

Empirical Paper

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Determinants of inheritance and gifts taxation in the European Union

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Abstract: Inheritance and gift taxation vary widely among countries in both the design and tax burden. We analyze the impact of a series of factors, such as the country's affluence, political preferences, preferences for equity, aging ratio, fiscal standing of the state, and the country's size, on inheritance tax systems. The applied methods involve the random effects ordered logistic regression for tax design and tobit correlated-random effect models for tax revenues. We find that inheritance tax design is mainly determined by demographic factors while tax revenues depend on a broader group of factors including political orientation of a state, condition of an economy, and the size of a country. Higher preferences for equal distribution and commitment to democratic norms are associated with higher tax revenues. Good economic condition of the state boosts revenues, as does country's higher population. The results shed some light on future evolution of inheritance taxation.

Keywords: inheritance tax, gift tax, bequest, wealth, dynamic panel regression

JEL Classification: D31, H24

1 Introduction

The observation of tax systems in the European Union (EU) countries reveals that bequest taxation (taxation of inheritance and gifts) provides a relatively small part of government revenues but its design remains complicated and diversified [Drometer et al., 2018]. It raises the question of why taxes of relatively small fiscal importance are so complicated in design. It is also not evident why inheritance taxation is not higher and more progressive, despite it being very useful to decrease wealth inequalities [Picketty and Saez, 2013]. Inheritance taxation selectively affects the accumulated wealth and remains relatively harmless to the utility of taxpayers [Cremer and Pestieau, 2006]. It is especially evident when inheritance occurs accidentally (accidental bequest) at the death of a testator. In line with the optimal taxation theory, an accidental bequest can be fully taxed as it does not affect the decision of the donor and recipient [Friedman and Warshawsky, 1990]. This motive of bequest is very popular. Davies and Shorrocks [2000] state that accidental bequest comprises 35%–45% of inherited wealth. The high share of accidental transfers stems from the imperfection of the annuity market. The latter makes impossible the consumption of all savings precisely during the life of an individual. The other transfer motives involve altruistic (related to the utility of recipients), paternalistic (related to the utility of donors), and exchange (related to the attention obtained in return for the bequest) reasons [Kopczuk, 2009]. The taxation of bequests motivated by these three last reasons is controversial

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but not excluded particularly when only the maximization of utility is considered [Cremer and Pestieau, 2011]. Taxation of bequests is highly recommended if the purpose of taxation is to minimize inequalities [Piketty and Saez, 2013]. Bequest taxation provides also some other benefits. For example, it fulfils fiscal needs [Bastani and Waldenström, 2020], maximizes welfare [Grossmann and Poutvaara, 2009], or makes the tax system fairer [Boserup et al., 2018; Elinder et al., 2018; Nekoei and Seim, 2021].

The fiscal meaning of bequest taxation in EU countries is limited and highly diversified. It suggests that this taxation is designed for purposes other than a reduction of wealth inequalities and its role is not perceived univocally. On the one hand, some European countries do not impose such a tax (e.g. Romania) or abandon it (e.g., Sweden), but on the other hand, in some countries (e.g., Spain) the tax rate can be as high as 81% of the inherited debt with a complicated progressive structure dependent on kinship (Worldwide Estate and Inheritance Tax Guide, 2021). It is astonishing since taxes with low fiscal meaning should be simple: one of their principal aims should be to reduce the administrative costs of their collection. Therefore, it is reasonable to discover the determinants staying beyond the inheritance taxation design and the revenues collected in the EU. We would like to investigate it separately for design and revenues, as it is not necessarily true that a complicated tax structure means a higher tax burden and a simple tax structure a low tax burden.

In this paper, we test several hypotheses about the determinants of inheritance taxation revenues:

Hypothesis 1: High taxation of inheritance is positively influenced by the affluence of countries.

One can expect that: affluent countries, with high wealth per capita, high gross domestic product (GDP) per capita, and high GDP measured in purchasing power standard (PPS), low unemployment, and deficit should receive higher inheritance tax revenue because they are richer and this stimulates higher transferred wealth. This conclusion stems from the administrative costs of taxation, as inheritance taxation is costly [Kaplow, 2001], and so it should be applied only when inherited wealth is substantial. The last situation is more likely in wealthier societies.

Hypothesis 2: High inheritance and gift taxation is the result of a political preference for high taxation.

Therefore, we can expect that: pro-social states, oriented toward egalitarianism and economically oriented left, prefer higher taxation. In fact, the true reasons for inheritance and gift tax design stem from the past and were determined by political reasons that are not present now. But we build on the assumption that the design of taxes is changing if the political will is changing [Persson and Tabellini, 1992; Hettich and Winer, 1999; Milanovic, 2000; Gottschalk and Peters, 2003]. Therefore, even if the motives of inheritance taxation design are not public now, we can expect that they are consistent with political preferences. If these preferences are changing, then also the design of inheritance taxes should adjust to meet the new expectations of voters. For example, low bequest taxation can be an effect of a negative social judgment of high taxation of wealth transferred between close relatives and inherited by younger individuals [Gross et al., 2017; Abraham et al., 2018].

Hypothesis 3: High taxation of inheritance and gifts is used to reduce income and wage inequalities.

Therefore, high values of inequality measures of income and wealth should induce higher tax revenues. The distribution of wealth in the contemporary world is highly asymmetric. In the EU countries together with the United Kingdom, the Gini coefficient of the wealth distribution range from 0.499 (Slovakia) to 0.902 (the Netherlands) [Global Wealth Databook, 2019]. It is much more than the Gini coefficients for the income distribution which range from 0.228 (for Slovakia) to 0.408 (for Bulgaria) [Eurostat, 2019]. Moreover, the inequalities in wealth tend to increase¹ and some arguments suggest

¹ Between 2010 and 2019, the average Gini for wealth for the same group of countries has increased from 0.67 to 0.71 (calculation based on data from *Global Wealth Databook* [2010, 2019]) and the further boost of inequalities is expected due to the COVID-2019 pandemic.

that high inequality can be harmful to economic growth. Some recent studies on this topic for selected countries include Saez and Zucman [2016] and Bricker et al. [2017] from the United States, Wei and Yang [2021] from China, Karagiannaki [2017] from the United Kingdom, and Klevmarken [2004] from Sweden. Higher wealth transfers are more likely if the asymmetry of wealth is greater, and so we can expect a positive impact of inequalities on tax revenues.

Hypothesis 4: High inheritance and gift taxation depend positively on the proportion of elderly people to young people in a society.

