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Luisa Blanco
Pepperdine University, luisa.blancoraynal@pepperdine.edu

Cynthia Rogers
University of Oklahoma Norman Campus

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Do Tax Havens *Really* Flourish?
Accounting for Endogeneity in Growth Regressions

Luisa Blanco*
School of Public Policy
Pepperdine University
Malibu, CA 90263
lblanco@pepperdine.edu

Cynthia Rogers**
Department of Economics
University of Oklahoma
Norman, OK 73019
crogers@ou.edu

Abstract

That tax haven policies contribute to favorable economic growth in tax haven countries is commonly accepted. There is, however, minimal empirical evidence to substantiate this assertation and empirical investigations are subject to endogeneity bias. Using a sample of 155 countries from 1982 to 2003, we find that the standard tax haven variable is endogenous to the error term in a typical growth regression. We offer land area measures as valid instruments for tax haven status. Results based on two-stage least squares estimation with heteroskedastic standard errors and controls for initial conditions provide support for the claim that tax havens "flourish" compared with non-tax haven countries. The sensitivity of the estimates to the treatment of endogeneity is salient for a variety of related research, including the current dialogue concerning the impact of tax haven policies on non-tax haven countries.

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* Corresponding Author

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1. Introduction

Tax havens attract disproportionate levels of capital: with less than one percent of the world population, they have 15.7 percent of the gross foreign assets of American firms (Hines, 2005a). Given the conspicuously favorable growth in tax havens compared with other countries (Hines, 2005a), tax haven policies are often touted as being beneficial for growth. Support for this conclusion, however, is not well established due to the theoretical and empirical complexity of the relationship.

Figure 1 highlights the connection between tax have policies and economic growth. Financial capital flows are a primary beneficiary of tax haven policies.[1] Much of the tax haven literature focuses on the favorable flows of financial capital to tax havens. Because the majority of financial capital inflows to tax haven countries flow back out to industrialized countries, attracting financial capital may have little bearing on capital investment and subsequent growth outcomes in tax havens (Rose and Spiegel, 2006). Thus, as illustrated by the dotted line in Figure 1, the growth implications of attracting financial capital is unclear.

Surprisingly few empirical studies investigate the empirical link between tax haven policies and economic growth. Hines (2005a) offers one of the few empirical investigations suggesting that tax havens "flourish" in terms of economic growth. Conclusions about tax haven impacts are suspect given the non-random assignment of tax havens among countries. As illustrated in Figure 1, countries with favorable growth conditions, such as political and economic stability, good financial markets, and high concentrations of wealthy individuals, are more inclined to become tax havens (Johns, 1983, Palan, 2002; Dharmapala and Hines, 2006;

[1] See for example, Grubert and Mutti (2000) and Hines (2005b). Examples of country specific studies include: Hines (1996), Grubert and Slemrod (1998), Rolfe et al. (1993), Rawlings (2005), and Christensen and Hampton's (2005). In terms of tax rate differentials, Desai, Foley, and Hines (2006a,b) present a theoretical model and an empirical analysis which suggest that economic activity in tax havens is beneficial for nearby non-tax havens. For a comprehensive literature review on tax havens refer to Dharmpala (2008).

Hansen and Kessler, 2001; Hines 2007). Given that these countries are more likely to have favorable growth anyway, estimates of tax haven impacts based on standard growth regressions are likely to suffer from endogeneity bias.

We contribute to the research by showing that the tax haven variable is endogeneous in typical growth regressions and by offering land area measures as valid instruments for estimating tax haven impacts on growth outcomes. Our analysis extends previous studies (e.g., Hines, 2005a) by including more recent data, a longer time period (1982-2003), and a larger sample of tax haven and non-tax haven countries. Like Desai et al. (2006a,b) we highlight that tax havens are nonrandomly distributed across the globe. While Desai et al. (2006a,b) investigate the relationship between tax haven demand and non-tax haven growth, we focus on the growth benefits for tax havens themselves. We find that estimated impacts are sensitive to the specification of endogeneity and that the popular view of tax haven policies being favorable for growth is supported when controlling for endogeneity.

