by Abadie and Gardeazabal (2003) and expanded by Abadie, Diamond, and Hainmueller (2010, 2014). At its heart is the idea that the effect of a particular intervention can be empirically assessed only by comparison with the appropriate counterfactual, and the SCM uses a data-driven approach to find this counterfactual.

In standard DID studies, the researcher selects the comparison group that mimics the counterfactual. However, Abadie, Diamond, and Hainmueller (2010) argue that this introduces substantive ambiguity about how comparison groups are chosen since researchers select comparison groups based on subjective measures of affinity between the treated country and the untreated countries. The main advantage of the SCM is that it solves this problem by creating a “synthetic” control unit that resembles the “treated” unit in the pre-treatment period, using a weighted average of all other units in the donor pool. The weights are chosen so that the pre-treatment outcomes and the covariates of the synthetic control unit match on average the outcomes and covariates of the treated unit. After the synthetic control unit is chosen, the SCM then compares the performance of the treated unit against the performance of the synthetic control unit after the intervention, where the difference in the outcomes of the treated unit and the synthetic control unit gives the “dynamic treatment effect”.

In our application to Latvia, we calculate dynamic treatment effects up to ten years, looking at both the level and growth rate of GDP per capita. We also calculate the SCM “average treatment effect" (ATE), or the difference between Latvia and synthetic Latvia after the treatment (the "SCM ATE"). We also calculate the DID average treatment effect (the "DID ATE"), or the difference between Latvia and synthetic Latvia after the treatment less the difference between Latvia and synthetic Latvia before the treatment. We restrict the donor pool to the countries of Eastern Europe and Central Asia only to control for unobservable regional characteristics associated with, say, geography, the level of economic and political development, culture, and any other secular changes over time.

To assess whether the comparison country created using the SCM is an "appropriate" counterfactual, we need some measure of how well the synthetic country mimics the treated country before the treatment. Abadie, Diamond, and Hainmueller (2010) use root of the mean of the squared prediction error (RMSPE). Instead, we use "pre-treatment fit index" developed by Adhikari and Alm (2014) to assess the overall quality of the pre-treatment fit. A pre-treatment fit index of 0.X implies that the fit of the trend in the outcome variable of Latvia and synthetic Latvia is equal to that created by a X percent deviation of outcome variable on each pre-treatment period.

To evaluate the significance of treatment effects, we conduct a series of "placebo" experiments by iteratively estimating the placebo treatment effect for each country in the donor pool (i.e., the untreated countries) by assuming that they implemented flat tax reform on the same year as Latvia and running the synthetic control method, while shifting Latvia to the donor pool. This iterative procedure provides a distribution of estimated placebo treatment effects for the countries where no intervention took place. Next, we calculate a "p-value" by taking the ratio of number of placebo treatment effects that are larger than the treatment effect for Latvia to the total number of placebo countries in the experiment. The p-value can be interpreted as the probability of obtaining an estimate larger than the one obtained for Latvia. Note that running the placebo experiment only on regional donor pool leaves us with a small number of countries, which means that the size and the power of the test will be small. Therefore, following Adhikari and Alm (2014), we run the placebo experiment using a worldwide sample of countries to make our results more robust, in which each placebo treatment effect is calculated controlling for unobservable regional characteristics, achieved by restricting the donor pool of each placebo units to their respective region (e.g., Eastern Europe and Central Asia, Latin America and Caribbean, Middle East and North Africa, Small Islands, South Asia and Pacific Island, Sub Saharan Africa, and Western Europe and offshoots). In the next section we describe the application of the SCM to the specific case of Latvia.

IMPLEMENTATION

In the first step, the SCM assigns weights to each of the covariates that can range from 0 to 100 percent but must add up to 100 percent, such that the variables that can most accurately predict the trend in the outcome variable of Latvia before the treatment receive the highest weights. The most predictive covariates (with weights shown in parenthesis) are GDP per capita in 1994 (79.4 percent), GDP per capita in 1993 (11.6 percent), GDP per capita in 1995 (6.9 percent), GDP per capita in 1996 (2 percent), and democracy dummy (0.04 percent). Population growth rate, investment share, inflation, schooling and openness have negligible predictive power, and thus are assigned 0 percent weights. Next, the algorithm finds the synthetic country as a linear combination of countries in the donor pool, such that two conditions are fulfilled: the chosen synthetic country matches the values of the variables with highest predictive power as closely as possible with the values of the same variables of the treated country, and the RMSPE (equivalently, pre-treatment fit index) of the outcome variable is minimized. Individual countries in the synthetic unit and their contribution (which ranges from 0 to 100 percent and adds up to 100 percent) are Armenia (49.2 percent), Hungary (25.5 percent), and Poland (25.3 percent). The remaining countries in the donor pool are assigned a 0 percent weight by the algorithm. Put differently, the weights reported above indicate that GDP per capita trends in Latvia prior to the adoption of flat tax reform is best reproduced by a combination of Armenia, Hungary, and Poland. The resulting RMSPE is 0.0414 (or a 0.01 fit index), an excellent fit. See Table 1.

