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Long and short-run tax buoyancies in small states

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Abstract

This paper uses a recently developed and updated tax revenue dataset to estimate long- and short-run tax buoyancies for a group of 36 small states for the period 1993-2017. The main findings suggest that while buoyancies for aggregate tax revenues are relatively high, the long-run buoyancy for indirect taxes—which accounts for most tax revenues—is relatively lower than the buoyancy for direct taxes. Also, short-run buoyancies were found to be relatively low for both tax categories. It was found that the magnitude of the long-run buoyancy declined from the pre-crisis period to the post-crisis period, while short-run tax buoyancies have improved.

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1. Introduction

Small states have peculiar structural characteristics—high vulnerability to external shocks derived from their narrow production and export bases, high exposure to natural hazards, and fiscal management gaps—that adversely weigh on their fiscal and debt performance compared to larger peers (International Monetary Fund (IMF, 2018)). Indeed, the global financial crisis of 2008, commodity price shocks of 2015 and the frequent occurrence of natural hazards in the past decade have all contributed to fiscal imbalances and rising debt levels in small states (see Khadan and Deonarine, 2019). The average fiscal deficit and debt ratios (as a percent of GDP) for small states over the period 2014-2018 were 2.3 percent and 63 percent, respectively—but with significant heterogeneity across countries. On the back of ongoing consolidation programs, positive real GDP growth rates have been forecasted for small states over the short-term (on average 3.7 percent for 2020-2024). Thus, an important policy question is how economic growth could influence tax revenues—i.e. how buoyant is the tax system?

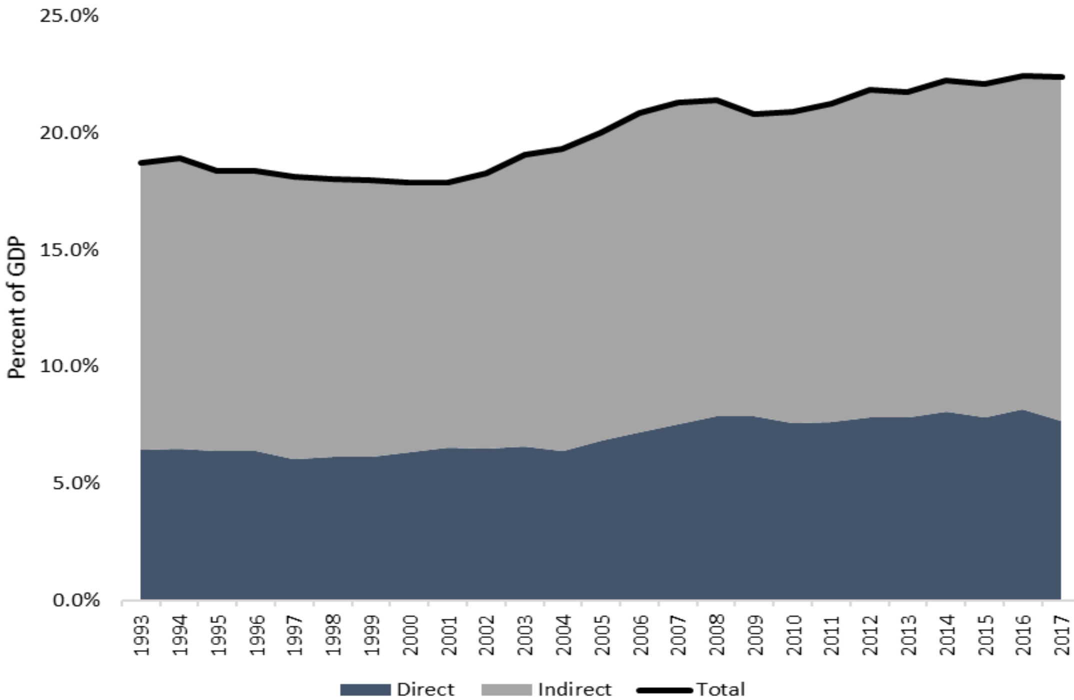
In that context, this paper estimates tax buoyancies for a panel of small states. Tax buoyancy measures the responsiveness of tax revenues to changes in national income. The buoyancy of the tax system indicates the extent to which increases in GDP can contribute to long-run fiscal sustainability and the extent to which it is an effective stabilization tool to smooth the effects of the economic cycle in the short-run (see Dudine and Jalles, 2017). The rest of this paper unfolds as follows: the next section briefly discusses the data, followed by the model specification and estimation strategy, results and conclusions.