From an international policy perspective, it is important to understand who benefits from tax haven policies. Our results suggest that tax havens experience beneficial growth outcomes relative to nontax havens even when accounting for endogeneity of tax haven status.

2. A *Little* Slice of Heaven: Importance of Size in Tax Haven Determination

Geographic size is recognized as an important factor in the non-random assignment of tax haven policies among countries. Size operates via numerous avenues to contribute to favorable growth potential of small countries. Low tax rates are found to be advantageous for small countries (Gordon, 1992; Kanbur and Keen, 1993; Bucovetsky and Haufler, 2008; Bucovetsky, 2007; Marceau et al, 2007; Althuser and Grubert, 2007; Clausing, 2007; and Winner, 2005). In

addition, the expensive land and low population density afforded by a small country, attracts high income households who favor low income taxes (Hansen and Kessler, 2001). Small size is also related to favorable social capital formation, (Palan, 2002; Hampton and Christensen, 2002; Armstrong and Read, 2000) and reliance on tourism (Christensen and Hampton, 2005).[2] Tax havens also tend to have small open economies, which tend to have lower corporate tax rates (Clausing, 2008; Devereux et al., 2008; Devereux and Loretz, 2007; Ghinamo et al., 2007). These countries also focus on developing politically stable environments, strategic agreements with developed countries and adequate infrastructure (Palan, 2002; Hampton and Christensen, 2002; Dharmapala and Hines, 2006). These size-related factors are associated with favorable growth prospects.

Thus, observed favorable growth in tax havens may be driven by factors related to size rather than by (endogenous) tax haven policies. Accordingly, it is important to control for endogeneity in standard regression framework. In the following sections, we investigate whether size can be used as a valid instrument in a standard regression framework.

3. Empirical Specification of Baseline Growth Regression

Following Hines (2005a) our baseline empirical specification is given as

$$(1) \qquad AVE\Delta GDP_i = \beta_0 + \beta_1 haven + \beta_2 (initialconditions)_i + \varepsilon_i ,$$

where $AVE\Delta GDP_i$ is the average over the period from 1982 to 2003 of the difference of the natural log in the yearly real gross domestic product per capita (*GDP*) for country i.[3] The tax haven dummy, *haven*, is equal to 1 for tax haven countries as identified by Dharmapala and

[2] Islandness of a place is related to the physical and socio-political factors of an island. Hampton and Christensen (2002) argue that in order to be able to develop tourism countries must have favorable infrastructure including a good transportation system, a variety of hotels and shops, and attractive climates.

[3] Specifically, $\Delta GDP_{i,t} = ln(GDP_{i,t} / GDP_{i,t-1})$ where *GDP* is calculated using the chain series method as reported in the Penn World Tables, Version 6.2 (Heston et al. 2004).

Hines (2006) and 0 otherwise.[4] The logarithm of the population (*POP*) and *GDP in 1982*, as well as their squared and cubed values are used to control for initial conditions.[5]

Our sample includes 25 tax haven and 130 non-tax haven countries for which data were available for the sample period, 1982 to 2003. These are identified in Tables 1 and 2, respectively.[6] Our empirical specification differs from that of Hines (2005a) by using the log percentage change to measure relative change in GDP per capita, by including a longer time series from the recently updated Penn World Table data, and by including more countries (both tax havens and non-tax havens).[7] The log percentage change measure offers advantages of being symmetric, normed, and additive (Törnqvist, Vartia and Vartia, 1985).

The descriptive statistics given in Table 3 highlight the obvious differences between the tax haven and non-tax havens. Over the sample period, tax haven countries tend to be smaller and enjoy greater growth compared with non-tax haven countries.

