# Public Sector Economics

## 2/2022

Institute of
Public Finance

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# Public policy reforms and their impact on productivity, investment and employment: new evidence from OECD and non-OECD countries

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PUBLIC SECTOR
ECONOMICS
46 (2) 179-205 (2022)

BALÁZS ÉGERT: PUBLIC POLICY REFORMS AND THEIR
IMPACT ON PRODUCTIVITY, INVESTMENT AND EMPLOYMENT:
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**Abstract**

*This paper evaluates the relationship between public policy reforms and productivity, investment, employment and per capita income for OECD and non-OECD countries. More competition-friendly product market regulations are associated with improved economic outcomes: lower barriers to foreign trade and investment go in tandem with greater multi-factor productivity (MFP), and lower barriers to entry and less pervasive state control over the business sector with larger capital stock and increased employment rate. More flexible labour market regulations are found to go hand in hand with higher employment rates whereas no robust link between labour market regulations and MFP and capital deepening can be established. The findings also suggest that the quality of institutions is fundamental for economic outcomes. Finally, the paper shows that countries at different levels of economic development face different policy effects and that some policy reforms interact with each other by attenuating and amplifying each others' economic impacts.*

*Keywords: public policies, structural reforms, product markets, labour markets, regulation, institutions*

## 1 INTRODUCTION

Especially since the 2007/08 financial and economic crises, which truncated economic growth all over the world, structural reforms have been at the forefront of policy discussion. The main policy question centred on the size of the long-run growth dividends of reforms but discussion has also focused on short-term benefits and costs and the political economy of public policy reforms.

There is an abundant body of literature investigating the connection between structural reforms and economic outcomes. It comprises country-, industry- and firm-level analyses, which show that stringent product and labour market regulations are accompanied by weaker productivity outcomes (Andrews and Cingalo, 2014; Nicoletti and Scarpetta, 2003; Cette, Lopez and Mairesse, 2013, 2014). Another strand looks at labour market policies and show that a variety of regulations and labour market institutions are strongly correlated with unemployment and employment outcomes (Blanchard and Wolfers, 2000; Bertola, Blau and Kahn, 2002; Nickell, Nunziata and Ochel, 2005). More specifically, stricter employment protection legislation (EPL), a good proxy for restrictions with regard to hiring and firing, is found to go hand in hand with higher unemployment and lower employment rates (Bassanini and Duval, 2009; De Serres, Hijzen and Murtin, 2014; and Gal and Theising, 2016). The business environment is also an important factor for investment as the costs of starting and running a business will affect business investment (World Bank, 2014). Tight regulation is identified as having a particular effect on investment in network sectors (Alesina et al., 2005; Vartia, 2008; Cambini and Rondo, 2011). There is, however, controversy as to whether labour market regulation is associated with greater or smaller investment (Cingano et al., 2010, 2015; Cette, Lopez and Mairesse, 2016; Égert, 2016). Finally, the growth literature identifies the quality of institutions as an important driver of long-term economic growth (Acemoglu and Johnson, 2005; Aghion et al., 2016).

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Against this background, the purpose of this paper is to estimate the relationship between public policy reforms and economic outcomes, including productivity, capital intensity, employment and long-term per capita income in OECD and non-OECD countries. In doing so, this paper investigates the economic effect of product, labour and financial market regulations, as well as the role of institutions. This study also raises the question of whether policy effects differ for countries at different levels of economic development, whether the quality of institutions and the stance of specific policies generate heterogeneity in the way individual countries react to specific policy changes.

Empirical results reported in this paper suggest that more competition-friendly product market regulations underpin long-term growth. In particular, reducing barriers to foreign trade and investment tend to be related to improved multi-factor productivity (MFP), whereas lowering barriers to entry and cutting back on state interference in the business sector is related to greater capital stock and higher employment rate; cutting the cost of hiring and firing in the labour market goes together with higher employment rates. At the same time, labour market regulations appear to have no strong relationship with MFP and capital deepening. Results also show that countries at different levels of economic development face different policy impacts and that some policy reforms interact with each other by mutual attenuation and amplification. Finally, and very importantly, the quality of institutions appears to have a strong link to improved productivity and per capita income level.

The remainder of the paper is structured as follows. Section 2 discusses data issues. Section 3 describes modelling challenges. Section 4 presents some stylised facts. Section 5 reports on and analyses the results of the assessment. Finally, section 6 demonstrates how the coefficient estimates can be used for reform quantification and shows the impact of policy changes on MFP, capital, employment and per capita income. Section 7 finally provides some concluding remarks.

## 2 MODELLING ISSUES
### 2.1 LINEAR MODELS AND ENDOGENEITY
The quantification of reforms draws on the production function approach, following Barnes et al. (2013), Bouis and Duval (2011), Johansson et al. (2013) and Égert, Gal and Wanner (2017). In such a framework, policy reform effects on GDP can be assessed through their impact on supply-side components including labour productivity and employment, which in turn can be further decomposed into capital intensity and multi-factor productivity, and labour force participation and unemployment, respectively (figure 1). In the empirical estimations, the employment rate is not broken down into the unemployment and participation rates because reduced-form estimation results cannot be always fully reconciled with the findings on the employment rate. The overall impact on GDP per capita is then obtained by aggregating the policy effects of the various channels through a production function.

The linear relationship between policies & institutions and the three supply-side channels: MFP, capital deepening and the employment rate can be modelled as shown in equations (1a to 1c):

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$$MFP_{j,t} = f(OPEN_{j,t}, INNOVATION_{j,t}, PMR_{j,t}, LMR_{j,t}, FMD_{j,t}, INSTITUTION_{j,t}) \quad (1a)$$

where innovation and openness foster the creation, adoption and diffusion of new technologies. PMR, LMR and FMD stand for product market regulation, labour market regulation and financial market development. The precise policy indicators used in the regression analysis are described in the next section dealing with data issues.

These policies determine how efficiently resources can be reallocated within and across firms and how easy it is to finance new and incumbent businesses. Institutions capture the overall institutional framework (see e.g., Égert, 2016).

Capital deepening can be written as in equation (1b):

$$(K/Y)_{j,t} = f(UCC_{j,t}, PMR_{j,t}, LMR_{j,t}, FMD_{j,t}, INSTITUTION_{j,t}) \quad (1b)$$

where UCC denotes the user cost of capital. For reasons of data availability, we use the real interest rate for the large panel (see e.g., Égert, 2018b).

The employment rate equation is given by equation (1c):

$$L_{j,t} = f(PMR_{j,t}, LMR_{j,t}) \quad (1c)$$

where LMR denotes a variety of labour market regulations and policies (see e.g., Gal and Theising, 2015). Regressions will be also estimated for per capita income levels. The double objective is to see: (i) whether the variables driving the three supply-side channels can be estimated directly for per capita income levels, and (ii) whether the results obtained for (1a) to (1c) are consistent with overall per capita income equations.

Three types of regressions are used in the empirical analysis in order to fully exploit the dataset.
- The first consists of estimating panel regressions including country- and time-fixed effects. The estimated coefficients will reflect how (panel wide) average changes in outcome variables (MFP, capital deepening and employment) correlate with average changes in regulation and institutions.
- The second set of regressions includes variables, which vary over time and a number of variables, which are time invariant and which replace the country fixed effects. The latter will show how cross-country differences in economic outcomes are associated with cross-country differences in policies and institutions.
- Finally, pure cross-country regressions will link outcomes and their covariates using only cross-country differences and no time variation in the data. For this purpose, equations 1(a) to 2(d) are estimated without the time dimension of the data.

The identification of policy effects using macro-level indicators has been criticised in the literature on the grounds that policy effects are not well identified due to aggregation bias and issues related to endogeneity and reverse causality. Against this background, a difference-in-differences approach, making use of industry or firm-level datasets, is often viewed as a panacea for a neater identification of reform effects. Such a set-up links country-level policy indicators to sectoral or firm-level data through an interaction with a variable that captures a different exposure to the regulation analysed. For instance, country-level labour market regulations, such as employment protection legislation, might have a larger effect on industries and firms with larger labour intensity.

Nevertheless, country-level panel estimates have a number of advantages over sector- and firm-level studies. First, sector- and firm level studies typically focus on one policy at a time whereas country-level regressions include a large number of policies. This implies that policy effects are conditional on a number of other policies. Second, and most importantly, country-level regression produces estimates reflecting general equilibrium effects, whereas sector- and firm-level studies provide partial equilibrium results for at least two reasons. First, sector- and firm-level studies use a specific channel (exposure variable), through which the policy reform influences economic outcomes. But other channels might also be at work in practice. As a result, using only one channel leads to partial equilibrium effects. By contrast, macroeconomic estimates provide general equilibrium effects, as they capture all policy channels. Second, sector- and firm-level studies identify the differential policy impact between the least and most exposed sectors/firms. In such a framework, the policy effect is not estimated (or assumed to be zero) for the least exposed sectors/firms. This also leads to partial equilibrium estimates. At the same time, country-level regressions incorporate both the baseline and the differential effects. Endogeneity remains an issue in macroeconomic regressions, in particular in cross-country regressions, and to a lesser extent in cross-country time-series regressions including country and/or time fixed effects. Estimation results should be considered and interpreted with corresponding caution.

## 2.2 ESTIMATING HETEROGENEOUS EFFECTS: THRESHOLD EFFECTS

Threshold models aim to capture non-linear effects that can occur abruptly when the variable of interest has different coefficients below and above a given value of the threshold variable (threshold non-linearity). For instance, the impact of product market regulation could depend on the level of another policy.

$$Y_{j,t} = \begin{cases} a_1 + \beta_1 non-linear\_variable_{j,t} + \varepsilon_t & \text{if} \quad threshold\_variable < T \\ a_1 + \beta_2 non-linear\_variable_{j,t} + \varepsilon_t & \text{if} \quad threshold\_variable \geq T \end{cases} \quad (2a)$$

where $T$ is the threshold value of the threshold variable. In equation (2a), only one variable is considered to be non-linear. The threshold variable can be the same variable or some other policies. At the same time, explanatory variables included in equations (1a) to (1d) are also included in the empirical analysis relying on regressions 2(a) to 2(d).

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The threshold value is determined endogenously through a grid search. In this paper, a grid search with steps of 1% of the distribution is carried out to identify the value of the threshold variable that minimises the sum of squared residuals of the estimated two-regime model. The grid search starts at 15% of the distribution and stops at 85% to ensure that a sufficient number of observations falls into each regime. There is evidence for non-linearity if the null hypothesis of $\beta_1 = \beta_2$ can be rejected against the alternative hypothesis of $\beta_1 \neq \beta_2$ (Hansen, 1996; 1999). In practice, this test shows whether coefficient estimates are significantly different for different country groups (e.g., emerging vs. developed countries).