If this relation is high, then the bequests are also high because the elderly compete for the attention of young people, which allows the government to tax these transfers more heavily.² The empirical simulation of Profet et al. [2014] provides some predictions on the decreasing role of inheritance taxation with the aging of societies.³ Partially, the problem of aging is mitigated by the immigration of young people. Immigration increases the care for the elderly, resulting in lower transfers to the younger population. Similarly, the care provided is alleviated if the independence of young people is small and the unemployment rate is high. There are also arguments that the aging of societies induces the abandonment of this taxation [Bertocchi, 2011].

Hypothesis 5: In highly populated countries the taxation of inheritance and gifts is higher.

It is because the diversification of wealth can be higher in larger countries and the possibility of tax flight abroad is lower. This is in line with the scale effect postulated by Kenny and Winer [2006]. Moreover, the tax administration in bigger countries is more extensive and effective. One can expect that larger and more diversified administration facilitates for the control of taxpayers, preventing tax avoidance.

The complication of tax design should foster higher revenues, particularly if it includes progressive components, but frequent exemptions can blur this effect. In practice, simpler taxes do not necessarily mean a low tax burden. Therefore, one can expect that similar factors should be valid for the complication of inheritance tax design, but their importance can be different. For example, the revenues may be motivated more by fiscal needs while the shape of bequest taxation is motivated more by social policy.

The econometric analysis in this paper is divided into two stages to enable separate analysis of tax design and tax revenues. In the first stage, using data from the EU and the United Kingdom, we apply ordered panel logistic regression in the period 1995–2019, to identify the possible factors affecting the inheritance tax design choice. We also use the panel logit model to explain the presence of inheritance taxation irrespective of the tax design. The results of this last regression are presented in Appendix. The period of the analysis was determined by the availability of data (especially data from Eurostat), but it is sufficient for the verification of our hypotheses, as they covered some switches between different tax designs (e.g., abolition of taxation instead of progressive tax).

In the second stage, we model the revenues collected from inheritance taxation. The inheritance tax revenues were taken from Eurostat [National Tax List, 2021] with code D91A and subsequently divided by the nominal GDP. It should be stressed that the inheritance-and-gift-taxation revenues dataset includes some zero values of the dependent variable (in some countries there was no revenue from this taxation), and so we decided to apply a correlated-random panel tobit model as the most appropriate and available for estimation.

² According to the exchange theory, bequest is a form of remuneration for attention and services delivered to elderly individuals from young individuals [Glazer et al., 2003].

³ These results are based on evidence from Canada, France, Germany, Italy, Japan, the UK, and the US corresponding to the period 1964–2009, and so they are concentrated on big economies and relatively old data, compared to our study of the more diversified EU countries and the UK.

2 The data and variables

The data about the citizens' wealth were taken from the Credit Suisse Global Wealth Databook and covered the period since 2000. The political variables were obtained from the V-Dem Dataset, version 11.1 (Varieties of Democracy) [Lührmann et al., 2020; Pemstein et al., 2020]. The other variables, including demographic, economic, and financial indicators, were gathered from Eurostat. For the consistency of the dataset, we limited the observation to the years 2000–2019, excluding previous and later observations because not all of them were available or complete. The independent variables are grouped into six economic groups.

The first group involves demographic data. This group captures the population's aging and more generally demographic changes. The *Independence of youth* is a percentage of the population aged between 18 years and 34 years and living with parents. The variable measures the need for the attention of parents (which should be lower for a higher share of children living together with parents) and the possible attractiveness of the financial support delivered by parents to their children. The cost of attention should be lower when young people live together with their parents and conversely higher independence requires higher gift or inheritance promises. A high share in the population of persons age 75 or higher (*75+ share*) is a proxy for the potential number of wealth transfers transferred to young individuals. The *Aging ratio* is the proportion of people aged greater than 64 years to those aged less than 21 years. The greater value of this ratio indicates a population aging and a decrease in the bargaining power of parents (the attention is less available and with higher cost because the number of young people is insufficient to provide attention to older people). The perspective of inheritance should also be affected by life expectancy, which is approximated by the expected number of years of future life at birth (*Life expectancy*). Finally, we add the sign of net migration, *Migration (sign)*. If immigration was higher than emigration, then this variable took the value 1, and otherwise it took 0. We use the sign of migration instead of immigration and emigration difference to obtain convergence in the estimation of parameters. The net inflow of people should alleviate the problem of the limited attention provided by the younger population to their parents as it increases the number of people who can provide care to older people. It simultaneously decreases the meaning of inheritances and gifts, which alleviates the need for complicated and burdensome inheritance taxation.

The second group of variables refers to the wealth of a country and includes gross domestic product per capita (*GDP per capita*), gross domestic product per capita in purchasing power standard (*GDP per capita in PPS*), and wealth per adult (*Wealth per adult*). The first two variables approximate the affluence of the country and the third refers to the accumulated wealth of a representative citizen. They can be interrelated, and so we apply them in separate econometric models.

The third group of variables consists of some macroeconomic variables, like *Inflation* measuring the consumer price index, *Unemployment* as a rate of unemployment, and the squared rate of unemployment (*Unemployment²*). The choice of the squared unemployment rate is justified by the ability to distinguish between moderate and high rates of unemployment. A high unemployment rate can indicate macroeconomic instability and possibly require different policies than low or moderate unemployment. To control the openness of the economy we use the sum of imports and exports to the gross domestic product (*Openness*). A more open economy can stimulate the concentration of wealth and more complicated forms of wealth taxation.

The next group of variables includes fiscal measures. General government revenues to gross domestic product (*Revenues to GDP*) represent the fiscalism of an economy. The higher share of revenues, the higher the tax burden should be and the higher the number of different tax types. Variable *Deficit to GDP* measures the imbalance in the budget, which can also affect tax policy. This measure is completed with two other measures of the expenditure structure: the ratio of subsidies to GDP (*Subsidies*) and the ratio of other transfers to GDP (*Other transfers*). These variables capture the preferences of a government for supporting the economy and citizens. Finally, we add some variables related to inequality and preferences for inequality from a political perspective. The first variable is a dummy taking the value 1 when the

relation of median wealth per capita to the mean wealth per capita is higher than 0.4 (*Median to mean*). This variable is a proxy of wealth inequality. We cannot use the Gini coefficient because its values are not available for all countries and periods, while the wealth data were collected since 2000 and have no gaps. The policy orientation of the state is captured by three variables (Varieties of Democracy data [V-Dem Dataset, version 11.1]):

- (1) preferences for egalitarian democracy (*Egalitarian democracy index*), which takes values between 0 and 1; and values closer to 1 are derived if “rights and freedoms of individuals are protected equally across all social groups,” “resources are distributed equally across all social groups,” and “groups and individuals enjoy equal access to power”;
- (2) orientation of the ruling party (*Economic left-right scale*), defined on a scale from 0 to 5. The scale starts at far left (0), through left (1), center left (2), center (3), center right (4), and right (5), to far right (6), where left means a higher preference for the active role of government in the economy; and
- (3) the illiberalism index (*Illiberalism*) taken from V-Dem, which measures the “extent to which the party shows a lack of commitment to democratic norms prior to elections.” It represents the measure of populism in a society. The variable takes values in the range 0–1.