The baseline model estimates are given in column (1) of Table 4. The estimated coefficient on the tax haven dummy is positive, very small, and statistically insignificant. The results are robust to the specification of the dependent variable (i.e., using percentage change in GDP) as well as the sample period (using 1982 to 1999) used by Hines (2005a).[8] Thus, we attribute our departure from Hines' (2005a) results of a positive estimated tax haven coefficient that is weakly significant to differences in sample composition and data revisions.

[4] Dhamapala and Hines (2006) choose tax havens as countries that are identified in Hines and Rice (1994) and that reappear in Diamond and Diamond (2002).
[5] Population and *GDP* data were available from the Penn World Tables Version 6.2 (Heston et al., 2004).
[6] Dharmapala and Hines' (2006) Table 1 shows a list of 39 tax haven countries. We were able to obtain data on GDP for the period of analysis for only 25 countries in the list.
[7] Hines (2005a) uses a sample of 119 countries, including 17 tax haven countries, for the period 1982 to 1999 and measures the change in *GDP* as the rate of change, whereas we use log percentage change.
[8] These estimates are not reported for brevity.

4. Instrumental Variable Approach

In the analysis of the impact of taxation policies on growth, it is important to note that taxation policies are likely to be endogenously determined in the growth equation. Dharmapala and Hines (2006) make a compelling case for the role of good governance in explaining which countries become tax havens. It is expected that favorable economic growth and good governance will be important determinants of tax haven status. For this reason, we consider important that the issue of endogeneity is recognized when analyzing whether tax havens outperform non-tax havens in terms of economic growth. Thus, we test for the endogeneity of tax haven status in the growth equation, provide valid instruments for tax haven status, and determine whether tax havens flourish once endogeneity is addressed for.

We employ the Hausman test to investigate whether tax haven status is determined endogenously in the growth equation (i.e. the tax haven dummy is correlated with the error term in equation 1). For this test, we first regress the tax haven dummy on all the exogenous variables in equation 1 and the proposed instruments and obtain the residuals (estimates shown on Table A1). We recommend land area, land area squared, and land area cubed as valid instruments for tax haven status in the growth equation.[9] Adding the residuals from this estimation to the baseline model, we find that the estimated coefficient on the residual is significant with a t-stat of 2.37 and p-value of .019 (Appendix, Table A.2). Accordingly, we can reject the null hypothesis that the OLS estimates are consistent and conclude that two-stage least squares (2SLS) estimation is appropriate.[10]

Two conditions must be met in order for land area, land area squared, and land area cubed to be considered a set of valid instruments. First, it is required that these instruments are

[9] Land area data are expressed in square kilometers and are obtained from the CIA's World Factbook (2007).
[10] See Wooldridge for an explanation of this version of the Hausman test (2002, p.118).

exogenous in the growth equation, where these instruments need to be uncorrelated with the error term in equation 1. For the condition of exogeneity, it is obvious that economic growth has no influence on land area since land area is a geographic factor. As discussed before, land area is associated with country institutional characteristics, and these institutional characteristics are likely to be related to economic growth.[11] Thus, it important for the exogeneity condition that land area does not have an independent effect on growth. The impact of country size on economic growth has been previously studied, where population is commonly used as measure of country size. Easterly and Kraay (2000) show that smaller states do not show different per capita income growth, but show greater volatility on output growth. Rose (2006) argues that small countries are not systematically different from other countries in terms of economic development. It is suggested that small countries are likely to differ in relation to trade only (Rose, 2006). Thus, it is unlikely that country size per see explains differences in economic growth across countries.

In our analysis, we corroborate the exogeneity of our instruments with the over-identification test, which is discussed below. Furthermore, running a regression of the residual obtained from the estimation of equation (1) on log of land area, land area squared, and land area cubed yields very small and insignificant coefficient estimates (results are shown in Appendix, Table A.3, column 1). This suggests that our instruments can be taken as exogenous in our growth equation as specified in equation (1) and support their use as valid instruments in our analysis.