The sample period for Latvia is1993 to 2007, or 4 pre-treatment years and 10 post-treatment years. Estonia and Lithuania are not included in the donor pool because they implemented a flat tax before Latvia, and Albania, Georgia, Kazakhstan, Kyrgyz Republic, Macedonia, Montenegro, Romania, Russia, Slovak Republic, Turkmenistan, and Ukraine are excluded because they implemented the flat tax within 10 years from Latvia. Belarus is not included in the donor pool because it had at least one missing outcome variable before 1997. Similarly, Afghanistan, Azerbaijan , Bosnia and Herzegovina, Moldova, Tajikistan, and Uzbekistan are excluded from the donor pool because they did not have single observation on inflation or schooling before the treatment. This leaves us with seven countries (Armenia, Bulgaria, Croatia, Czech Republic, Hungary, Poland, and Slovenia) in the donor pool.

Note that a good fit is not guaranteed in all cases. When the fit is poor, we lose the confidence that the treatment effect is due to the reform, because it could be due to the inability of the synthetic unit to mimic the trend in the outcome variable. The differences (shown in parentheses) in the pre-treatment average of covariates between Latvia and the synthetic Latvia are close to zero for lagged GDP per capita (4 USD), which were the most predictive covariates. All other covariates except for inflation had a good match. For instance, the difference between

Latvia and synthetic Latvia are: investment share (-4.5 percentage points), population growth rate (0.52 percentage points), trade as a share of GDP (23.3 percentage points), and average schooling (-1.2 years). Note that the good match for covariates with negligible predictive power is not important to the estimation.

RESULTS

The impact of flat tax reform on GDP per capita and GDP per capita growth rate of Latvia is illustrated in Figure 1. In the left panel, the vertical dashed line indicates the treatment year. The difference between the connected line (GDP per capita of Latvia) and dashed line (GDP per capita of the synthetic unit) before the treatment year indicates the quality of the fit; the fit index is also reported in the Figure 1. The same difference after the treatment year indicates dynamic treatment effects. The probability of observing a placebo treatment effect of greater magnitude than treatment effect at time t is also graphed in the left panel of Figure 1. We can see that all estimates have p-values of less than 0.20, although only last three estimates are significant at the 10 percent level. The difference in the slope (rate of change) of the solid and the dashed lines shows the impact on GDP per capita growth rates. We see a substantial and positive impact of flat tax reform on both the level ($1526 higher, significant at the 10 percent level) and the growth rate (3.81 percentage points higher, significant at the 1 percent level) of GDP per capita for Latvia compared to its synthetic counterpart.

The time series graph of the placebo experiments is presented in the right panel of Figure 1. The dashed vertical line denotes the treatment year, the black solid line indicates the regional treatment effect for the treated country, and dashed gray lines indicate regional placebo treatment effects of global sample. Out of 69 placebo units, 64 are consistently below the solid black line, indicating that most of the placebo treatment effects are smaller in magnitude than the true treatment effect.

CONCLUSIONS

Our use of synthetic control methods allows us to carefully construct the counterfactual so that we can isolate the causal effect of flat tax reform on GDP per capita and GDP per capita growth rate of Latvia. We find positive and significant impacts on Latvia's GDP per capita and its growth rate. These estimates suggest that Latvia's GDP per capita was $1526 higher on average than the synthetic unit (significant at the 10 percent level), and its growth rate was 3.81 percentage points higher on average than the synthetic unit (significant at the 1 percent level). Similar results are found in all of various robustness tests (unreported).

These results confirm that, at least in the case of Latvia, flat tax reform had considerable effects on economic performance. More broadly, the SCM has many useful applications in evaluating other dimensions of economic policy making, especially when only a small number of aggregate entities (such as countries or states) are affected, for which suitable single comparisons often do not exist and traditional DID methods are not appropriate.

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Table1: Pretreatment Balance: Latvia and Synthetic Latvia

	Latvia	Synthetic Latvia	Difference	Diff/Synth
Democracy Dummy	1	0.877	0.123	0.14
Investment Share	11.447	15.988	-4.54	-0.284
Population Growth	-1.549	-1.025	-0.524	-0.511
Inflation	46.821	774.765	-727.945	-0.94
Average Schooling	8.916	10.099	-1.183	-0.117
Openness	101.721	78.38	23.341	0.298
Pretreatment GDP	5.973	5.969	0.004	0.001

Figure 1: GDP Per Capita Trends and Placebo Experiment: Latvia versus Synthetic Latvia