Finally, we add a dummy variable (*Big countries*) to distinguish between the more populated countries and the other ones. If the country in question is France, Germany, Italy, Poland, Spain, or the United Kingdom, this variable takes on a value of 1, and it takes 0 otherwise. The larger countries easier enforce the payment of inheritance taxes and can benefit more from large inheritances (high accumulated wealth). The descriptive statistics of variables are included in Table A1 in Appendix.

3 The models explaining the design of taxes

The progressivity of taxation or the total amount of paid taxes are not good approximations of the severity of taxation and do not provide insight into the ideas behind the design of these taxes. It is because progressive taxation includes several exemptions and sometimes even the full abolition of inheritance taxation for all or a selected group of potential taxpayers. It makes us distinguish the four basic inheritance tax designs with increasing complications or rules: the lack of inheritance taxation, the proportional taxation related to the value of wealth, the indirectly progressive taxation with a constant rate and tax-free amount of wealth, and progressive taxation with progressivity dependent on the level of kinship. The lack of taxation is the simplest design, as no tax on inheritance is imposed. The proportional tax has mainly fiscal motivation and can be applied irrespectively on the whole inherited wealth or the received share of inheritance or transfer. An indirect progressive tax is a proportional tax with a tax-free amount. This tax-free amount can be diversified regarding affinity. Finally, we can encounter progressive tax with complicated rules providing exemptions related to kinship.

The different types of tax designs were coded as cardinal numbers from 0 (no tax) to 3 (progressive tax with exemptions) and used as the dependent variable. We concentrate on the tax design as the approximation of the complication of inheritance and gift taxation. These basic rules were applied to all taxpayers, but obviously the complications of the tax system for an individual taxpayer can be different. For example, the exemption of tax makes the situation of some taxpayers similar to the lack of taxation. In this sense, the inheritance tax design is more the result of political will than the measure of the tax burden. To check whether the presence of inheritance alone in a tax system (irrespective of the tax design) is associated with the same independent variables as in tax design, we applied panel logistic regression. The dependent variable, in this case, was a dummy taking value 1 when inheritance taxation was present and 0 when there was no such tax in a country. The results of this regression are included in Table A2 in Appendix.

The inheritance tax design is relatively stable over time but sometimes governments decide to modify it (see Table 1). It is important because we count only remarkable changes in tax design, omitting minor ones

Table 1. The types of inheritance tax design in the sample

Countries	Type of inheritance tax design	
Austria	Progressive with exceptions 1995–2008	No tax since 2009
Belgium, Bulgaria, France, Finland, Germany, Greece, Luxembourg, the Netherlands, Poland, Slovenia, Spain	Progressive with exceptions	
Czechia	Progressive with exceptions, 1995–2013	No tax since 2014
Denmark	Proportional tax	
Cyprus, Estonia, Romania	No tax	
Hungary, Ireland, Malta, Portugal, the United Kingdom	Indirectly progressive	
Italy	Progressive with exceptions, 1995–2000 and 2007–2019	No tax 2001–2006
Latvia	No tax 1995–2002	Progressive taxation since 2003
Lithuania	No tax 1995–1996	Progressive taxation since 1997
Slovakia	Progressive with exceptions, 1995–2003	No tax since 2004
Sweden	Progressive with exceptions, 1995–2004	No tax since 2005

(like changes in items taxed or kinds of tax exceptions). The change from a more complicated tax design to a less complicated one (e.g. change from progressive tax with exceptions to proportional taxation) is described here as a simplification of tax design. The opposite change is treated here as a complication of tax design. These switches between tax designs allow us to investigate the inheritance policy changes in an econometric way.

We treat inheritance and gift taxation jointly. Gift taxation is of less importance and depends on the will of the donor, and so in further analysis, we will include it in inheritance taxation. In most cases, to prevent tax arbitrage, the tax rules are similarly constituted for the taxation of inheritance and gifts (although some differences between these two types of taxes can be noticed in Denmark, Estonia, Finland, Lithuania, Latvia, Luxembourg, and the United Kingdom). The differences between the taxation of inheritance and gifts include different tax rates, different impacts of kinship on the tax requirements, imposition of gift taxation with the exemption of inheritance taxation, and payment of gift taxes as a part of personal income tax. Tax arbitrage involves the use of donation instead of inheritance to decrease the tax burden and probably is widespread in economies where the rules differ. For example, there is evidence of such behavior outside Europe, in Japan [Nimi, 2019].

The dependent variable is the tax design type, represented by an ordinal number (0–3). For this kind of variable, the natural choice is the random effects ordered logistic regression. In ordered choice models, it is assumed that the dependent variable takes on the values $\{0, 1 \dots J\}$ and the value J is known and equals 3. The foundation of the random effects ordered logistic model is a latent variable approach. A latent variable is assumed to be affected by a list of variables $\mathbf{x}_{it}$, that is

$$y_{it}^* = \mathbf{X}_{it}'\boldsymbol{\beta} + \alpha_i + \varepsilon_{it}.$$

where α_i represents the individual effect, in this case, the country effect, while ε_{it} stands for the idiosyncratic error. The observed values are derived using the threshold parameters $c_1, c_2, \dots, c_J$ in the following way:

$$\begin{aligned} y &= 0 & \text{if } y^* \leq c_1, \\ y &= j & \text{if } c_{j-1} \leq y^* < c_j, \\ y &= J & \text{if } y^* > c_J, \end{aligned}$$