The second condition for the validity of land area instruments is that they correlated with the endogenous variable, the tax haven dummy. In particular, we investigate the empirical

[11] Hanson and Olsson (2006) find that there is a negative relationship between country size (using land area) and several measures of institutional quality (rule of Law, political stability, voice and accountability, government effectiveness, regulatory quality, and corruption)

relationship between land area, land area squared, and land area cubed and the tax haven dummy variable using a Probit regression with heteroskedastic-consistent standard errors (Table A4, column 1). The resulting estimated coefficients on the land area, land area squared, and land area cubed are significant with negative, positive, and negative coefficient estimates. Thus, they are correlated with the tax haven variable as required for a valid instrument. We also test for the relevance of our instruments by performing a F test of the land area coefficients in the estimation with the tax haven dummy as dependent variable that includes all the exogenous variables in Equation 1 (regression estimates shown in Table A3). We reject the null hypothesis that these variables as a group have no explanatory power at the 1 percent level. We also use the Cragg-Donald F-statistic test to check for the relevance of our instruments. We find that instruments are not weak as the F-statistic is equal to 12.75, which ensures that the bias of TSLS is no more than 10% of the inconsistency of OLS (critical value is 9.08). Thus, we conclude that land area, land area squared, and land area cubed are valid instruments of tax haven status since they are exogenous in the growth equation and they are significantly related to tax haven status.

We implement TSLS by regressing the tax haven dummy variable on the land area instruments, the control variables in equation (1), and a constant. The predicted estimate of the tax haven dummy is then used in equation (1). Estimates in column (2) of Table 4 show that the tax haven dummy coefficient is positive and significant (P=0.006). Thus, treating endogeneity caused the estimated coefficient of the tax haven variable to become significant. The magnitude of the impact of tax haven on economic growth is significant. We observe that while a

representative non-haven country experiences a growth rate of 1 percent, a representative tax haven country has a growth rate equal to 3 percent.[12]

In the 2SLS estimation we use the over identification test to corroborate the exogeneity of our instruments. For this test we take the residuals from the 2SLS estimates using the land area instruments and regress them on all the exogenous instruments. We fail to reject the null of over identification at the 5 percent level.[13] Thus, this test supports the use of the land area variables as instruments for tax haven.

Due to the nature of our endogenous variable, the tax haven dummy, we consider an alternative estimator to the 2SLS. Although 2SLS provides consistent estimates even if the endogenous variable is not continuous, we explore whether our previous results are robust to a treatment-effects model. In this estimation we consider the 'treatment effect' of low taxation in tax havens. This approach deals with the issue that there will be some omitted variable bias as taxation policies are highly correlated to other institutional characteristics associated with good governance. With the treatment effect, we intend to control for the bias arising from the uncontrolled differences related to the potential to attract capital between tax havens and non-tax havens. Results of the estimation of the treatment-effects model with a two-step consistent estimator are shown in Table 4, column 3. In this estimation, we find evidence that there is a selection bias, which suggests that the treatment selection models are adequate. We find that the tax haven dummy is significant at the 1 percent level and the magnitude of coefficient is greater than the one found with the TSLS.

[12] Economic growth for the representative non-haven country has been estimated using the mean values of the independent variables for non-tax havens. To calculate economic growth for the representative tax haven country we use the mean values of the independent variables for tax haven countries.

[13] The R-square from this regression is 0.035, where the test statistic is 5.44. The critical value for the chi-square distribution with 2 degrees of freedom at the 5 percent level is 5.99. Therefore, with a P-value of 0.07, we fail to reject the null of over identification.