One question addressed in this paper is whether various product and labour market policies have the same impact in all countries or whether different countries may face different policy impacts. One obvious source of heterogeneity, which could lead to different policy impacts across groups of countries is the level of development. Per capita income will be used in this paper to measure economic development. Adjusting equation (2a) to per capita income levels as the threshold variable gives equation (2b):

$$Y_{j,t} = \begin{cases} a_1 + \beta_1 policy\_variable_{j,t} + \varepsilon_t & \text{if} \quad per\_capita\_income < T \\ a_1 + \beta_2 policy\_variable_{j,t} + \varepsilon_t & \text{if} \quad per\_capita\_income \geq T \end{cases} \quad (2b)$$

where $T$ is threshold value/the tipping point of the per capita income variable.

Another question to be raised is the extent to which institutions matter. Institutions could enter the country-time panel regressions as a time-varying variable. If country fixed effects are included into the regressions, the relationship will be identified through the within dimension, that is through the time variation in these variables. However, institutions tend to change very slowly over time. It would therefore be interesting to investigate the extent to which the cross-country variation in institutions is correlated with cross-country differences in economic outcomes. One way to look at this issue is to replace country fixed effects with constants capturing institutions. In such a setting, institutions would be measured as their period averages. Obviously, such an approach runs the risk of an omitted variables bias. But if the overall fit (adjusted R-squared) of the regressions excluding country-fixed effects and including institutional constants comes close to that of regressions including country-fixed effects, such a bias is possibly small.

Institutions may matter for economic outcomes not only in their own right but also through the way they influence the impact of other policies. For instance, better institutions could increase the negative impact of more restrictive regulations via better enforcement. Better quality institutions could also decrease the negative impact of more binding regulations via reducing regulatory uncertainty. This hypothesis could be tested as follows:

$$Y_{j,t} = \begin{cases} a_1 + \beta_1 policy\_variable_{j,t} + \varepsilon_t & \text{if} \quad institutions < T \\ a_1 + \beta_2 policy\_variable_{j,t} + \varepsilon_t & \text{if} \quad institutions \geq T \end{cases} \quad (2c)$$

where *T* is the threshold value of the variable capturing institutional quality.

Threshold regressions are well suited to provide insights for the last question posed by this paper: do different policies interact with each other? More specifically, we would be interested to figure out whether the level of labour market policies amplifies or attenuates the effect of product market regulations on output levels and vice versa. Equation (2d) will be employed to test for this hypothesis:

$$Y_{j,t} = \begin{cases} a_1 + \beta_1 product\_market\_regulation_{j,t} + \varepsilon_t & \text{if} \quad labour\_market\_regulation < T \\ a_1 + \beta_2 product\_market\_regulation_{j,t} + \varepsilon_t & \text{if} \quad labour\_market\_regulation \geq T \end{cases} \quad (2d)$$

where *T* is the threshold value of labour market regulations.

## 3 DATA ISSUES

The major challenge is related to data availability.[1] The main OECD indicators of regulation are either not available for non-OECD emerging market economies or they are available only for a very recent period (usually as one single observation), making their use impossible for regression analysis drawing on the time series dimension of the data (panels including country and time fixed effects). There are, however, two possible remedies for this problem. First, using the cross-section dimension of the variables offers only one or two observations per country. Two OECD indicators have been recently expanded to cover non-OECD countries: (i) the overall Product Market Regulation (PMR) indicator and its sub-components are available for more than 60 countries. For the countries recently added to the database, only one observation is available for a recent period (usually 2013 or 2014). (ii) the employment protection legislation (EPL) indicator has also become available for additional countries. A similar number of countries are covered by PMR and EPL but they do not cover exactly the same countries (table 1). Second, finding alternative indicators covering more countries is an option. Measures of product and labour market regulations from non-OECD databases could be potentially used to investigate policy impacts for a larger set of countries. Three major datasets could be of use here:

- The World Bank's Doing Business indicators. They cover the cost and time of starting a business, insolvency procedures and contract enforcement.
- The Fraser Institute's Economic Freedom of the World (EFW) database, which offers a measure of business regulation and a measure of labour market regulation (each broken down into six sub-categories). The headline business and labour market regulation indicators are used in the following regression analysis.[2]
- The very comprehensive dataset of the Cambridge Labour Regulation Indicator (CBR LRI) annually covers labour market-related legal regulations in 117 countries over more than 40 years (Adams, Bishop and Deakin, 2016). The dataset includes 40 categories of labour market regulations. For the

[1] Another challenge, mentioned earlier and difficult to tackle here is the widespread informality and the larger difference between *de jure* and *de facto* measures of indicators in less-developed countries.
[2] It would be interesting to use the sub-indicators. Nevertheless, they are strongly correlated with each other both along the within (variation over time) and between (cross-country variation) dimensions. Hence, they could not be included in the regressions at the same time.

purpose of quantification, the six categories concerning regular contracts are considered. Their simple arithmetic average is used as an alternative to the OECD's EPL indicator (for regular contacts).

One question that begs for answer in this context is the extent to which OECD indicators are related to the above listed alternative measures of product and labour market regulation. A comparison can be done in the cross section (using country averages over 2002 to 2012) as the OECD's PMR and EPL indicators will be used to explain cross-country variation and not variation over time (due to data availability). Cross-section correlation shows that the correlation coefficient between the OECD's EPL and the EFW's labour market regulation indicator is around 0.7. The same figure is slightly higher than 0.6 for OECD EPL and Cambridge EPL. Correlation is weaker between the OECD's PMR indicator and the alternative measures. The figure is about 0.5 for the EFW business regulation indicator and ranges from 0.1 to 0.5 for the various Doing Business indicators.

TABLE 1

*Overview of indicators used in the regression analysis by main policy and outcome areas*

| | Source | Country coverage | Time coverage |
|---|---|---|---|
| **Product market regulation** | | | |
| Overall | OECD product market regulation indicators database | Around 60 | Every five years, only one observation for about 15 countries |
| Barriers to entry | | | |
| Barriers to trade & investment | | | |
| Scope of state control | | | |
| **General business sector regulation** | | | |
| Business regulation | Fraser Institute | More than 100 countries | Annual, about 10 years |
| Cost of contract enforcement | World Bank Doing Business indicators | More than 100 countries | Annual, about 10 years |
| Time of contract enforcement | | | |
| Cost of insolvency procedures | | | |
| Time of insolvency procedures | | | |
| Cost of starting a business | | | |
| Time of starting a business | | | |
| **Labour market regulation** | | | |
| EPL regular contracts | OECD | Around 60 countries, 10 countries different than for PMR | Annual, 30 years, only one observation for about 15 countries |
| Labour market regulation | Fraser Institute | More than 100 countries | Annual, about 10 years |
| EPL regular contracts | Cambridge | 117 countries | Annual, 40 years |

| | Source | Country coverage | Time coverage |
|---|---|---|---|
| **Institutions** | | | |
| Legal system | Fraser Institute | Around 100 countries | Annual, about 10 years |
| Legal system – enforcement | | | |
| Legal system – judicial independence | | | |
| Rule of law | WB's World Governance Indicators | Around 100 countries | |
| Political stability | | | |
| Corruption | | | |
| Government effectiveness | | | |
| **Financial development** | | | |
| Financial liberalisation – EFW | Fraser Institute | Around 100 countries | Annual, until 2005 |
| Domestic credit % GDP | World Bank's World Development Indicators database | Around 100 countries | Annual, about 30 years |
| Domestic private credit % GDP | | | |
| Bank branches per capita | | | |
| Stock market capitalisation % GDP | | | |
| Stock market turnover % GDP | | | |
| **Trade openness** | | | |
| Openness | World Bank's World Development Indicators database | Around 100 countries | Annual, about 30 years |
| Log openness | | | |
| Log openness – size adjusted | Own calculation based on WDI | | |
| Trade liberalisation – EFW | Fraser Institute | Around 100 countries | Annual, until 2005 |
| **Innovation intensity** | | | |
| R&D spending % GDP | World Bank's World Development Indicators database | Around 100 countries | Annual, about 30 years |
| Patents/capita | | | |

*Source: Author.*

The dataset used for the empirical analysis is obtained from the OECD's Structural Policy Database for Economic Research (SPIDER) database, which contains four main types of indicators: (i) legal and political institutions; (ii) framework conditions and regulations that determine the overall business environment in which businesses operate. They determine for instance how costly it is to start, run and close a business and reallocate resources within and across firms; (iii) very specific regulations and intermediate outcomes. They cover policies and regulations affecting only a specific segment of a supply-side channel such as elderly or female workers. Examples are family benefits or policies aimed at influencing the effective retirement age. The frontier between framework conditions and very specific policies is

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not always very clear cut. (iv) Outcome variables. These cover variables that are influenced by institutions and policies such as per capita income, various measures of productivity, investment, employment, unemployment and the participation rate.[3]

Based on SPIDER, two panels are considered:
- The first and smaller panel covers countries for which the OECD's PMR and EPL indicators are available. This means a total of around 60 countries.
- The second and larger panel comprises more than 100 countries (including countries of the first panel)[4]. The time coverage of this dataset goes from 2002 to 2012. The data coverage is largely dictated by data availability of the regulation indicators and to a lesser extent the institutional indicators. The Doing Business indicators covering the cost and time of starting a business, contract enforcement and insolvency procedures have a time-series of about 10 years. The same applies to the business and labour market regulation indicators by Economic Freedom of the World (EFW). In an attempt to reduce noise in the data, countries with a population less than one million people are excluded.

There are variables for which only one data point is available for a number of countries (the OECD's PMR and EPL indicators). Second, the variables coming from alternative sources are annual series but they tend to cover only 10 years (Doing Business indicators, the Fraser Institute's regulation indicators). This period is considerably shorter than the time span of about 30 years of the OECD indicators. There are two avenues to dealing with this situation:
- For the OECD's PMR and EPL indicators, we estimate models in which the cross-section dimension of such data is exploited. These variables will be used either as constants in cross-country/time panels or as covariates in cross-section regressions.
- For variables available for roughly 10 years, panel regressions will be used. Nevertheless, these variables have more cross-country variation than changes over time. Hence, period averages for these variables will be also calculated and used as constants in panel regressions or as variables in cross-section regressions (annex A provides descriptive statistics for the variables used in the empirical analysis).