Table 2. Results of random effects ordered logistic models

Dependent: Tax design type	(1)	(2)	(3)	(4)	(5)
Independence of youth	0.05 (0.05)	0.06 (0.05)	0.05 (0.05)	0.04 (0.05)	0.04 (0.05)
75+ share	281.55*** (83.62)	284.99*** (79.81)	279.08*** (79.52)	248.07*** (76.30)	294.80*** (79.07)
Aging ratio	-15.79*** (4.96)	-17.39*** (4.90)	-15.82*** (4.70)	-16.88*** (4.77)	-16.65*** (4.62)
Life expectancy	-0.61* (0.34)	-0.86** (0.36)	-0.56* (0.31)	-0.04 (0.22)	-0.55** (0.24)
Migration (sign)	-0.37 (0.86)	-0.36 (0.87)	-0.37 (0.87)	-0.28 0.59	-0.39 (0.83)
GDP per capita	13.52 (59.00)				
GDP per capita PPS		15,485.99 (13,033.01)			
Wealth per adult			-0.002 (0.088)		
Inflation	-0.15 (0.14)	-0.15 (0.14)	-0.15 (0.14)		0.15 (0.14)
Unemployment	0.41 (0.27)	0.51* (0.28)	0.40 (0.27)		0.34 (0.25)
Unemployment ²	-0.02* (0.01)	-0.02* (0.01)	-0.02 (0.01)		-0.02 (0.01)
Openness	1.29 (0.91)	1.49* (0.89)	1.26 (0.86)		1.34 (0.87)
Deficit (% of GDP)	-1.22 (6.12)	-2.02 (5.97)	-0.64 (5.76)		-0.92 (5.67)
Revenue to GDP	-3.68 (13.77)	-3.00 (11.35)	-5.84 (11.00)		-5.11 (10.43)
Subsidies (% of GDP)	125.71 (89.66)	124.7 (86.00)	123.80 (85.24)		112.37 (83.73)
Other transfers (% of GDP)	-15.24 (84.85)	11.59 (86.62)	-14.26 (83.81)		6.35 (72.92)
Median to mean <0.4	0.05 (0.65)	0.08 (0.65)	0.04 (0.64)	0.06 (0.58)	
Egalitarian democracy index	-3.17 (6.87)	-3.73 (6.80)	-2.89 (6.83)	-1.09 (5.63)	
Economic left-right scale	0.41 (0.28)	0.40 (0.28)	0.41 (0.28)	0.34 (0.27)	
Illiberalism	-1.80 (2.19)	-1.39 (2.22)	-1.82 (2.19)	-1.17 (1.97)	
Big countries [#]	15.82*** (3.93)	17.21*** (4.08)	16.23*** (3.92)		15.38*** (3.79)
Observations	421	421	421	421	421

(Continued)

Table 2. Continued

Dependent: Tax design type	(1)	(2)	(3)	(4)	(5)
Countries	27	27	27	27	27
Joint insignificance (chi-square statistics)	36.74**	37.43**	36.81**	21.63***	34.98***
Std. dev. of the individual effect	13.29	13.73	13.52	13.62	13.19
Individual effects insignificance	380.06***	407.51***	400.03***	463.74***	467.39***
AIC	403.6	417.5	418.7	407.8	411.3
BIC	460.2	510.5	511.7	460.4	484.1

#Big countries include France, Germany, Italy, Poland, Spain and the United Kingdom.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

GDP, gross domestic product; PPS, purchasing power standard, AIC, Akaike Information Criterion, BIC, Bayesian Information Criterion.

for all $j \in \{1, 2, \dots, J-1\}$. Assuming the logistic distribution of the idiosyncratic error, the probabilities of alternatives are derived in the form

$$\begin{aligned}
 P(y=0|X) &= \Lambda(c_1 - X'\beta), \\
 P(y=j|X) &= \Lambda(c_j - X'\beta) - \Lambda(c_{j-1} - X'\beta), \\
 P(y=J|X) &= 1 - \Lambda(c_J - X'\beta),
 \end{aligned}$$

for all $j \in \{1, 2, \dots, J-1\}$, and where $\Lambda(\cdot)$ denotes the logistic cumulative distribution function. As a result, information on parameter estimates is meaningful for only two of the marginal effects. More specifically, the marginal effect of the very first alternative takes on the opposite sign as the parameter, while the marginal effect of the very last alternative is of the same sign as the estimate [Wooldridge, 2010]. The results of the random effect ordered logistic model are presented in Table 2.

The obtained results indicate that complication of inheritance taxation is mainly related to demographic factors. The high proportion of people aged greater than 75 years in a population increases the probability of a complicated taxation structure of inheritance. At the same time, the high ratio of the number of elderly people to young ones (aged less than 20 years), similar to higher life expectancy, mitigates this tendency. It hints that the age structure of the population is crucial for tax design. If older people dominate the population structure then inheritance taxation is simplified, but if the share of older people is high together with the share of younger people also being high, the taxation remains complicated. The simplest explanation is as follows: the aging of societies forces higher transfers of wealth from the elderly to young people and stimulates greater attention to the former. If the tax policy is concentrating on fostering wealth transfers or substitution of public care with private care provided by the young population, then more complicated bequest taxation is superfluous.

There are also arguments for higher complications of taxation in highly populated countries. These countries can tax relatively more very rich people than small countries. Moreover, the tax flight for a wealthy person is less likely from a larger country than from a small country, as it requires the taxpayer to give up intensive relationships (personal, business) with the country where business and life activity are concentrated. A large country also has a stronger tax administration that can detect tax avoidance more easily and enforce the payment of taxes even if the taxpayer lives abroad.

The unemployment turns out significant in Model 2 and the squared value of unemployment in Models 1 and 2 at a 10% significance level. In the second model, the rate of unemployment favors a more complicated tax design, but for very high levels of unemployment (supposedly indicating structural problems in an economy) simpler tax structures are chosen. It seems that government policy in the latter case promotes milder taxation to improve the transfer of wealth from the old to the young when high unemployment is an important problem in a country.

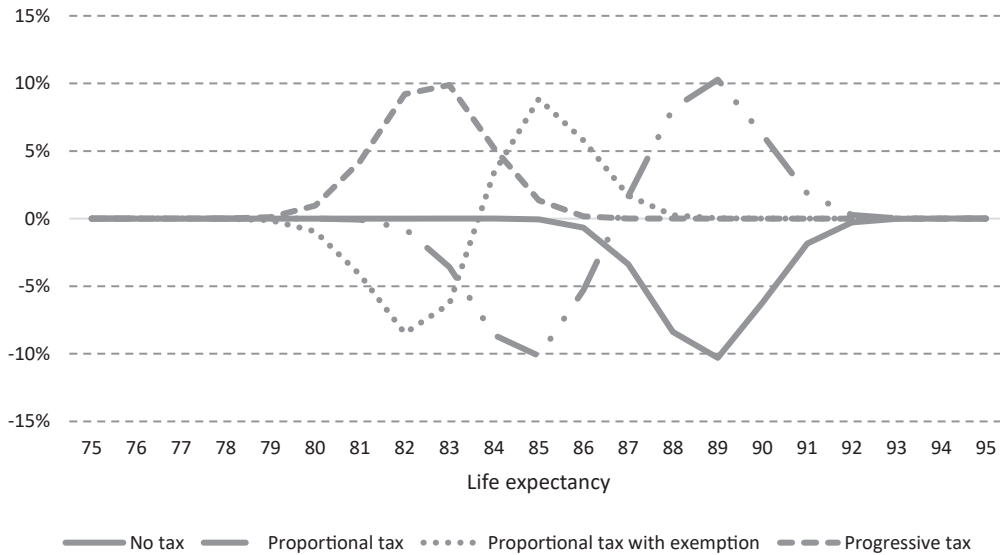


Figure 1. Marginal effects for unemployment at 5% in relation to life expectancy.