Other Instruments

Dharmapala and Hines (2006) analysis suggests that tax havens are well governed and are better governed than non tax havens. We investigate whether good governance, as defined by Dharmapala and Hines (2006), could be used as a valid instrument for tax haven status in our growth regression. The estimation results to determine the validity of the governance indicator are given in the second columns of Appendix Tables A.3 and A.4.[14] As noted by Dharmapala and Hines (2006), good governance is likely to be related to past economic growth, which is what we find. Thus, the good governance variable is not a valid instrument for tax haven status in our growth regression, and cannot be used as in independent variable. We also find that good governance and land area are negatively correlated.[15] Thus, the predicted positive relationship between growth and tax haven status (using land area instruments) may reflect the role of good governance on growth as well as that as the tax haven status. Separate identification of good governance effects and tax haven policies are elusive given that both are related to each other as well as to past growth.

5. Discussion and Conclusion

Because taxation policy is likely to be endogenously determined, it is important to develop a model that accounts for the non-random selection of tax haven status. Our analysis documents the endogeneity of tax haven status and demonstrates the sensitivity of standard growth regressions to the problem. We do not find a statistically significant relationship between economic growth and tax haven status in our baseline estimation that does not account for

[14] In Appendix Table A.1, column 2 shows that the governance index in 2004 has an explanatory power in the determination of tax havens. In Appendix Table A2, column 2 shows that governance is endogenously determined in the growth equation.
[15] The correlation between land area and the governance index is equal to -0.303.

endogeneity. In contrast, we find, using a set of land area variables to instrument for tax haven status, that tax haven status has a positive and significant coefficient in our 2SLS estimation. Our results suggest that tax havens outperform non-tax haven countries, and that this result is not driven by endogeneity of tax haven policies or initial conditions.

Addressing the endogeneity of tax haven status is important for policy-relevant research focused on the international taxation of capital. In particular, if tax havens are well governed, as documented by Dharmapala and Hines (2006), and good governance leads to favorable growth, then international debates focusing on "fixing" international tax rate differentials may be misguided. Furthermore, to the extent that a host of underlying exogenous factors are related to past and future economic growth as well as government policies, investigations of growth impacts of particular policies are impacted by endogeneity concerns.

More research is needed to better understand what it is about tax havens that leads to favorable growth and the extent to which favorable taxation contributes to growth. Along these lines, Dharmapala and Hines (2006) include a rich set of socio-political and geographical factors in analyzing tax haven determinants. We offer a set of land area variables as potential factors for such investigations.

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FIGURE 1: Endogeneity of Tax Haven Status