2. Data

The analysis covers a sample of 36 small states using annual data for the period 1993 to 2017. The countries included in the panel have a population of less than 1.5 million.[1] Tax variables are obtained from the recently updated 2018 Government Revenue Dataset of the International Centre for Tax and Development/United Nations University—World Institute for Development Economics Research, (ICTD/UNU-WIDER). This database contains a detail breakdown of tax revenues. However, data for small states is still relatively sparse for various components of tax revenues. As a result, data from the Economic Commission for Latin America and the Caribbean, and reports from the IMF and country authorities were used to develop a more comprehensive tax dataset for small states. The analysis focuses on total tax revenues and two broad tax categories (direct and indirect taxes). The macroeconomic variables (real GDP, nominal GDP and inflation) are obtained from the IMF, World Economic Outlook, April 2019. Figure 1 shows the composition of tax revenues as a percent of GDP.

[1] The countries are Antigua and Barbuda, Aruba, The Bahamas, Barbados, Belize, Bhutan, Cape Verde, Comoros, Cyprus, Djibouti, Dominica, Estonia, Fiji, Grenada, Guyana, Iceland, Kiribati, Luxembourg, Maldives, Malta, Marshall Islands, Mauritius, Montenegro, Palau, Samoa, San Marino, Sao Tome and Principe, Seychelles, Solomon Islands, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Swaziland, Tonga, Trinidad and Tobago, and Vanuatu.

Figure 1. Composition of tax revenues (average, % of GDP)



Sources: Authors estimates from ICTD/UNU-WIDER; Economic Commission for Latin America and the Caribbean and IMF country reports.

3. Model specification and estimation strategy

The empirical assessment of tax buoyancy is based on the following panel autoregressive distributive lag model (p, q):

$$\ln T_{i,t} = \sum_{j=1}^{p} \emptyset_{i,j} ln\, T_{i,t-j} + \sum_{j=0}^{q} \varphi_{i,j} ln\, Y_{i,t-j} + \mu_i + \epsilon_{i,t} \quad (1)$$

From equation (1), $T_{i,t}$ is defined as the relevant category of tax revenues (total, direct, or indirect taxes) for country i at time t, $Y_{i,t}$ is defined as GDP, and μ_i and $\epsilon_{i,t}$ represents the country fixed effects and the error term respectively. Equation (1) can be further transformed into the following single error correction model (ECM):

$$\Delta\ln T_{i,t} = \lambda_i\left(ln\, T_{i,t-1} - \beta_i ln\, Y_{i,t-1}\right) + \theta_{i,0}\, \Delta\ln Y_{i,t} + \mu_i + \epsilon_{it} \quad (2)$$

Where $\lambda_i = -(1 - \emptyset_{i,1})$, $\beta_i = \frac{\theta_{i,0}+\theta_{i,1}}{\lambda_i}$; λ_i measures the country-specific speed of adjustment, that is how fast buoyancy converges to its long-run equilibrium. β_i denotes the long-run buoyancy and $\theta_{i,0}$ measures the short-run tax buoyancy (see Dudine and Jalles, 2017).

The parameters in equation 2 are typically estimated by Mean Group (MG) and Pooled Mean Group (PMG) estimators. The MG estimator of Pesaran and Smith (1995) fits the parameters by computing simple arithmetic averages of country-specific regressions. It allows for all parameters (intercepts, slope coefficients, and error variances) to vary across panel units. Alternatively, the PMG of Pesaran, Shin and Smith (1999) constraints the long-run coefficient to be homogeneous across panels while allowing for country-specific short-run and adjustment parameters. A Hausman test is used to test determine validity of the homogeneity assumption of the long-run parameters between the PMG and MG.