A longer life increases the need for taking care in a society, which can be easier when expected benefits for the young are higher and inheritance taxation is simple or does not exist. This can work for the simplification of inheritance taxation. We can follow this tendency better by looking at the changes in the probability of tax design in relation to life expectancy (Figure 1). This graph presents the changes in the popularity of tax design with changing life expectancy. The calculation is made for the given level of unemployment, established at 5%, to be close to the average unemployment at the end of the considered period. For the life expectancy of about 83 years, the highest effect is for progressive taxation (its popularity is increasing at the expense of proportional taxation with exemption) and it goes through proportional taxation with exemption (for about 85 years) to proportional taxation without exemptions when the life expectancy rises to 90 years. Summing up, both the high unemployment and the long-life expectancy coincide with the simplification of tax design in inheritance taxation.

The other variables are not significant. It is interesting as one can expect the impact of policy measures on tax design, but it is in fact not acknowledged. If we compare these results with the model describing the occurrence of inheritance taxation (Table A2 in Appendix), we observe that three things are different. First, the unemployment and the long-life expectancy do not affect the probability of inheritance occurrence. Second, the lower *Independence of youth* (higher value of the variable) increases the probability of inheritance tax. Third, greater *Openness* also positively stimulates this probability. However, it should be emphasized that this model predicts something different from tax design, and so we cannot expect that the parameters of these models have to be concordant.

4 The models of inheritance and gift taxations revenues

Usually, for panel data representing tax revenues to GDP, the fixed or random effect estimator should be used. Unfortunately, several observations of the dependent variable include zero values (as in some countries there were no such tax or revenues were collected only for some periods) and the other values of the dependent variable consist of non-negative values. In this situation, the best choice is the tobit panel model with random effects. Unfortunately, the major drawback of this estimator is the assumption of zero correlation between the regressors and the individual effects. It makes the fixed effects estimator more appealing than the random effects estimator but the estimation of time-invariant regressors is impossible when the correlation between regressors and the individual effect is not zero [Baltagi, 2013, p. 20]. Summarizing, the fixed effect model cannot be estimated while the random effect model can be estimated

but would violate the required assumptions. A certain solution to this conundrum can be a correlated-random effects estimator, proposed in Mundlak [1978]. This model has the following form:

$$y_{i,t} = X'_{i,t}\beta + u_{i,t}$$

in which the joint error term $u_{i,t}$ consists of the individual effect λ_i and the idiosyncratic error $\varepsilon_{i,t}$. In the correlated-random effects estimator, the joint error term is complemented with time averages of the regressors, that is

$$\bar{x}_i = \frac{1}{T} \sum_{t=1}^T x_{i,t}$$

for $i = 1, \dots, K$. So, the correlated-random effects model has the form

$$y_{i,t} = X'_{i,t}\beta + \lambda_i + \gamma_1 \bar{x}_1 + \dots + \gamma_K \bar{x}_K + \varepsilon_{i,t}.$$

It can be shown that $Cov(\bar{x}_i, \lambda_i) = 0$ for all regressors. More importantly, the estimates of the correlated-random effects correspond to those of the fixed effects estimator, as it allows estimation of time-invariant variables' parameters [Wooldridge, 2010, Chapter 10]. The signs of marginal effects assess the association of independent variables with the dependent variable in the correlated-random effect model. Table 3 presents estimates of the tobit correlated-random effects estimator and Table 4 the marginal effects of the models from Table 3.

According to Table 4, the macroeconomic variables *Unemployment*, *Deficit to GDP*, and *Revenue to GDP* contribute to lower revenues (similarly to the positive coefficient of *GDP per capita*) and only the squared

Table 3. Results of panel tobit correlated-random effects models

Dependent: Tax revenues to GDP	tobit_cre_1	tobit_cre_2	tobit_cre_3
	(1)	(2)	(3)
Independence of youth	−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)
75+ share	0.215*** (0.08)	0.201*** (0.09)	0.215*** (0.08)
Aging ratio	−0.004 (0.01)	0.001 (0.01)	−0.004 (0.01)
Life expectancy	−0.001*** (0.00)	−0.001*** (0.000)	−0.001*** (0.00)
Migration (sign)	0.001 (0.00)	−0.001 (0.00)	−0.001 (0.00)
GDP per capita	−0.004* (0.09)		
GDP per capita PPS		−3.495 (16.92)	
Wealth per capita			−0.000 (0.00)
Inflation	−0.000 (0.00)	0.000 (0.00)	−0.000 (0.00)

(Continued)

Table 3. Continued

Dependent: Tax revenues to GDP	tobit_cre_1	tobit_cre_2	tobit_cre_3
	(1)	(2)	(3)
Unemployment	−0.001*** (0.00)	−0.001*** (0.00)	−0.001*** (0.00)
Unemployment ²	0.000*** (0.00)	0.0000*** (0.00)	0.0000*** (0.00)
Openness	0.002 (0.00)	0.001 (0.00)	0.002 (0.00)
Deficit (% of GDP)	−0.035*** (0.01)	−0.034*** (0.01)	−0.034*** (0.01)
Revenue to GDP	−0.032* (0.02)	−0.045** (0.02)	−0.032* (0.02)
Subsidies (% of GDP)	0.06 (0.08)	0.054 (0.10)	0.062 (0.09)
Other transfers (% of GDP)	−0.037 (0.08)	−0.114 (0.09)	−0.039 (0.08)
Median to mean	−0.000 (0.00)	−0.001 (0.00)	−0.000 (0.00)
Egalitarian democracy index	0.081*** (0.01)	0.095*** (0.01)	0.082*** (0.01)
Economic left-right scale	−0.000 (0.00)	−0.001* (0.00)	−0.000 (0.00)
Illiberalism	−0.008*** (0.00)	−0.009*** (0.00)	−0.008*** (0.00)
Big countries [#]	0.016** (0.01)	0.018** (0.01)	0.031*** (0.01)
Constant	0.586*** (0.13)	0.568*** (0.13)	0.561*** (0.12)
sigma_u	0.008*** (0.00)	0.009*** (0.000)	0.008*** (0.00)
sigma_e	0.006*** (0.00)	0.006*** (0.000)	0.0063** (0.000)
All variables' joint insignificance	318.92***	344.71***	337.99***
Observations	625	536	625
Countries	27	27	27
Individual effects joint insignificance	436.26***	379.7***	416.78***
Log-likelihood	1,966	1,665.2	1,968.2
AIC	−3,852	−3,250.4	−3,854.4
BIC	−3,674.5	−3,079	−3,672.4

[#] Big countries include France, Germany, Italy, Poland, Spain and the United Kingdom.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

GDP, gross domestic product; PPS, purchasing power standard.