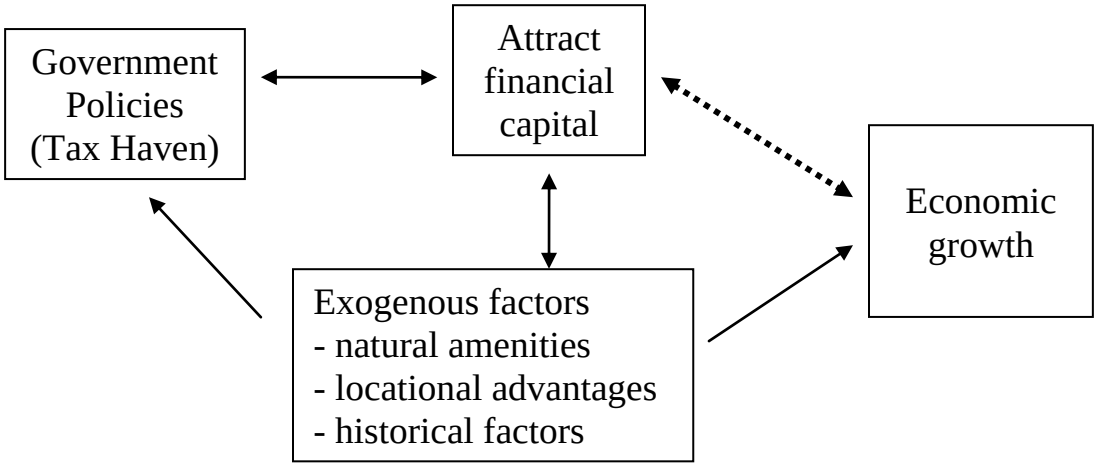

Table 1
Tax Haven Countries in Analysis (n=25)*

Antigua	Luxembourg
Bahamas	Macao
Bahrain	Maldives
Barbados	Malta
Belize	Netherlands Antilles
Bermuda	Panama
Cyprus	Singapore
Dominica	St. Kitts & Nevis
Grenada	St. Lucia
Hong Kong	St. Vincent & Grenadines
Ireland	Switzerland
Jordan	Vanuatu
Liberia	

*Source: Tax Havens identified in Dharmapala and Hines' (2006) Table 1. Dharmapala and Hines identified 14 other tax haven countries for which no data are available – Andorra, Anguilla, British Virgin Islands, Cayman Islands, Channel Islands, Cook Islands, Gibraltar, Isle of Man, Lebanon, Liechtenstein, Marshall Islands, Monaco, Montserrat, and Turks and Caicos Islands.

Table 2

Non-Tax Haven Countries in Analysis (n=130)*

Afghanistan	Ecuador	Lesotho	Samoa
Algeria	Egypt	Madagascar	Sao Tome and Prin.
Argentina	El Salvador	Malawi	Saudi Arabia
Australia	Equatorial Guinea	Malaysia	Senegal
Austria	Ethiopia	Mali	Sierra Leone
Bangladesh	Fiji	Mauritania	Solomon Islands
Belgium	Finland	Mauritius	Somalia
Benin	France	Mexico	South Africa
Bhutan	Gabon	Micronesia	Spain
Bolivia	Gambia, The	Mongolia	Sri Lanka
Botswana	Germany	Morocco	Sudan
Brazil	Ghana	Mozambique	Suriname
Brunei	Greece	Namibia	Swaziland
Burkina Faso	Guatemala	Nepal	Sweden
Burundi	Guinea	Netherlands	Syria
Cambodia	Guinea-Bissau	New Zealand	Taiwan
Cameroon	Honduras	Nicaragua	Tanzania
Canada	Hungary	Niger	Thailand
Cape Verde	Iceland	Nigeria	Togo
Central African Rep.	India	Norway	Tonga
Chad	Indonesia	Oman	Trinidad &Tobago
Chile	Iran	Pakistan	Tunisia
China	Iraq	Palau	Turkey
Colombia	Israel	Papua New Guinea	Uganda
Comoros	Italy	Paraguay	United Arab Emirates
Congo, Dem. Rep.	Jamaica	Peru	United Kingdom
Congo, Republic of	Japan	Philippines	United States
Costa Rica	Kenya	Poland	Uruguay
Cote d`Ivoire	Kiribati	Portugal	Venezuela
Cuba	Korea, Dem. Rep.	Puerto Rico	Zambia
Denmark	Korea, Republic of	Qatar	Zimbabwe
Djibouti	Kuwait	Romania	
Dominican Republic	Laos	Rwanda	

*Note: Countries for which data are available from 1982 to 2003 in the Penn World Tables, version 6.2 (Heston et al., 2004)

Table 3
Summary Statistics

	Tax Haven		***Non-Tax Haven***		***All Countries***	
Variable	***Mean***	***Std. Dev.***	***Mean***	***Std. Dev***	***Mean***	***Std. Dev.***
GDP 1982	10,290	7,437	6,688	7,856	7,269	7,880
Population 1982	1,112	1,724	31,979	111,022	27,000	102,250
Area	18,469	32,991	810,203	1,784,667	682,504	1,659,368
Ln(GDP 1982)	8.95	0.82	8.21	1.12	8.33	1.11
Ln(pop. 1982)	5.90	1.52	8.71	1.93	8.26	2.14
Ln(area)	7.61	2.41	12.07	2.10	11.35	2.70
AVEΔGDP	0.02	0.03	0.01	0.02	0.01	0.02