4. Results

When applying panel cointegration models one must first test for cross sectional independence among the panel units, unit roots and cointegration. In the first instance, the Pesaran (2004) cross-sectional dependence (CD) test is used to check for cross-sectional dependence among the panel units. The results of the CD test statistics for real GDP and real tax revenues were 89.9 and 79.4 respectively, with p-values less than 5 percent, implying the presence of cross-sectional dependence. With evidence of cross-sectional dependence, the second generation Cross-sectionally augmented Im, Pesaran and Shin (CIPS) panel unit root test of Pesaran (2007) is applied to determine whether the variables are stationary or not. The CIPS panel unit root tests showed that tax revenues and GDP are non-stationary in levels but are stationarity in first differences, implying that both variables are integrated to the order of one (i.e. one unit root). Finally, applying the panel cointegration tests of Westerlund (2007) which tests a null hypothesis of no cointegration and uses bootstrapping to treat with cross-sectional dependence, indicates the presence of a long-run equilibrium relationship between GDP and tax revenues.[2,3]

The Hausman test fails to reject the null hypothesis indicating that the PMG estimator is more efficient than the MG estimator. Thus, the PMG is used to produce the results in columns 3-6 of Table 1. The speed of adjustment parameter has the expected negative sign (-0.362 from PMG) and is statistically significant at all conventional levels of statistical significance, confirming convergence of both variables to a long-run relationship. The long-run tax buoyancy is larger than one, 1.215 while the short-run buoyancy is less than one, 0.906. These results suggest that in the long run, on average, the tax system in small states is buoyant: that is, it is a good automatic stabilizer and it can support long-run fiscal sustainability. However, given the relative composition of tax revenues as shown above, it is important to examine tax buoyancy by tax categories as tax categories with a smaller share in tax revenues can have higher buoyancy and vice versa.

Columns 3 and 4 of Table 1 shows that there is a clear difference between the buoyancy of direct and indirect taxes. The long-run buoyancy for direct tax revenue is relatively higher than the buoyancy for indirect tax revenues. Similarly, the short-run buoyancies are low (below one) for both tax categories, and relatively higher for indirect taxes. Moreover, columns 5 and 6 of Table 1 shows that long-run buoyancy in the pre-global financial crisis period (1993-2008) was much higher than in the post- global financial crisis period (2009-2017), while short-run buoyancy improved during the post-crisis period when compared to the pre-crisis period. These results suggest that the stabilization function of the tax system improved after the 2008 global financial crisis, but the long-run fiscal sustainability function of the tax system has weakened. It should be noted that these results represent the average effect and can vary across countries (see Table A1 for country-specific estimates of long run buoyancy estimates for the full period, pre-crisis period and post-crisis period).

[2] The Westerlund tests consists of two sets of alternative hypotheses: (i) group mean tests (Gt and Ga) and (ii) panel tests (Pt and Pa). The group mean tests do not assume equality of the error-correction while the panel tests assume that it is equal for all panel units.

[3] Th results of the CD and CIPS tests statistics are available upon request.

Table 1. Dependent variable: tax revenue and components of total tax revenues

	Alternative estimators		Components of tax revenues		Alternative time periods	
	1	2	3	4	5	6
Explanatory variables	PMG	MG	Direct	Indirect	Pre-crisis 1993-2008	Post-crisis 2009-2017
Long run buoyancy	1.215	1.419	1.604	1.217	1.038	0.756
	[0.029]***	[0.095]***	[0.055]***	[0.034]***	[0.025]***	[0.021]***
Speed of adjustment	-0.362	-0.519	-0.359	-0.345	-0.439	-0.478
	[0.037]***	[0.037]***	[0.051]***	[0.031]***	[0.052]***	[0.063]**
Short run buoyancy	0.906	0.752	0.549	0.973	0.629	1.322
	[0.166]***	[0.166]***	[0.251]***	[0.199]**	[0.250]***	[0.229]***
Constant	-3.996	-7.853	-7.736	-3.964	-3.070617	-0.179801
	[0.414]***	[0.994]***	[1.159]***	[0.362]***	[0.365]***	[0.068]***
Observations	827	827	770	776	505	322
Countries	37	37	37	37	37	37
Hausman test	3.71					
(MG vs. PMG)	[0.054]					

Note: Standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

A robustness check of the results is performed by examining the effect of price changes on tax buoyancy estimations. In this regard, equation 2 is estimated using nominal changes in total tax revenues and nominal GDP, while controlling for inflation. Table 5 shows that the short and long run coefficients are positive but statistically insignificant at the 5 percent level of statistical significance, implying that for the group of small states considered tax buoyancy appears to be neutral to inflation (see Table 2).