Using some of the regulatory indicators needs to be taken with a pinch of salt because *de jure* policy indicators developed by the OECD, the World Bank and

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[3] SPIDER is a compilation of data from 43 existing data sources. It draws heavily on a large number of existing OECD databases. It includes a number of non-OECD databases such as the World Bank's Doing Business and World Development Indicators databases of the Penn World Table 8.0. The final source of data in SPIDER is individual research papers, either academically published articles or working papers (for more details, see Égert, Gal and Wanner, 2017).
[4] The full set including countries for which a small combination of variables is available comprises 149 countries. The ISO codes of the countries are given as follows: ago alb are arg arm aus aut aze bdi bel ben bfa bgd bgr bhr bhs bih blz bol bra brb brn bwa caf can che chl chn civ cmr cog col cpv cri cyp cze deu dnk dom dza ecu egy esp est eth fin fji fra gab gbr geo gha gmb gnb grc gtm guy hkg hnd hrv hti hun idn ind irl irn isl isr ita jam jor jpn kaz ken kgz khm kor kwt lbn lka lso ltu lux lva mar mda mdg mex mkd mli mlt mmr mne mng moz mrt mus mwi mys nam ner nga nic nld nor npl nzl omn pak pan per phl png pol prt pry qat rus rwa sau sen sgp sle slv srb sur svk svn swe swz syr tcd tgo tha tjk tto tun tur tza uga ukr ury usa ven vnm yem zaf zmb zwe.

other institutions might not fully correspond to *de facto* policies, especially in emerging market economies and developing countries. Another reason for caution is the fact that informality, widespread in less developed countries, is not captured by our outcome variables, especially for the employment rate but also for multi-factor productivity and the capital stock.

## 4 STYLISED FACTS

This section gives some stylised facts on economic outcomes, regulations and institutions for a large set of advanced, emerging and developing countries. Scatterplots suggest that better institutions and competition-friendly product market regulations correlate with better economic outcomes, in particular with higher MFP levels. At the same time, it is difficult to see a firm and clear pattern between outcomes and labour market regulation.

Some strong and some very weak (or non-existent) relationships can be read from figures 2 and 3. Starting with the strong relationships, better institutions (measured by the rule of law, corruption or government effectiveness) are clearly associated with higher per capita income levels. This relationship, confirmed by annual and cross-section data (figures 1 and 2), is unlikely to be monotonic. Looking at the three supply side channels, the data reveal a similarly positive link to institutions in the case of MFP (see figure A1 in annex A in Égert, 2018a), but much less so for the capital stock and employment rates.

Turning to product market and general business regulations, the simple correlations with economic outcomes provide a somewhat less clear-cut picture. Using cross-section data for the OECD's PMR indicator and its sub-components suggests that more stringent regulations are associated with lower per capita income levels (figure 2). This pattern is clearly present for MFP and, to a lesser extent, for the employment rate, but not for the capital stock (see figure A3 in annex A in Égert, 2018a). Alternative indicators capturing the ease of starting and operating a business (World Bank's Doing Business and the Fraser Institute's EFW business regulation) show signs of a positive correlation with per capita income levels (figure 2). Again, this relation reflects a similar correlation between different indicators of regulations and MFP whereas there is no apparent correlation with the capital stock and employment (see figure A2 in annex A in Égert, 2018a).

A look at labour market regulations suggests that there is no straightforward correlation between labour market regulations and per capita income levels. At most, only a weak negative link between the OECD's EPL indicator and outcomes can be detected (especially with per capita income and MFP).[5]

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[5] But the scatterplots shown in figures 2 and 3 and in the annex A reported in Égert (2018a) do not reveal any apparent link between the two other indicators and economic outcomes.

**FIGURE 1**

*Stylised facts – per capita income, regulation and institutions, annual data*
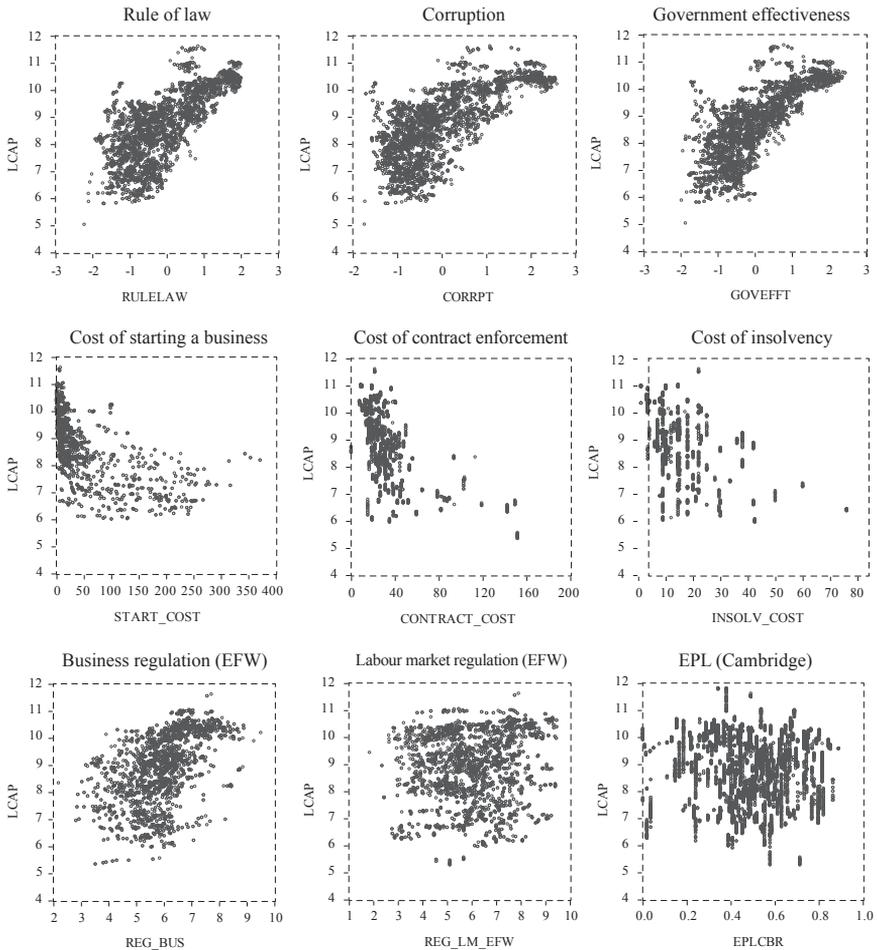


*Note: LCAP, on the vertical axis, denotes log per capita income (USD, constant PPP). On the horizontal axes are displayed the policies and institutions. For the rule of law, corruption and government effectiveness, higher numbers show a stronger rule of law, less corruption and a more effective government. START_COST, CONTRACT_COST and INSOLV_COST refer to the cost of starting a business, the time required for contract enforcement and insolvency procedures. REG_BUS and REG_LM_EFW are the EFW's business regulation and labour market regulation indicators: higher values indicate more business-friendly regulation. EPL_CBR is the Cambridge Labour Regulation Indicator relating to regular contract: higher numbers indicate more stringent regulation.*

*Source: Author.*

**Figure 2**

*Stylised facts – per capita income, regulation and institutions, cross-section data (country averages)*
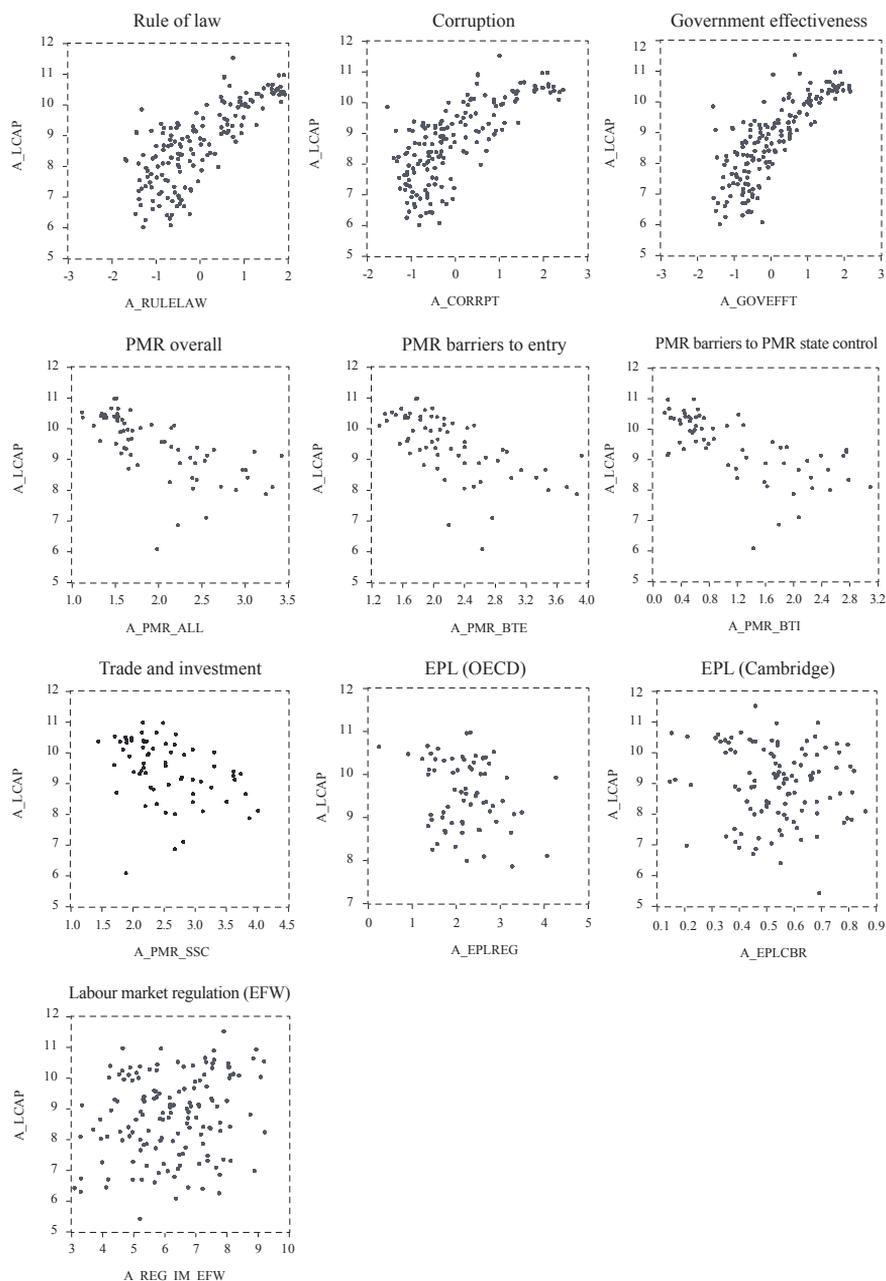


Note: A_LCAP, on the vertical axis, denotes log per capita income (USD, constant PPP, country averages). On the horizontal axes are displayed the policies and institutions. For the rule of law, corruption and government effectiveness, higher numbers show a stronger rule of low, less corruption and a more effective government. For the OECD's PMR indicator, its sub-components and the OECD and Cambridge EPL indicators, higher figures reflect more stringent regulation. For the EFW's labour market regulation indicator, higher values indicate less stringent regulation.