Table 4
Dependent Variable: AVEΔGDP
n=155

	OLS	TSLS	Treatment
Constant	2.403	1.855	2.108
	(0.553)	(0.566)	(0.576)
Tax haven dummy	0.004	0.029***	0.034***
	(0.007)	(0.010)	(0.010)
Ln(population 1982)	0.022	0.016	0.046***
	(0.017)	(0.017)	(0.017)
Ln(population 1982)^2	-0.004*	-0.003	-0.006***
	(0.002)	(0.002)	(0.002)
Ln(population 1982)^3	0.0002***	0.0002	0.0003***
	(0.0001)	(0.0001)	(0.0001)
Ln(GDP 1982)	-0.908***	-0.702***	-0.833***
	(0.202)	(0.208)	(0.211)
Ln(GDP 1982)^2	0.112***	0.086***	0.103***
	(0.024)	(0.025)	(0.026)
Ln(GDP 1982)^3	-0.005***	-0.003***	-0.004***
	(0.001)	(0.001)	(0.001)
R-squared	0.237	0.123	

Robust standard errors in parenthesis
'***','**', and '*' indicate significance at 1 percent, 5 percent, and 10 percent, respectively.

Appendix

Table A.1
Dependent Variable: Tax haven dummy
n=155

	OLS
Constant	15.876
	(6.689)
Ln(population 1982)	0.619**
	(0.315)
Ln(population 1982)^2	-0.077**
	(0.036)
Ln(population 1982)^3	0.003**
	(0.001)
Ln(GDP 1982)	-5.7653**
	(2.4807)
Ln(GDP 1982)^2	0.726**
	(0.305)
Ln(GDP 1982)^3	-0.030**
	(0.015)
Ln(area)	-0.417
	(0.280)
Ln(area)^2	0.023
	(0.027)
Ln(area)^3	-0.0004
	(0.0008)
R-squared	0.474

Robust standard errors in parenthesis
'***','**', and '*' indicate significance at 1 percent, 5 percent, and 10 percent, respectively.

Table A.2
Dependent Variable: AVEΔGDP
n=155

	OLS
Constant	1.855
	(0.524)
Tax haven dummy	0.029***
	(0.011)
Ln(population 1982)	0.016
	(0.016)
Ln(population 1982)^2	-0.003
	(0.002)
Ln(population 1982)^3	0.0002*
	(0.0001)
Ln(GDP 1982)	-0.702***
	(0.194)
Ln(GDP 1982)^2	0.086***
	(0.024)
Ln(GDP 1982)^3	-0.003***
	(0.001)
Residual	-0.031**
	(0.013)
R-squared	0.267

Robust standard errors in parenthesis
'***','**', and '*' indicate significance at 1 percent, 5 percent, and 10 percent, respectively.

Table A.3
Dependent Variable: Residual
n=155

	OLS	OLS
Constant	-0.001	0.000
	(0.030)	(0.001)
Ln(area)	0.002	--
	(0.010)	
$Ln(area)^2$	-0.0001	--
	(0.001)	
$Ln(area)^3$	-0.000001	--
	(0.00003)	
Governance Index	--	0.007***
		(0.002)
R-squared	0.026	0.106

Robust standard errors in parenthesis
'***','**', and '*' indicate significance at 1 percent, 5 percent, and 10 percent, respectively.

Table A.4
Dependent Variable: Tax haven dummy
n=155

	Probit	Probit
Constant	53.190	-1.153
	(19.199)	(0.141)
Ln(area)	-17.598***	--
	(6.484)	
$Ln(area)^2$	1.897***	--
	(0.706)	
$Ln(area)^3$	-0.068***	--
	(0.025)	
Governance Index	--	0.576***
		(0.152)
R-squared	0.473	0.126

Robust standard errors in parenthesis
'***','**', and '*' indicate significance at 1 percent, 5 percent, and 10 percent, respectively.