Table 4. Marginal effects of the models from Table 3

	Marginal effects		
	E(y 0<=y)		
	tobit_cre_1	tobit_cre_2	tobit_cre_3
Independence of youth	−0.0000	−0.0000	−0.0000
75+ share	0.2153***	0.2151***	0.2014**
Aging ratio	−0.0043	−0.0043	0.0007
Life expectancy	−0.0014***	−0.0013**	−0.0013**
Migration sign	0.001	0.001	0.0006
GDP per capita	−0.0045		
GDP per capita PPS		−3.4953	
Wealth per capita			−0.0000
Inflation	−0.0002	−0.0002	0.0001
Unemployment	−0.0012***	−0.0012***	−0.0014***
Unemployment ²	0.0000***	0.0000***	0.0000***
Openness	0.0024	0.0024	0.0013
Deficit (% of GDP)	−0.0347***	−0.0345***	−0.0342***
Revenue to GDP	−0.0318*	−0.032*	−0.0449**
Subsidies (% of GDP)	0.0599	0.0621	0.0543
Other transfers (% of GDP)	−0.0369	−0.039	−0.1138
Median to mean	−0.0000	−0.0001	−0.0006
Egalitarian democracy index	0.0815***	0.0816***	0.0952***
Economic left-right scale	−0.0003	−0.0003	−0.0005*
Illiberalism	−0.0076***	−0.0077***	−0.0088***
Big countries [#]	0.0157***	0.0308***	0.0184**

[#] Big countries include France, Germany, Italy, Poland, Spain and the United Kingdom.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

GDP, gross domestic product; PPS, purchasing power standard.

unemployment rate works in the opposite direction. Therefore, the relatively good condition of the economy is associated with higher revenues, not a bad economy. Despite some measures of affluence that turned out insignificant (*wealth per capita* or *GDP per capita PPS* were not), it remains in line with the first hypothesis, that wealthy economies collect more revenues in relation to their GDP.

Two of the three marginal effects of political variables were significant. The *egalitarian democracy index* was positively related to tax revenues, and so for more widespread preferences for equal distribution, the tax revenues were greater. The inheritance tax revenues were also higher when the commitment to democratic norms was higher (the negative sign of *Illiberalism*). We can guess that libertarian and populist governments are more prone to making the inheritance tax burden low. These results confirm that political reasons are important for inheritance tax revenues but not necessarily the leftist or rightist orientation of the government (it was insignificant). This supports the second hypothesis.

Similarly, as in the case of the tax design, the inequalities did not play any substantial role in the tax revenue size. This is indicated, inter alia, by insignificant measures of inequality (*median to mean*) or wealth per capita. The latter refers to the level of wealth, but frequently, higher wealth is associated with a higher concentration of wealth. This suggests that the third hypothesis is not confirmed.

The marginal effects of demographic variables were significant only for the share of people aged greater than 75 years and for life expectancy. The signs were not confusing. The higher share of older people increases revenues while the higher the life expectancy reduces it. Contrary to the models describing tax design, aging was not important, and so the fourth hypothesis is not corroborated.

More populated countries obtained higher tax revenues in relation to their GDP. This is in line with the fifth hypothesis.

5 Conclusions

Our results are one of the first attempts to investigate the shape and inheritance of revenues using econometric methods. Particularly, we shed some light on the determinants of some types of inheritance tax design. Generally, we show that the shape of inheritance taxation is determined to the greatest extent by demographic factors. Countries with rapid population aging (increasing the ratio of elderly people to young people) are more inclined to simplify inheritance taxation, so the deepening of inheritance tax simplification, with the expected intensification of aging occurring in European countries, is expected.

We point out that more complicated tax structures are more popular in larger countries where the taxation of the rich is easier. The number of wealthy people in more populated countries is higher and they cannot effectively avoid inheritance taxation by emigration to other jurisdictions. Interestingly, this variable is also important for the explanation of tax revenues.

Summing up the relations between variables and tax design, one can expect that small countries evidencing population aging will simplify the tax structure or abandon this type of tax. Conversely, highly populated countries with slow aging will preserve more complicated inheritance taxation structures. The increasing life expectancy should also contribute to the simplification of inheritance tax structures. The macroeconomic factors are not important in these processes but sometimes small effects related to an unemployment rate appear.

We also contributed to the investigation of factors enhancing higher tax revenues. It turns out that the determinants of tax revenues differ from those valid for tax design. Higher tax revenues are associated with political preferences, good economic conditions, and a high number of inhabitants in a country.

There is some evidence about the impact of demographic variables on revenues. When the share of elderly people rises, the tax revenue also becomes higher. When people live longer, the tax revenues drop, probably because the resources are consumed more during the lifetime of a consumer and to a smaller extent inherited. Aging does not affect revenues.

Similarly, for now, the average wealth and its distribution are not significant factors explaining the shape and revenue of inheritance taxes. Therefore, one can suppose that, despite the postulate formulated in the literature on inequality for the increase of the inheritance tax burden, there is no evidence that such a policy is currently widely applied, at least in the analyzed group of countries.

Statements and declarations

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Conflict of Interest

The authors have no relevant financial or non-financial interests to disclose.

Data availability

The datasets generated and/or analyzed during the present study are available from the corresponding author upon request.