Source: Author.

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## 5 ESTIMATION RESULTS

The stylised facts presented in the previous section give a broad idea on the bivariate correlations between outcomes, product market regulation and institutions. The regression analysis, presented hereafter, provide a more formal and systematic study of the relations linking outcomes to policies and institutions.[6] This section presents the main results by policy areas, looking first at linear regressions and then going through some of the key non-linear specifications.

### 5.1 LINEAR REGRESSIONS
#### 5.1.1 INSTITUTIONS

The quality of institutions matters to a large extent both over time and across countries. Improvements in institutional quality (government effectiveness and political stability) relate to better economic outcomes. Countries with better institutions have superior economic outcomes. These results hold for MFP and the employment rate and for all measures of institutions (tables B2 to B4 and tables B8 to B10 in annex B in Égert, 2018). Yet, there is no empirical evidence that better institutions are associated with a greater capital stock (tables B5 to B7 in annex B in Égert, 2018a).[7] A very strong direct aggregate impact of institutions on per capita income can also be identified in growth regressions (tables B10 to B12 in annex B in Égert, 2018a).

#### 5.1.2 PRODUCT MARKET REGULATIONS

Regarding the OECD's PMR indicator, results suggest that greater barriers to trade and investment are linked to weaker MFP. By contrast, no significant effect can be identified for barriers to entry and there is positive correlation between state control and MFP. Regressions carried out for labour productivity (GDP per employee) and per capita income are in accordance with the results found for MFP: a negative relationship to barriers to trade and investment and a positive one to state control. This latter result needs further analysis.

The PMR indicator exhibits a negative link to capital deepening and the employment rate. A robust finding is that more direct state involvement in business sector activities are connected with a lower employment rate (tables B9 and B10 in annex B in Égert, 2018a). There is also some evidence that higher barriers to entry are related to lower capital stock and employment rate. But this finding does not hold for all alternative specifications (tables B6, B9 and B10 in annex B in Égert, 2018a).

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[6] Some of the explanatory variables used in the analysis are strongly correlated with each other. To avoid the problem of multi-collinearity in the regressions, the variables are grouped in the regressions so that strongly correlated variables are not used at the same time. The correlation analysis indicates no major problem of correlation for the variables once country and time fixed effects are purged from the data (for the country/time panel regressions). However, there is clearly a problem of correlation for the cross-section dimension. The institutional variables are strongly correlated with one another but also with the OECD's PME indicator and sub-components, and the EFW business regulation index. The three labour market regulation indicators are also correlated with each other. There is also a strong correlation between various measures of trade openness. The two measures of innovation intensity also exhibit a high correlation coefficient. Furthermore, R&D spending as a % of GDP is correlated with other covariates as well. Against this background, only variables will be included in the same regression, which are not correlated with each other.

[7] Further analysis would be needed to confirm this result.

### 5.1.3 BUSINESS REGULATIONS

The stance of general business sector regulation[8] and the extent to which it undermines competition is an important driver of MFP levels. A more competition-friendly stance of the Fraser Institute's business regulation indicator is associated with higher MFP in cross-country/time series panels (table B2 in annex B in Égert, 2018a). Cross-section regressions confirm this result for the large sample (table B4 in annex B in Égert, 2018a). A similar but less robust relationship could be identified for the employment rate. Capital deepening does not appear to have a link with this particular indicator of business sector regulation.

Doing Business indicators have a similar impact. For instance, higher costs of setting-up a business are associated with lower MFP levels (table B2 in annex B in Égert, 2018a). Increased costs of contract enforcement and longer times required for insolvency procedures also go hand in hand with lower MPF in both pooled and cross-country regressions (table B3 and B4 in annex B in Égert, 2018a). The connection between business regulation and capital deepening is less robust. Yet there is some evidence that higher costs of contract enforcement are associated with lower capital stock (table B7 in annex B in Égert, 2018a).

### 5.1.4 LABOUR MARKET REGULATIONS

Estimation results show a very weak link between labour market regulation and MFP. In cross-country regressions, the OECD's EPL indicator is statistically not significant. The two alternative indicators, the Cambridge EPL and the EFW labour market regulation index either turn out not to be related to MFP or indicate that more stringent regulation is associated with better MPF outcomes. Results indicate that tightening labour market regulations reduces capital deepening. Nevertheless, no such relationship can be established for the cross-section dimension.[9]

Findings are slightly more encouraging for the employment rate: a tightening of labour market regulations is associated with a decrease in the employment rate (EFW's labour market regulation indicator). In the cross-section dimension, stricter labour market regulation goes hand in hand with lower employment rates for the EFW's indicator and the Cambridge EPL indicator. The OECD's EPL indicator does not seem to have a statistically significant relationship with the employment rate (tables B8 to B10 in annex B in Égert, 2018a). For per capita income, results do not support the view that more costly hiring procedures reduce the employment rate (tables B11 to B13 in annex B in Égert, 2018a). This could be because the various measures of EPL on regular contracts may not be a pure measure of firms' constraints on employment. First, *de jure* EPL indicators for regular contracts may be far from how EPL is applied in practice (*de facto*). Second, other components of labour market regulations may be more binding.

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[8] Business sector regulation refers to the World Bank's Doing Business indicators. Product market regulation indicators refer to the OECD's PMR indicator.
[9] It could be argued that more restrictive labour market regulation would lead to a greater capital deepening as businesses would reduce labour intensity. Empirical results are mixed on this effect. Égert (2018b) provides an overview of the empirical literature on this issue and reports results, using country-level data for OECD countries, according to which more stringent labour market regulation reduces capita deepening.

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### 5.1.5 FINANCIAL DEVELOPMENT AND OTHER CONTROLS

Financial sector development is an important factor of MFP. A more developed financial sector and to some extent a deeper capital market are found to boost MFP. Financial sector development is also crucial for capital deepening. This result is strongly supported for the overall per capita income regressions (tables B11 to B13 in annex B in Égert, 2018a).

Regarding the other controls, human capital tends to have a positive relation with MFP, mostly when used to explain cross-country variation in MFP. By contrast, it is very difficult to establish robust relationships between the various measures of innovation intensity (R&D spending as a share of GDP and patent per capita) and alternative measures of trade openness (adjusted or not for country size, taken in level or in log level) on the one hand, and MFP on the other hand. Experimenting with country and time coverage shows that results are sensitive to data coverage. In particular, longer time series are required to identify a positive link between innovation, openness and MFP (table B1 in annex B in Égert, 2018a).

### 5.2 HETEROGENEITY

The following sub-sections give details on possible heterogeneous effects conditional on the level of economic development, the strength of institutions and the stance of other regulations and policies.[10,11]

### 5.2.1 THE EFFECT OF ECONOMIC DEVELOPMENT

Countries at different level of economic development face different policy impacts. Threshold regressions show that product market regulations are more binding for countries with lower per capita income levels. More specifically, stringent product market regulations will have a three time larger negative relation to MFP in countries with per capita income lower than about 8,000 USD (in PPP terms).[12] These effects also hold true for barriers to entry, barriers to trade and investment and the scope of state control. A very similar pattern can be observed for Doing Business indicators even though the estimated thresholds can vary between about 3,000 to 9,000 USD for the cost of contract enforcement, the time of insolvency procedures and the time of starting a business (tables C1 and C2 in annex C in Égert, 2018a).

An opposite set of patterns emerge for the employment rate: negative policy effects tend to be higher for more developed countries. To start with cross-country regressions, negative PMR effects are larger for countries having per capita incomes above 6,000 USD. Such threshold effects can be identified for barriers to entry and for the scope of state control (but not for barriers to trade and investment) (tables C5 and C6 in annex C in Égert, 2018a).

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[10] For MFP, the non-linear regressions contain the following linear control variables: human capital, openness, innovation intensity (patents per capita) and financial development (banking sector and stock markets). PMR, labour market regulations and institutions were included if these variables were not the non-linear variables in the regressions.
[11] Table C10 in annex C in Égert (2018a) provides descriptive statistics of the threshold variables.
[12] We also experimented by imposing per capita income threshold of 5,000 and 10,000 USD. Coefficient estimates are less precisely estimated in these cases (suggesting that it is better to estimate the thresholds rather than to impose them).

Non-linear relationships can be established along the within (time series) dimension for labour market indicators. The Cambridge EPL indicator has an estimated negative sign for per capita income levels exceeding around 6,000 USD. The Fraser Institute's labour market regulation indicator shows that more regulation will be associated with lower employment if per capita income exceeds approximately 12,000 USD.[13]

Policy effects on the capital stock are found not to be conditional on per capita income levels.

At the aggregate level, non-linear effects obtained for MFP dominate non-linear effects on the employment rate: threshold regressions run for per capita income are in line with those for MFP. Larger negative effects of PMR and doing business indicators can be observed for less developed countries, when using both the PMR indicator and the World Bank's Doing Business indicators. The regime switches are also estimated to happen around very similar tipping points (tables C7 and C8 in annex C in Égert, 2018a).

### 5.2.2 THE EFFECT OF INSTITUTIONS ON OTHER POLICIES

The quality of institutions has a strong impact on how policies correlate with outcomes. Regarding MFP, weaker institutions are associated with a substantially larger negative effect of overall product market regulation. The negative correlation between MFP and higher barriers to entry, trade and investment and more state involvement is more significant if the quality of institutions is low (table C1 in annex C in Égert, 2018a). Similarly, Doing Business indicators, in particular longer insolvency procedures, have disproportionally larger coefficient estimates if the rule of law is weak. Employment and capital stock also have a non-linear relationship to product market regulations conditional on the quality of institutions. In contrast to MFP, the negative link between regulations on the one hand and investment and employment on the other are larger if institutions are stronger. For instance, if institutions are stronger, more stringent labour market regulations (Cambridge EPL) have a more negative relationship with employment (tables C4 to C6 in annex C in Égert, 2018a). Again, the negative association between PMR and MFP seem to outweigh the negative link to capital deepening and employment. Threshold regressions for per capita income produce very similar regimes as for MFP: a larger negative coefficient estimate of regulations at lower levels of institutions. The threshold value that separates the two regimes (the value of institutions below and above which the impact of regulations is different) is also very similar (tables C7 and C8 in annex C in Égert, 2018a).

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[13] Regression were also run to see whether the coefficient estimates on trade openness, innovation intensity and human capital differ as a function of per capita income levels. Results indicate, especially when only these three variables are used as explanatory variables, that openness starts to have a positive coefficient if per capita income is higher than USD 10,000 for time series panel regressions and above USD 6,000 for cross-section regressions. Similarly, the coefficient estimate on human capital is more positive above comparable thresholds. No non-linear effect can be identified for innovation intensity.