Table 2. Robustness check: tax buoyancy for total tax revenues with and without controlling for inflation

	No control for inflation	Control for inflation
Long run buoyancy	1.094	1.157
	[0.010]***	[0.034]***
Short run buoyancy	0.712	0.648
	[0.074]***	[0.089]***

Long run price effect		-0.081
		[0.056]
Short run price effect		0.225
		[0.124]*
Speed of adjustment	-0.359	-0.385
	[0.036]***	[0.039]***
Constant	-1.366	-1.905
	[0.138]***	[0.199]***
Observations	872	827
Countries	38	37

Estimations by PMG estimator. Standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

5. Conclusions

This paper showed that although buoyancies for total tax revenues exceed one, there are significant differences across broad tax categories and between the pre-crisis and post-crisis periods. In terms of the composition of tax revenues, indirect tax revenues account for more than three-fifths of tax revenues and it has a relatively lower long-run buoyancy coefficient than direct taxes. Moreover, while short-run buoyancies are low for both tax categories, it is relatively higher for indirect taxes when compared to direct taxes. It was also found that long-run tax buoyancy weakened in the post-crisis period when compared to the pre-crisis period, which implies a diminishing influence of the tax system to support long-run fiscal sustainability. These findings provide robust insights to guide the expectations of policymakers when designing tax and economic growth policies in small states. Further research on the buoyancy of the tax system in small states can expand the categories of taxes (disaggregated historical tax data on small states are currently sparse) which can provide further insights for policy makers and examine what are the possible factors contributing to the decline in long-run buoyancy coefficients in the post-crisis period.

6. References

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Appendix

Table A1. Long run buoyancy coefficients by country

Country	Full period (1993-2017)	Pre-crisis (1993-2008)	Post-crisis (2009-2017)
Aruba	0.87**	0.97***	0.71
Antigua and Barbuda	1.37***	1.67***	0.52*
The Bahamas	2.40***	2.24**	4.64
Belize	1.20***	1.00***	2.59*
Comoros	0.78***	0.91*	0.42
Cape Verde	1.21***	1.31***	0.68
Cyprus	1.76***	1.89***	0.57
Djibouti	0.39**	1.04	0.30***
Dominica	1.51***	1.47***	4.94
Estonia	1.37***	1.26***	2.04***
Fiji	1.82***	1.43***	2.13***
Grenada	1.20***	1.00***	1.90***
Guyana	2.32***	3.51***	0.86***
Kiribati	0.72	2.11***	1.61
St. Kitts and Nevis	1.05***	1.16***	1.61***
St. Lucia	1.51***	1.70***	0.33
Luxembourg	0.93***	0.91***	1.34***
Macao SAR, China	1.65***	1.74***	1.10**
Maldives	2.30***	2.08***	3.66***
Malta	1.57***	1.86***	0.98***
Montenegro	2.18***	3.09***	2.49***
Mauritius	1.11***	1.15***	0.75 ***

Palau	3.16***	2.36***	2.56***
Solomon Islands	1.96***	2.01***	0.94**
Sao Tome and Principe	0.73***	0.27	0.53**
Suriname	1.74***	1.93***	2.91
Swaziland	1.58***	2.12***	2.83*
Seychelles	1.82***	1.38**	1.18***
Tonga	1.05***	1.25***	2.80**
St. Vincent and the Grenadines	1.15***	1.18***	3.19***
Vanuatu	1.16***	1.25***	1.46***
Samoa	0.88***	0.82***	2.01

Estimations by MG estimator; *** $p<0.01$, ** $p<0.05$, * $p<0.1$.