References

- Abraham, M., Lorek, K., Richter, F., Wrede, M. (2018), Breaking the norms: when is evading inheritance taxes socially acceptable? *European Journal of Political Economy*, Vol. 52, pp. 85-102.
- Baltagi, B.H. (2013), *Econometric analysis of panel data*, 5th edn, Chichester: John Wiley & Sons.
- Bastani, S., Waldenström, D. (2020), Perceptions of inherited wealth and the support for inheritance taxation, *Economica*, Vol. 88, No. 350, pp. 532-569.
- Bertocchi, G. (2011), The vanishing bequest tax: the comparative evolution of bequest taxation in historical perspective, *Economics and Politics*, Vol. 23, No. 1, pp. 107-131.
- Boserup, S.H., Kopczuk, W., Kreiner, C.T. (2018), Born with a silver spoon? Danish evidence on wealth inequality in childhood, *The Economic Journal*, Vol. 128, No. 612, pp. F514-F544.
- Bricker, J., Dettling, L.J., Henriques, A., Hsu, J.W., Jacobs, L., Moore, K.B., Pack, S., Sabelhaus, J., Thompson, J., Windle, R.A. (2017), Changes in U.S. family finances from 2013 to 2016: evidence from the survey of consumer finances, *Federal Reserve Bulletin*, Vol. 103, No. 3, pp. 1-42.
- Cremer, H., Pestieau, P. (2006), Wealth transfer taxation: a survey of the theoretical literature, in: L.A. Gerard-Varet, S.C. Kolm, J. Mercier Ythier, (Eds), *Handbook on the economics of giving, reciprocity and altruism*, North-Holland, Amsterdam, pp. 1107-1134.
- Cremer, H., Pestieau, P. (2011), The tax treatment of intergenerational wealth transfers, *CESifo Economic Studies*, Vol. 57, No. 2, pp. 365-401.
- Davies, J.B., Shorrocks, A.F. (2000), The distribution of wealth, in: A.B. Atkinson, F. Bourguignon, (Eds), *Handbook of income distribution*, 1, Elsevier, Oxford, pp. 606-675.
- Drometer, M., Frank, M., Pérez, M.F., Rhode, C., Schworm, S., Stitteneder, T. (2018), Wealth inheritance taxation: an overview and country comparison, *Ifo DICE Report*, Vol. 16, No. 2, pp. 45-54.
- Elinder, M., Erixson, O., Waldenström, D. (2018), Inheritance and wealth inequality: evidence from population registers, *Journal of Public Economics*, Vol. 165, pp. 17-30.
- Eurostat (2019), Gini coefficient of equivalised disposable income - EU-SILC survey, retrieved from <https://ec.europa.eu/eurostat/databrowser/view/tessi190/default/bar?lang=en> on 18.10.2022.
- Friedman, B., Warshawsky, M. (1990), The cost of annuities: implications for saving behavior and bequests, *The Quarterly Journal of Economics*, Vol. 105, No. 1, pp. 135-154.
- Glazer, A., Kanninen, V., Niskanen, E. (2003), Bequests, control rights, and cost-benefit analysis, *European Journal of Political Economy*, Vol. 19, No. 1, pp. 71-82.
- Global Wealth Databook. (2019), Credit Suisse Research Institute, retrieved from <https://www.credit-suisse.com/media/assets/corporate/docs/about-us/research/publications/global-wealth-report-2019-en.pdf> on 18.10.2022.
- Gottschalk, S., Peters, W. (2003), Redistributive taxation in the era of globalization, *International Tax and Public Finance*, Vol. 10, No. 4, pp. 453-468.
- Gross, C., Lorek, K., Richter, F. (2017), Attitudes towards inheritance taxation – results from a survey experiment, *Journal of Economic Inequality*, Vol. 15, No. 1, pp. 93-112.
- Grossman, V., Poutvaara, P. (2009), Pareto-improving bequest taxation, *International Tax and Public Finance*, Vol. 16, No. 5, pp. 647-669.
- Hettich, W., Winer, S.L. (1999), *Democratic choice and taxation: a theoretical and empirical analysis*, Cambridge University Press, New York.
- Kaplow, L. (2001), A framework for assessing estate and gift taxation, in: W. Gale, J.R. Hines, J. Slemrod, (Eds), *Rethinking estate and gift taxation*, Brookings Institution Press, Washington, D.C, pp. 164-215.
- Karagiannaki, E. (2017), The impact of inheritance on the distribution of wealth: evidence from Great Britain, *The Review of Income and Wealth*, Vol. 63, No. 2, pp. 394-408.
- Kenny, L.W., Winer, S.L. (2006), Tax systems in the world: an empirical investigation into the importance of tax bases, administration costs, scale and political regime, *International Tax and Public Finance*, Vol. 13, No. 2/3, pp. 181-215.
- Klevmarken, N.A. (2004), On the wealth dynamics of Swedish families, 1984-98, *The Review of Income and Wealth*, Vol. 50, No. 4, pp. 469-491.
- Kopczuk, W. (2009), Economics of estate taxation: a brief review of theory and evidence, *Tax Law Review*, Vol. 63, No. 1, pp. 139-157.

- Lührmann, A., Düpont, N., Higashijima, M., Kavasoglu, Y.B., Marquardt, K.L., Bernhard, M., Döring, H., Hicken, A., Laebens, M., Lindberg, S.I., Medzihorsky, J., Neundorf, A., John Reuter, O., Ruth-Lovell, S., Weghorst, K.R., Wiesehomeier, N., Wright, J., Alizada, N., Bederke, P., Gastaldi, L., Grahn, S., Hindle, G., Ilchenko, N., von Römer, J., Wilson, S., Pemstein, D., Seim, B. (2020), Varieties of party identity and organization (V-Party). V-Party dataset. Varieties of democracy (V-Dem) project, <https://doi.org/10.23696/vpartydsv1>.
- Milanovic, B. (2000), The median-voter hypothesis, income inequality, income redistribution: an empirical test with the required data, *European Journal of Political Economy*, Vol. 16, No. 3, pp. 367-410.
- Mundlak, Y. (1978), On the pooling of time series and cross section data, *Econometrica*, Vol. 46, pp. 69-85.
- National Tax List. (2021), Eurostat, retrieved from https://ec.europa.eu/taxation_customs/taxation-1/economic-analysis-taxation/data-taxation_en on 18.10.2022
- Nekoei, A., Seim, D. (2021), How do inheritances shape wealth inequality? Theory and evidence from Sweden, CESifo Working Paper 9017.
- Nimi, Y. (2019), The effect of the recent inheritance tax reform on bequest behaviour in Japan, *Fiscal Studies*, Vol. 40, No. 1, pp. 45-70.
- Pemstein, D., Marquardt, K.L., Tselgov, E., Wang, Y., Medzihorsky, J., Krusell, J., Miri, F., von Römer, J. (2020), The V-Dem measurement model: latent variable analysis for cross-national, cross-temporal expert-coded data, V-Dem Working Paper No. 21, 5th edn, Varieties of Democracy Institute, University of Gothenburg, <https://doi.org/10.2139/ssrn.3595962>.
- Persson, T., Tabellini, G. (1992), The politics of 1992: fiscal policy and European integration, *Review of Economic Studies*, Vol. 59, No. 4, pp. 689-701.
- Piketty, T., Saez, E. (2013), A theory of optimal inheritance taxation, *Econometrica*, Vol. 81, No. 5, pp. 1851-1886.
- Profet, P., Scabrosetti, S., Winer S.L. (2014), Wealth transfer taxation: an empirical investigation, *International Tax and Public Finance*, Vol. 21, pp. 720-767.
- Saez, E., Zucman, G. (2016), Wealth inequality in the United States since 1913: evidence from capitalized income tax data, *Quarterly Journal of Economics*, Vol. 131, No. 2, pp. 519-578.
- Wei, H., Yang, Z. (2022), The impact of inheritance on the distribution of wealth: evidence from China, *The Review of Income and Wealth*, Vol. 68, No. 1, pp. 234-262.
- Wooldridge, J.F. (2010), *Econometric analysis of cross section and panel data*, 2nd edn, Cambridge: MIT Press.
- Worldwide Estate and Inheritance Tax Guide. (2021), EY private client services, retrieved from https://www.ey.com/en_gl/tax-guides/worldwide-estate-and-inheritance-tax-guide on 18.10.2022.