### 5.2.3 THE INTERACTION BETWEEN PRODUCT AND LABOUR MARKET POLICIES

Estimation results strongly suggest that PMR effects are conditional on the level of labour market regulations for MFP and the employment rate. A surprisingly robust result for MFP, holding for all three alternative measure of labour market regulation is that the negative PMR coefficient becomes more negative if labour market regulation is looser (table C9 in annex C in Égert, 2018a).

TABLE 2

*Summary of estimation results*

| | MFP | Capital deepening | Employment rate | Per capita income |
|---|---|---|---|---|
| **Linear relationships** | | | | |
| **Within dimension** | | | | |
| Institutions | Yes | No | Yes | Yes |
| Business regulation | Yes | No | No | No |
| Product market regulation | – | – | – | – |
| Labour market regulation | – | Yes | Yes | – |
| Financial system development | Yes | No | – | Yes |
| **Between dimension** | | | | |
| Institutions | Yes | No | Yes | Yes |
| Business regulation | ? | No | No | No |
| Product market regulation | BTI | BTE, SSC | BTE, SSC | BTI |
| Labour market regulation | Yes?? | No | Yes?? | No |
| Financial system development | Yes | Yes | – | Yes |
| **Non-linear relationships** | conditional on | | | |
| | *per capita income* | | | |
| Business regulation | Yes | No | Yes | Yes |
| Product market regulation | BTE, BTI, SSC | No | BTE, SSC | BTE, BTI, SSC |
| Labour market regulation | No | No | Yes | No |
| | *institutions* | | | |
| Business regulation | Yes | No | Yes | Yes |
| Product market regulation | BTE, BTI, SSC | BTE, SSC | BTE, SSC | BTE, BTI, SSC |
| Labour market regulation | No | No | Yes | No |
| | *labour market regulations* | | | |
| Business regulation | No | No | No | No |
| Product market regulation | BTE, BTI, SSC | No | BTE, SSC | BTE, BTI, SSC |
| Labour market regulation | No | No | No | No |

*Notes: Results on the linear relationship are split into two main parts: within dimension (coefficient estimates identified from the time variation in the data); and between dimension (coefficient estimates obtained on cross-sectional data). Non-linear relationships are estimated only on cross-section data (because no time series are available for PMR). The column "non-linear variables" lists the variables, which take different coefficients, depending on the level of other variables. These "other variables" are named in the rows "conditional on ..." and are per capita income, institutions and labour market regulations. "Yes" implies a statistically significant relationship. "?" implies that the estimated relationship is not very robust. "No" indicates the absence of a statistically significant relationship. "–" indicates that the variable could not be included in the regressions. BTE, BTI and SSC indicate that there is a statistically significant relationship between the PMR sub-components barriers to entry (BTE), barriers to trade and investment (BTI) and the scope of state control (SSC) on the one hand and economic outcomes (MFP, capital deepening, the employment rate and per capita income) on the other hand.*

## 6.1 MEASURING REFORMS

Reform effects are analysed in two different ways. First, a one standard deviation in the time series purged of country and year fixed effects captures past average reforms. Second, a one standard deviation of the cross-country differences can be used to demonstrate the potential for future reforms.

Cross-country variation in the data is substantially larger than the average variation over time. Figure 3 below shows that the difference can be very large. For instance, the cross-country (between) variation of the rule of law variable is about nine time higher than the (within) variation over time. The ratio averages around 5 for other institutional variables and the OECD's PMR and EPL indicators.

**Figure 3**

*The ratio of standard deviation of the pure cross-section to standard deviation over time*
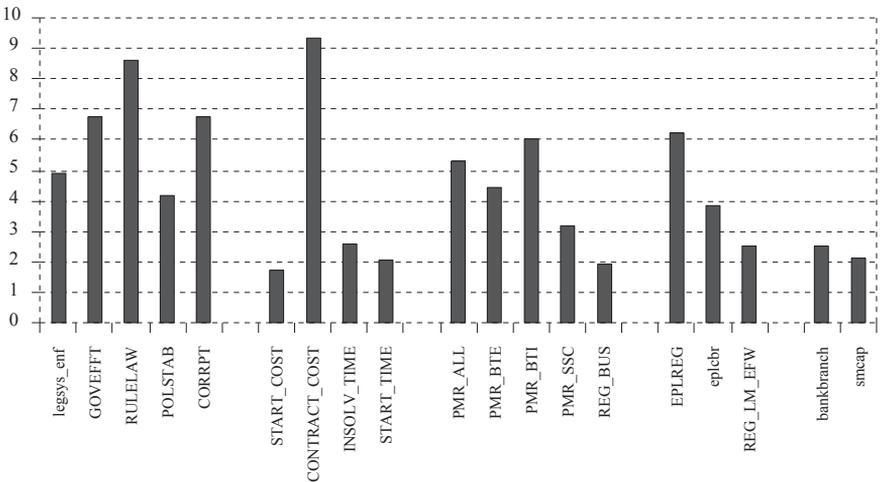


*Note: The ratio displayed above is the ratio between the standard deviation calculated on cross-section observations (averages for individual countries, the pure between effect) and the standard deviation of the series stripped of country means and common time trends (pure within effect).*

*Source: Author's calculations.*

Most of the earlier literature aimed at quantifying structural reforms carried out regression analysis for a panel of OECD countries. In such regressions, country and time fixed effects are employed. The consequence of this estimation strategy is that coefficient estimates reflect average correlations over time for the countries included in the panel. Yet these estimates were often used to show what would happen if a poorly performing country aligned its policies with good-practice countries (Barnes et al., 2013; Bouis and Duval, 2011; Cette, Lopez and Mairesse, 2016a, 2016b). This is problematic. Indeed, this practice is tantamount to applying inference identified over the time series (within) dimension to cross-section data. We saw that the cross-country variation of most policy variables is substantially larger than the within variation.

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The approach presented here offers a remedy in the calculations for countries that wish to adjust their policies and regulation to "cutting edge" countries. Our coefficient estimates are partly obtained on the basis of cross-sectional data. They can hence be safely applied to simulate policy impacts due to cross-country differences.

### 6.2 QUANTIFICATION OF REFORMS
### 6.2.1 LINEAR REGRESSIONS

Quantification results show a number of striking features. First, as flagged earlier, the cross-country (between) variation in the data is larger than that over time (within). The quantification results reflect this observation. Second, better institutions are associated with considerably higher per capita income. When cross-country differences are taken into account, reforms in institutions, captured by one standard deviation, are linked with per capita income by up to 50%. This effect is channelled through MFP and to a much lesser extent by the employment rate. Capital deepening does not play a role. The overall aggregate effects are very comparable whether from adding up the three supply-side channels or whether they are derived directly from per capita income regressions (table 3a). Yet as noted earlier, large cross-country variations, such as observed in institutional quality are very likely to disappear even in the medium to long run, and hence these effects should be considered as potential effects.

It should be noted that not all of the policy effects reported in table 3a can be summed up. For instance, the results for institutions are obtained from separate equations. So the results should be taken separately. A change in the rule of law and corruption cannot be added up, because they are highly correlated with one another. The same applies to the overall PMR indicator and its sub-components. Business regulation and product market regulations go in tandem with substantial economic improvements: a one standard deviation cross-country improvement is associated with 20% higher per capita income. These effects transit through all three supply-side channels. Financial sector development is associated with higher per capita income. Both more developed banking sectors and deeper financial markets are correlated with improved economic outcomes, mostly through a boost to MFP. Labour market regulations are found to be linked to capital deepening and the employment rate. The magnitude of these relationships is, however, much smaller than those generated by institutional reform and more competition-friendly business and product market regulations.

Overall, direct estimates on per capita income deliver results consistent with those aggregated up from MFP, capital deepening and the employment rate. However, some caution is of order here. To start with, some of the policy effects cannot be detected in per capita income regressions. In such cases, no direct comparison is possible and this also validates the use of the disaggregated supply-side channels. Another observation is that in some instances, direct and indirect per capita income effects can differ. In the matter of the cost of starting a business and in that of banking sector development, the direct effects are considerably lower.

Table 3b below demonstrates the non-linear relationship between the OECD's PMR indicator and its sub-components and MFP. Large positive effects are established for all components if per capita income is lower than about 8,000 USD and if the rule of law is weak. Effects in the high per capita income and the strong rule of law regimes are economically large for barriers to trade and investment. At the same time, barriers to entry and state control have a small influence on MFP in the same regimes.

**TABLE 3A**

*Quantification results – linear regressions, per capita effects due to the three supply-side channels (in percent)*

| | Impact through | | | | | | Total impact | |
|---|---|---|---|---|---|---|---|---|
| | **MFP** | | **K/Y** | | **L** | | **Per capita income: aggregated from MFP, K/Y and L** | |
| | Policy measured as one standard deviation | | | | | | | |
| | Within | Between | Within | Between | Within | Between | Within | Between |
| **Institutions** | | | | | | | | |
| Government effectiveness | 7.4 | 50.0 | | | 0.8 | 5.2 | 8.2 | 55.2 |
| Rule of law | 5.0 | 42.9 | | | 0.5 | 4.5 | 5.5 | 47.4 |
| Political stability | 5.7 | 24.0 | | | 1.0 | 4.3 | 6.7 | 28.3 |
| Corruption | 5.9 | 39.8 | | | 0.9 | 6.0 | 6.8 | 45.8 |
| **Business regulation** | | | | | | | | |
| Cost of starting a business | 0.8 | 1.3 | 9.0 | 15.6 | | | 9.8 | 16.9 |
| Cost of contract enforcement | 1.4 | 13.5 | | | | | 1.4 | 13.5 |
| Time of insolvency procedures | 5.6 | 14.6 | | | 1.1 | 2.8 | 6.6 | 17.4 |
| **Product market regulation** | | | | | | | | |
| PMR – overall | – | | – | 8.9 | – | 1.5 | – | 10.4 |
| PMR – barriers to entry | – | 17.3 | – | 5.2 | – | 2.0 | – | 24.5 |
| PMR – barriers to trade & investment | – | 8.3 | – | | – | | – | 8.3 |
| PMR – scope of state control | – | | – | 6.4 | – | 4.1 | – | 10.5 |
| **Labour market regulation** | | | | | | | | |
| EPL – OECD regular contracts | | | | | | 0.9 | | 0.9 |
| EPL – Cambridge indicator | | | | | 0.8 | 3.1 | 0.8 | 3.1 |
| Labour market regulation (EFW) | | | 2.1 | 5.5 | 0.8 | 2.0 | 2.9 | 7.5 |

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| | Impact through | | | | | | Total impact | |
|---|---|---|---|---|---|---|---|---|
| | MFP | | K/Y | | L | | Per capita income: aggregated from MFP, K/Y and L | |
| | Policy measured as one standard deviation | | | | | | | |
| | Within | Between | Within | Between | Within | Between | Within | Between |
| **Financial development** | | | | | | | | |
| Banking sector | 4.9 | 12.4 | 4.2 | 10.7 | | | 9.1 | 23.0 |
| Financial markets | 8.1 | 17.2 | | | | | 8.1 | 17.2 |

*Note: MFP, K/Y and L indicate by how much per capita income would increase due to policy changes affecting the three supply-side channels. The change in the indicators is defined as one standard deviation in the data. Columns named "within" show that the change in the policies are based on the within dimension (variation over time). Columns named "between" show that the changes in the policies are obtained from the between (cross-section) dimension. The effects are calculated following the methodology set out in box 1 in Égert and Gal (2016). Empty cells indicate the absence of robust empirical relationships. Cells filled with "–" indicate that regression analysis was not possible for the particular variable and dimension (PMR indicator over time). The coefficient estimates used to calculate the effect are the average of the minimum and maximum coefficient estimates. Table C11 summarises from which particular regressions the coefficient estimates are used.*

*Source: Author's calculations.*

TABLE **3B**

*Quantification – non-linear regressions (in percent)*

| | If per capita income is | | If rule of law is | | If OECD's EPL on regular contracts is | |
|---|---|---|---|---|---|---|
| | Below | Above | Below | Above | Below | Above |
| | The estimated threshold | | | | | |
| **Effects on MFP of** | | | | | | |
| PMR – overall | 40.4 | 17.4 | 28.2 | **12.6** | 30.4 | 25.3 |
| PMR – barriers to entry | 24.5 | **1.5** | 19.4 | **2.8** | 19.4 | **13.0** |
| PMR – barriers to trade & investment | 53.1 | 15.8 | 35.5 | **11.0** | 27.7 | 41.0 |
| PMR – scope of state controll | 27.1 | **5.3** | 18.1 | **2.8** | 16.9 | **11.0** |

*Note: Numbers in bold indicate that the calculations are based on coefficient estimates that were statistically not significant at the conventional level of 10%.*

*Source: Author's calculations.*

## 7 CONCLUDING REMARKS

This paper has quantified the long-term relationships between pro-market product, labour and financial market regulation reforms on the one hand and country-level economic outcomes on the other hand for a panel including OECD and non-OECD countries. The findings show that reforming product, labour and financial market regulations is associated with substantial benefits, though the magnitude of the relationship between labour market deregulation and per capita income is considerably lower compared with those generated by improving product and

financial market regulations. The quantification results reveal that improved institutions are associated with massively better economic outcomes, in particular in multi-factor productivity, and this effect is considerably larger than the positive link of outcomes and a range of other regulations, even though caution is needed here as improving the quality of institutions is a particularly hard job and is fraught with a great deal of historical inertia. Results also indicate large differences across developed and developing countries with the growth benefits being larger in less developed countries. These results can potentially be very helpful to policymakers for the evaluation of the economic impact of past reforms or to get a broad idea about the link between planned and future public policy reforms and economic outcomes.

**Disclosure statement**

There are no conflicts of interest to disclose.

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**ANNEX**

**DESCRIPTIVE STATISTICS**

TABLE **A1**

*Descriptive statistics: time varying variables*

| Variables | Min | Max | Mean | St. dev. |
|---|---|---|---|---|
| | **Worldwide sample** | | | |
| Per capita income | 5.29 | 11.62 | 8.75 | 1.31 |
| Openness | 0.31 | 449.99 | 91.94 | 51.78 |
| Log Openness | -1.18 | 6.11 | 4.40 | 0.52 |
| Log Openness (size adjusted) | -4.93 | 1.99 | 0.24 | 0.49 |
| R&D spending % GDP | 0.01 | 4.52 | 1.00 | 0.99 |
| Rule of law | -2.67 | 2.00 | 0.00 | 0.99 |
| Cost of starting a business | 0.00 | 1,540.00 | 67.00 | 143.00 |
| Time of starting a business | 1.00 | 687.00 | 41.00 | 59.00 |
| Labour market regulation – EFW | 2.34 | 9.73 | 11,475.00 | 1.49 |
| Business regulation – EFW | 2.86 | 8.89 | 6.01 | 1.04 |
| Finance – bank branches per capita | 0.13 | 237.07 | 19.38 | 23.96 |
| Stock market capitalisation % GDP | 0.04 | 606.00 | 54.91 | 62.54 |
| | **OECD sample** | | | |
| Openness | 5.73 | 371.44 | 68.15 | 43.87 |
| Log Openness | 1.75 | 5.92 | 4.04 | 0.61 |
| Log Openness (size adjusted) | -2.12 | 1.32 | 0.03 | 0.49 |
| Business spending on R&D % GDP – OECD | 0.01 | 3.76 | 1.05 | 0.73 |
| General spending on R&D % GDP – OECD | 0.15 | 4.48 | 1.68 | 0.88 |
| General spending on basic R&D % GDP – OECD | 0.05 | 0.90 | 0.31 | 0.16 |
| ETCR – overall | 0.79 | 6.00 | 4.08 | 1.47 |
| ETCR – entry barriers | 0.43 | 6.00 | 3.77 | 1.84 |
| ETCR – public ownership | 0.83 | 6.00 | 4.29 | 1.43 |
| EPL regular contracts | 0.26 | 5.00 | 2.18 | 0.83 |
| ALMP spending | 0.45 | 22.00 | 22.00 | 21.53 |

**TABLE A2**
*Descriptive statistics: time-invariant variables (period averages)*

| Variables | Worldwide sample | | | | OECD sample | | | |
|---|---|---|---|---|---|---|---|---|
| | Min | Max | Mean | St. dev. | Min | Max | Mean | St. dev. |
| **Institutions** | | | | | | | | |
| Legal system | 2.23 | 8.93 | 5.53 | 1.61 | 4.86 | 8.54 | 7.27 | 1.07 |
| Legal system – enforcement | 0.00 | 8.11 | 4.46 | 1.75 | 3.22 | 8.11 | 5.75 | 1.29 |
| Legal system – judicial independence | 0.60 | 9.15 | 4.80 | 2.15 | 3.85 | 9.17 | 7.06 | 1.74 |
| Rule of law | -2.38 | 1.94 | 0.01 | 0.99 | -0.53 | 1.94 | 1.27 | 0.60 |
| Civil liberties | 1.00 | 7.00 | 4.78 | 1.81 | 4.02 | 7.00 | 6.29 | 0.86 |
| Polity2 – political stability | -10.00 | 10.00 | 3.78 | 6.17 | 27.00 | 10.00 | 8.01 | 3.17 |
| Corruption | -1.71 | 2.45 | 0.01 | 0.98 | -0.31 | 2.44 | 1.33 | 0.80 |
| Government effectiveness | -2.18 | 2.18 | 0.00 | 0.99 | 0.16 | 2.14 | 1.36 | 0.56 |
| **Business environment** | | | | | | | | |
| Cost of contract enforcement | 8.00 | 163.00 | 35.00 | 26.00 | 8.00 | 39.00 | 21.00 | 8.00 |
| Time of contract enforcement | 133.00 | 1,715.00 | 628.00 | 305.00 | 216.00 | 1,332.00 | 517.00 | 260.00 |
| Cost of insolvency procedures | 1.00 | 76.00 | 17.00 | 12.00 | 1.00 | 23.00 | 10.00 | 6.00 |
| Time of insolvency procedures | 0.40 | 6.97 | 2.75 | 1.21 | 0.40 | 5.84 | 1.92 | 1.16 |
| Cost of starting a business | 0.00 | 991.49 | 66.32 | 121.40 | 0.05 | 20.69 | 6.80 | 6.42 |
| Time of starting a business | 2.78 | 690.71 | 41.86 | 60.34 | 2.71 | 61.08 | 16.83 | 11.68 |
| **OECD Product Market Regulation Indicator** | | | | | | | | |
| PMR – overall | | | | | 1.18 | 2.80 | 1.73 | 0.35 |
| PMR – barriers to entry | | | | | 1.49 | 3.07 | 2.06 | 0.37 |
| PMR – barriers to trade & investment | | | | | 0.20 | 2.09 | 0.74 | 0.41 |
| PMR – scope of state control | | | | | 1.51 | 3.92 | 2.41 | 0.54 |

# Institutional environment and tax performance: empirical evidence from developing economies

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**Abstract**

*Unlike its predecessor studies, this paper investigates the contemporaneous and lagged effects of institutional variables on tax performance, using unbalanced panel data from 79 developing countries for the 2002-2019 period. The instrumental variable (IV) and system-generalized method of moments (SGMM) estimation models were employed in this study to address potential endogeneity and specification biases in the estimation model. Generally, this study found that countries with low corruption levels and good governance quality could produce more tax revenues. Moreover, the lagged effects of institutional variables, which are much more substantial than their contemporary effects, provide meaningful insight. Efforts directed at fighting corruption and improving the quality of governance must be carried out as early as possible to obtain optimal tax revenues in the future. These efforts can be taken by streamlining tax administration, so that opportunities for bribery and corruption can be reduced.*

*Keywords: corruption, governance, tax revenue*

## 1 INTRODUCTION

The low ability of governments to generate sufficient revenues to finance vital public provision expenditures is a typical fiscal issue in most developing countries. In the last decade, developing countries have typically collected taxes amounting to only about 13 percent of GDP (World Bank, 2021). It is still below the tipping point of 15 percent of GDP as suggested by the World Bank (Junquera-Varela and Haven, 2018). Apart from economic, institutional factors, such as poor governance and high levels of corruption or perceptions of unfair tax regimes also play an essential role in this problem (Besley and Persson, 2014; Moore and Prichard, 2020). Weak governance delivers complex and inefficient tax systems, which in turn increases tax evasion and the cost of tax correction (Everest-Phillips and Sandall, 2009). The complexity of the taxation system is the cause of rampant corruption in tax administration, especially in the tax collection process (Fjeldstad, 2006; Rahman, 2009). Such situations will undermine the tax structure and revenue collecting capacity of a country, generating a significant loss in availability of funds for the provision of public services (Transparency International, 2014). In the long run, corruption can also ruin taxpayers' morality and erode public trust in government institutions (Nawaz, 2010). Thus, improving the taxation system and building tax administration capacity are two essential components that reinforce each other in generating revenue (Brondolo et al., 2008).