Appendix

Table A1. Descriptive statistics of independent variables

	Observations	Mean	St. dev.	Min	Max
Independence of youth	667	49	14.4	15.7	74.4
75+ share	675	0.07	0.02	0.04	0.12
Aging ratio	675	0.87	0.23	0.38	1.53
Life expectancy	675	78.05	3.49	67.7	84
Migration (sign)	675	0.73	0.45	0	1
GDP per capita	675	0.02	0.02	0.00	0.1
GDP per capita PPS	675	0.00	0.00	0.00	0.00
Wealth per adult	540	13.37	9.35	0.38	35.84
Inflation	666	3.22	7.59	−1.7	154.9
Unemployment	641	8.62	4.3	1.8	27.5
Unemployment ²	641	92.77	105.39	3.24	756.25
Openness	669	1.13	0.61	0.43	4.08
Deficit (% of GDP)	675	−0.02	0.03	−0.32	−0.07
Revenue to GDP	675	0.42	0.07	0.25	0.58
Subsidies (% of GDP)	675	0.01	0.01	0.00	0.05
Other transfers (% of GDP)	675	0.02	0.01	0.00	0.05
Median to mean <0.4	675	0.61	0.49	0	1
Egalitarian democracy index	675	0.75	0.09	0.34	0.88
Economic left-right scale	675	0.09	1.14	−2.43	2.8
Illiberalism	675	0.15	0.2	0.02	0.88
Big countries [#]	675	0.22	0.42	0	1

[#] Big countries include France, Germany, Italy, Poland, Spain and the United Kingdom.
GDP, gross domestic product; PPS, purchasing power standard.

Table A2. Results of panel logit random effects models for the presence or absence of an inheritance tax

Dependent: Tax imposed or not imposed	(1)	(2)	(3)	(4)	(5)
Independence of youth	0.269*** (0.09)	0.216* (0.12)	0.258** (0.12)	0.27*** (0.09)	0.197 (0.12)
75+ share	971.34*** (186.56)	1,053.99*** (202.99)	1,016.6*** (239.93)	798.228*** (133.78)	907.16*** (165.65)
Aging ratio	-62.09*** (11.77)	-70.97*** (12.31)	-70.73*** (13.99)	-59.31*** (9.86)	-63.87*** (9.64)
Life expectancy	-1.145 (0.72)	-1.369 (0.85)	-1.599 (1.01)	-0.512 (0.64)	-0.55 (0.6)
Migration (sign)	-1.308 (2.38)	-1.829 (2.52)	-2.286 (2.47)	-2.953 (2.67)	-1.81 (2.41)
GDP per capita	-3.262 (123.93)				
GDP per capita PPS		10,936.894 (37,191.26)			
Wealth per adult			0.131 (0.23)		
Inflation	-0.24 (0.4)	-0.188 (0.49)	-0.212 (0.47)		-0.212 (0.47)
Unemployment	0.125 (1.14)	-0.65 (1.37)	-0.928 (1.31)		0.14 (0.76)
Unemployment ²	-0.009 (0.01)	0.012 (0.01)	0.015 (0.01)		-0.022 (0.03)
Openness	6.748*** (2.58)	14.058*** (3.3)	13.038*** (3.4)		8.081 (3.27)
Deficit (% of GDP)	-17.869 (34.31)	-45.532 (38.5)	-38.856 (37.12)		-29.303 (37.8)
Revenue to GDP	-29.866 (38.37)	7.219 (49.2)	13.096 (40.83)		19.882 (48.05)
Subsidies (% of GDP)	195.229 (244.81)	193.637 (298.12)	198 (250.26)		-51.89 (252.54)
Other transfers (% of GDP)	185.668 (204.34)	367.259 (260.93)	361.802 (255.71)		155.646 (232.86)
Median to mean < 0.4	4.999** (2.28)	1.722 (2.35)	0.562 (2.1)	1.333 (1.79)	
Egalitarian democracy index	-11.579 (17.89)	-19.586 (18.21)	25.821 (17.22)	6.269 (12.5)	
Economic left-right scale	0.056 (0.72)	0.5 (0.87)	0.449 (0.89)	0.572 (0.79)	
Illiberalism	-1.69 (4.53)	-1.272 (5.54)	-1.285 (5.28)	-2.847 (4.09)	
Big countries [#]	9.186** (3.8)	21.718*** (5)	21.861*** (4.32)		12.695** (6.21)
Constant	49.759 (47.41)	51.073 (55.83)	69.962 (61.98)	26.567 (41.25)	13.949 (39.07)

(Continued)

Table A2. Continued

Dependent: Tax imposed or not imposed	(1)	(2)	(3)	(4)	(5)
Observations	421	421	421	421	421
Countries	27	27	27	27	27
Joint insignificance (chi-square statistics)	82.179***	89.516***	90.699***	51.82***	73.79***
Std. dev. of the individual effect	13.45	15.705	19.753	19.546	13.81
Individual effects insignificance	232.112***	241.938***	247.546***	295.48***	298.3***
AIC	108.674	103.876	104.197	97.418	96.204
BIC	193.569	188.881	189.092	141.887	160.887

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

Big countries include France, Germany, Italy, Poland, Spain and the United Kingdom.

GDP, gross domestic product; PPS, purchasing power standard.