This study investigates the extent to which corruption and governance affect tax performance in developing countries. Several empirical studies have contributed to this topic. However, most of them neglect to address the endogeneity problem of institutional variables. For example, Syadullah (2015) estimated the impact of governance quality and corruption level on tax revenue in 7 Southeast Asian countries during 2003-2012. The authors found that control of corruption has significant adverse effects on the tax ratio, while the rule of law and quality of regulatory variables positively impact the tax ratio. Epaphra and Massawe

(2017), by using a data set for 30 African countries from 1996 to 2016, showed that corruption and institutional quality have more influence on indirect tax revenues than on other types of taxes (direct taxes and trade taxes). Arif and Rawat (2018), based on data from 10 Emerging and Growth-Leading Economies (EAGLE) with a period between 2001 and 2015, confirmed the vital role of the institutional environment in determining the level of tax revenue. Hassan et al. (2021) used data from Pakistan covering the period 1976-2019. They concluded that good governance is an essential resource to increase tax revenue both in the short and in the long run.

Some authors on the same topic may acknowledge the issue of endogeneity in the model, like Ajaz and Ahmad (2010) in developing countries and Imam and Jacobs (2014) in the Middle East. They argued that persistent tax revenues over time are assumed to be endogenous to its lag, so it can potentially create specification bias in the model. They used the dynamic panel SGMM estimator to solve this problem. They found that corruption is the leading cause of low tax revenues in developing countries and the Middle East. The problem with their study is that they fail to answer these questions: for example, do countries with higher tax performance have better governance indicators? Moreover, the SGMM is quite unsatisfactory for dealing with endogeneity when the variables show persistence over time, and the IV approach is much preferred.

Hwang (2002) and Bird, Martinez-Vazquez and Torgler (2008) are probably the only studies on this topic that address institutional variable endogeneity issues. Hwang (2002) found that an increasing in cases of corruption will undermine government revenues. The author used the share of the population professing Protestantism and whether it was a former British colony, and the index of ethnolinguistic fractionalization as instruments for corruption. Meanwhile, Bird, Martinez-Vazquez and Torgler (2008) used the legal origins (English) of a country and fractionalization as instruments of institutional variables and found that enhancing voice or accountability and reducing corruption is an important prerequisite for a more satisfactory level of tax revenue in developing and developed countries. However, their study still contains some limitations. First, they only include total tax revenue as a measure of tax performance without breaking it down into the types of taxation. Dividing tax revenue into its types will sharpen the "knife of analysis." It lets us know which taxes are most affected by corruption and governance (see, e.g., Imam and Jacobs, 2014; Epaphra and Massawe, 2017). Second, the authors ignored the persistent nature of tax revenue, which can create a specification bias in the model (see, e.g., Ajaz and Ahmad, 2010; Imam and Jacobs, 2014). Third, they only control economic factors and ignore other potential control variables, such as population size, public trust, and the shadow economy.

Therefore, the main contribution of this study is expected to be discussion of the intersection of issues that have not been addressed by any previous related studies.

To achieve this goal, we will use an unbalanced panel data set for 79 developing countries covering 2002 to 2019. To measure tax performance, we use aggregate revenues and three general categories of taxation, including direct taxes, indirect taxes, and trade taxes. In addition, we also control for macroeconomic factors (GDP per capita, industrial sector, inflation, and trade openness), demographic factors (population size), and political factors (trust in government), and the shadow economy. To solve the endogeneity problem, we will use two democracy indicators (civil liberties and political rights) as instruments of the troublesome variables. We will analyze the problem using a two-stage least square (2-SLS) estimation. In addition, since tax revenue is persistent over time, it is reasonable to introduce a lagged level of tax revenue as additional independent variable in the model. We will analyze this part using the SGMM estimator to calibrate the auto-correlation and heteroscedasticity in the model. Finally, another contribution of this study is that we also introduce the lagged level of institutional variables in the SGMM estimation. Estimating such a dynamic model allows us to observe both the contemporary and the lagged effects of the institutional environment on tax performance.

The rest of this paper is organized as follows. Section 2 is devoted to discussing research data and variables. Section 3 designs the econometric framework used to study the effects of the institutional environment on tax performance. Section 4 discusses the empirical results of this study. Section 5 concludes and raises some policy implications.

## 2 DATA
As mentioned in the introduction section, we use panel data from 79 developing countries worldwide covering 2002-2019 to achieve the research objectives. To ensure the robustness of the results, we utilize secondary data obtained from primary sources for each variable studied, such as World Development Indicators (WDI), World Governance Indicators (WGI), Freedom House, World Economic Forum Global Competitiveness Index, and an empirical study conducted by Elgin et al. (2021) aimed at providing detailed information on the construction and sources for the variables included in the database and shows two applications of the database: the stylized facts of informal economic activity around the world and the cyclical features of the informal economy. Their proposed measurement formula has been used by the World Bank to estimate global informal activity over the period 1990-2018.

To measure a country's tax performance, we use aggregated tax revenues and three other categories of tax revenues, namely direct taxes, indirect taxes, and trade taxes. All these tax revenue indicators are expressed as a percentage of GDP and are obtained from WDI.

**TABLE 1**

*Variable description and summary statistics*

| Variable | Description | N | Mean | Std. dev | Min | Max | Source |
|---|---|---|---|---|---|---|---|
| $TR_{it}$ | Total taxes (% of GDP) | 977 | 15.196 | 5.624 | 0.915 | 39.988 | A |
| $DTR_{it}$ | Direct taxes (% of GDP) | 977 | 5.183 | 3.099 | 0.250 | 20.797 | A |
| $IDTR_{it}$ | Indirect taxes (% of GDP) | 977 | 7.676 | 3.732 | 0.099 | 18.622 | A |
| $TTR_{it}$ | Trade taxes (% of GDP) | 977 | 1.942 | 2.129 | 0.00003 | 13.436 | A |
| $VA_{it}$ | Voice and accountability (-2.5 to 2.5 scale) | 977 | -0.320 | 0.663 | -1.971 | 1.152 | B |
| $PS_{it}$ | Political stability and no violence/terrorism (-2.5 to 2.5 scale) | 977 | -0.409 | 0.734 | -2.699 | 1.263 | B |
| $GE_{it}$ | Government effectiveness (-2.5 to 2.5 scale) | 977 | -0.338 | 0.575 | -1.848 | 1.267 | B |
| $RQ_{it}$ | Regulatory quality (-2.5 to 2.5 scale) | 977 | -0.244 | 0.564 | -2.071 | 1.127 | B |
| $RL_{it}$ | Rule of law (-2.5 to 2.5 scale) | 977 | -0.429 | 0.530 | -1.823 | 1.077 | B |
| $GVN_{it}$ | Governance index | 977 | 0.014 | 0.996 | -2.605 | 2.842 | C |
| $CC_{it}$ | Control of corruption (-2.5 to 2.5 scale) | 977 | -0.471 | 0.543 | -1.826 | 1.647 | B |
| $ICAP_{it}$ | Log of GDP per capita (current US$) | 977 | 4,132.364 | 3,470.211 | 237.757 | 22,942.61 | A |
| $IND_{it}$ | Industry, value added (% of GDP) | 977 | 29.293 | 10.593 | 9.476 | 84.349 | A |
| $INF_{it}$ | Inflation, consumer price index (annual %) | 977 | 111.397 | 3,283.225 | -3.749 | 102,629.8 | A |
| $TOP_{it}$ | Exports plus imports (% of GDP) | 977 | 80.000 | 32.157 | 16.141 | 210.374 | A |
| $SHD_{it}$ | Shadow economy output (% of GDP) | 883 | 34.842 | 10.384 | 8.552 | 66.137 | D |
| $POP_{it}$ | Population size (Persons in thousands) | 977 | 70,300 | 222,000 | 108.3 | 1,400,000 | A |
| $TIP_{it}$ | Trust in politicians (1 = extremely low to 7 = extremely high) | 576 | 2.602 | 0.806 | 1 | 6 | E |
| $CVL_{it}$ | Civil liberty (1 = maximum freedom to 7 = absence of freedom) | 968 | 3.761 | 1.347 | 1 | 7 | F |
| $PR_{it}$ | Political rights (1 = maximum freedom to 7 = absence of freedom) | 968 | 3.863 | 1.769 | 1 | 7 | F |

*Explanation: A = WDI. B = WGI. C = Calculated by the authors using PCA based on five govern-ance indicators / WGI (VA$_{it}$, PS$_{it}$, GR$_{it}$, RQ$_{it}$, RL$_{it}$). D = Elgin et al. (2021), E = World Economic Forum Global Competitiveness Index. F = Freedom House.*

*Source: Own calculation.*

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Following Arif and Rawat (2018), we construct a governance index using principal component analysis (PCA) of governance indicators introduced by World Governance Indicators (WGI): voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, and the rule of law. WGI also covers corruption control as an indicator of a country's governance. However, we did not include this one indicator in the formation of the governance index. Instead, we use it separately as one measure of corruption. It is done to avoid collinearity between the two key explanatory variables (governance and corruption). Unlike Transparency International's annual Corruption Perceptions Index, this index incorporates different aspects of corruption, from the frequency with which companies make "additional payments to get things done," to the effect of corruption on the business environment, to the corruption measure of "major corruption" in the political arena (Olken and Pande, 2012).

The WGI itself is constructed using the Goldberger (1972) and Efron and Morris (1971, 1972) unobserved components model (UCM) and is expressed in a scale range from -2.5 to 2.5, with higher scores referring to a higher quality of governance and lower level of corruption (Kaufmann, Kraay and Mastruzzi, 2010). Meanwhile, PCA used in this study is a technique used to extract meaningful information from several correlated quantitative variables to represent them as a new set of orthogonal variables called principal components (Hotelling, 1933). PCA also represents the pattern of similarity of observations and variables by displaying them as points on the map (Jackson, 1991; Saporta and Niang, 2009; Jollife and Cadima, 2016). With reference to the literature review presented in section 1, the main hypothesis of this study is formulated as follows:

H1: Corruption has an adverse effect on tax revenues.
H2: Governance has a positive effect on tax revenues.

By including a battery of control variables in the analysis, we intend to consider factors beyond the central question in this study, but which are essential to consider because they can influence the size of tax revenues through mechanisms other than the institutional environment. The level of national development is one of the most potentially confounding determinants. GDP per capita is an indicator widely used in the literature on tax revenues to control different national development levels across countries (Le, Moreno-Dodson and Rojchaichaninthorn, 2008). We argue that per capita income is very close to the "ability to pay" in society. Thus, we suspect that per capita income has a significant positive effect on tax revenue. The inclusion of the economy's composition also seems essential as another determinant in the tax revenue regression. An increasingly industrialized economy structure tends to be easier to tax because companies in this sector have better annual financial reports than other sectors such as agriculture, allowing tax officials to audit it more easily (Gupta, 2007). We suspect that inflation will erode people's purchasing power and thereby hamper the productivity of government revenues (Immervoll, 2005). Therefore, we include inflation in the set of control variables. We also control for the degree of openness of the economy, which affects revenues, particularly international trade taxes (Gaalya, 2015). Data for

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these variables are obtained from WDI. In addition, since our investigation focused on the case of developing countries faced with harsh shadow economic phenomena, we also include the shadow economy as a control variable. Referring to the results disclosed by Schneider (2005), we suspect that any expansion of the shadow economy will decrease the level of tax revenue. We argue that the shadow economy includes unreported income from legal activities and several illegal activities that will not be counted in GDP (i.e., drug dealing, smuggling, fraud, etc.) (Lippert and Walker, 1997), thereby reducing the taxable revenue bases. To control for demographical factors, we use population size. We consider the population (human resources) as the main producer of the tax revenue bases, so it is estimated to positively affect revenue. Lastly, the issue of trust also seems to influence tax revenue. Accordingly, we also include trust in politicians to control for political factors. We argue that a high level of public trust is the principal capital for the growth of voluntary tax compliance, which leads to an increase in tax revenue. Table 1 delivers a detailed description of all the variables described above.

## 3 ECONOMETRIC FRAMEWORKS

The first set of models used to estimate the causal relationship between the institutional environment and tax performance is a simple ordinary least squares (OLS) model similar to the basic model used in Epaphra and Massawe (2017):

$$T^{`}_{it} = \beta_1 X^{`}_{it} + \gamma Z^{`}_{it} + d_t + a_i + \varepsilon_{it} \tag{1}$$

Where $i$ and $t$ are the indexes for country and year, respectively. $T^{`}_{it}$ is a $1 \times g_1$ vector of outcome variables (i.e., total tax revenue, direct tax revenue, indirect tax revenue, and trade tax revenue). $X^{`}_{it}$ is a $1 \times k_2$ vector of primary explanatories (i.e., governance and corruption). $Z^{`}_{it}$ is a $1 \times k_3$ vector of observations on the control variables included as covariates to alleviate omitted variable bias (i.e., income per capita, the economic composition, inflation, and trade liberalization). $\phi$, $\beta_1$, and $y$ are $y$, $k_1 \times 1$, $k_2 \times 1$ and $k_2 \times 1$ vectors of unknown coefficients. $d_t$ and $a_i$ are the country level and year level effects, respectively. Lastly, $\varepsilon_{it}$ is the usual error term and assumed to be non-independently and identically distributed for each $i$ over all $t$.

However, it should be noted that our OLS estimate as shown in equation (1) is likely to be biased because institutional environment variables are expected to be endogenous to a country's tax performance. For example, countries with higher tax collections may be associated with better governance indicators. By a similar logic, higher tax collections may exacerbate the level of corruption in a country. Equation (1) does not address these concerns, thus potentially biasing our results.

To cope with these issues, we need to incorporate IV in the model with the following characteristics: correlated with $X^{`}_{it}$ (strong instruments) and orthogonal to $T^{`}_{it}$ (valid instruments). We use two indicators of democracy, namely political rights and civil liberties as instruments for corruption and governance. We can confidently say that the instruments are strong because the existing literature concludes that political rights and/or civil liberties can affect the level of corruption (Abu

and Staniewski, 2019) and the quality of governance (Benkovskis and Fadejeva, 2014). In addition, we also argue that these two instruments are valid because it seems unlikely that political rights and civil liberties directly affect tax performance without undergoing improvements/deterioration in the institutional environment. For example, when basic individual and political rights are fully granted to citizens it may contribute to political stability and improved institutional quality, which in turn increases the government's efforts to mobilize tax revenues. Data on these instruments are drawn from Freedom House. The index of both instruments ranges from 1 (max freedom) to 7 (total absence of freedom). Table 1 reports summary statistics of these instruments.

The second set of models explores the dynamic relationship between the institutional environment and tax performance. Given that the level of tax collection tends to be highly persistent over time, it is reasonable to assume that current tax revenues depend on past tax levels and institutional quality. Therefore, we estimate the variance of tax performance with a dynamic panel model by introducing the lagged levels of tax revenue and institutional quality on the right side of the equation. The following equation captures that dynamic:

$$T^{'}_{it} = \phi T^{'}_{it-1} + \beta_1 X^{'}_{it} + \beta_2 X^{'}_{it-1} + \gamma Z^{'}_{it} + d_t + a_i + \varepsilon_{it} \qquad (2)$$

The main difference shown by equations (1) and (2) is that the latter captures both the contemporary effect and the lagged effect of the institutional environment variables on tax performance. Estimating this dynamic model allows us to perform indirect tests of different causal mechanisms. Again, it makes sense because the economy recognizes a natural phenomenon known as time lag. Policies designed to improve the quality of current institutions may only have an impact in the future, particularly in relation to improving tax performance. Existing studies seem to fail to capture this mechanism.

However, it should be noted that, equation (2) can still produce biased and inconsistent parameters because heteroscedasticity in residuals and autocorrelation within panels (countries) always appear in data involving many units across places. In addition, the bias parameter is also attributed to the potential endogeneity of the lagged tax revenues ($T^{'}_{it-1}$) in a dynamic panel model – when this variable correlates with the random error term of the equation. The potential for this problem to arise is very high, since we cannot fully capture the determinants of tax revenues.

To address those potential issues, we explore model (2) using the dynamic SGMM proposed by Arellano and Bover (1995) and Blundell and Bond (1998). In contrast to the difference-GMM (DGMM) proposed by Arellano and Bond (1991), the SGMM estimation corrects the endogeneity problem by introducing more instruments, thereby dramatically increasing the estimator's efficiency. Generally, there are two types of instruments used in the SGMM, namely first differences of the endogenous variable and the lagged levels of the equation. SGMM then

transforms these instruments to make them orthogonal to the fixed effects. Another advantage of using this model is that it allows us to minimize data loss better than the DGMM. This is because instead of subtracting the previous observation from a contemporaneous one, SGMM subtracts the average of all future available observations of a variable. It implies that no matter how many gaps we have in our unbalanced panel data set, such a data is computable for all observations except the last for each individual (country). In addition, Monte Carlo simulation also suggests that when the time span is short and the dependent variable is persistent, there are gains in precision and the small sample bias is reduced when the SGMM is applied (Blundell and Bond, 1998).

Both one-step and two-step SGMM estimators will be used in this study to ensure robust estimation results. In the presence of heteroscedasticity and serial correlation, a two-step GMM estimator should be used by exploiting a weighting matrix using residuals from the first step (Roodman, 2009). However, in finite samples, such standard errors tend to be downward biased. The conventional approach by practitioners in such circumstances is to use what is known as the Windmeijer (2005) adjustment to correct for such a small sample bias.

To test the validity of the instrument, we will run the Hansen test and the difference-in-Hansen test. The null hypothesis for the first test states that all instruments used are exogenous (orthogonal to dependent variables). The null hypothesis for the second test confirms the exogeneity of external instruments (consists of key explanatories and control variables) in the SGMM estimation. However, Roodman (2009) stated that the *p*-value of those tests might be bloated, primarily when the instruments used to overcome the endogeneity problems outnumber the country panels. Due to the relatively large number of periods under study $t = 18$, the SGMM model we build is likely to face the instrument proliferation problem, especially when all lags are exploited as instruments. Therefore, the GMM-style instrument lag needs to be restricted from two to four to prevent overuse of the instruments in the model, as Roodman (2009) suggested. We treat $T^{'}_{it-1}$, $X^{'}_{it}$ and $X^{'}_{it-1}$ as endogenous and generate the GMM-style instruments for the corresponding endogenous variables.

## 4 RESULTS AND DISCUSSION
### 4.1 CORRELATION ANALYSIS
According to table 2, all correlation coefficients show the direction of the relationship as hypothesized, except the relationship between per capita income (transformed into logarithm) and trade tax which appears with a negative sign. The likely plausible reason for this result is that most trade taxes are levied on imports rather than exports, while import is an element of leakage for a GDP. In addition, another interesting finding here is the positive relationship between economic openness and trade taxes. It emphasizes that although economic openness indicates a reduction in tariffs, it is compensated by an increase in the trade volume, which encourages the flow of trade tax revenues.

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**TABLE 2**
*Pearson correlation matrix*

|  | $TR_{it}$ | $DTR_{it}$ | $IDTR_{it}$ | $TTR_{it}$ | $GVN_{it}$ | $CC_{it}$ |
|---|---|---|---|---|---|---|
| $TR_{it}$ | 1 | | | | | |
| $DTR_{it}$ | 0.755 | 1 | | | | |
| $IDTR_{it}$ | 0.650 | 0.168 | 1 | | | |
| $TTR_{it}$ | 0.494 | 0.295 | -0.096 | 1 | | |
| $GVN_{it}$ | 0.352 | 0.354 | 0.191 | 0.123 | 1 | |
| $CC_{it}$ | 0.435 | 0.422 | 0.212 | 0.220 | 0.864 | 1 |
| $LOG\_ICAP_{it}$ | 0.162 | 0.195 | 0.142 | -0.086 | 0.409 | 0.297 |
| $IND_{it}$ | 0.060 | 0.187 | 0.263 | 0.005 | 0.032 | -0.039 |
| $INF_{it}$ | -0.018 | -0.012 | -0.095 | 0.147 | -0.100 | -0.101 |
| $TOP_{it}$ | 0.498 | 0.333 | 0.424 | -0.183 | 0.250 | 0.224 |
| $SHD_{it}$ | -0.062 | -0.084 | -0.014 | -0.067 | -0.445 | -0.331 |
| $LOG\_POP_{it}$ | -0.471 | -0.177 | -0.448 | -0.247 | -0.217 | -0.303 |
| $TIP_{it}$ | 0.142 | 0.258 | 0.100 | 0.188 | 0.463 | 0.461 |
| $CVL_{it}$ | -0.331 | -0.249 | -0.283 | -0.068 | -0.451 | -0.444 |
| $PR_{it}$ | -0.262 | -0.230 | -0.236 | -0.005 | -0.387 | -0.410 |

*Source: Own calculation.*

Table 2 also reports that institutional variables (governance and corruption) appear to be correlated. The governance index has a strong positive relationship with control of corruption ($r = 0.86$). It implies that there are multicollinearity problems among institutional variables. Hence, these three variables need to be applied separately in the regression analysis to avoid a biasness in the estimation model.

**4.2 REGRESSION ANALYSIS OF TOTAL TAX REVENUE**
Table 3 (models 1-6) shows the main IV estimation results for governance index and control of corruption with aggregate tax revenues. The two variables representing the institutional factors are tested separately in all regressions to avoid multicollinearity bias. In addition, the shadow economy and public trust in politician variables are also analyzed separately from other control variables because there are fewer observations of them due to the paucity of data. Overall, our estimation results support the central hypothesis of this study. Countries with better governance quality and lower levels of corruption tend to have higher aggregate tax performance. The result is consistent with Bird, Martinez-Vazquez and Torgler (2008), and Ajaz and Ahmad (2010), who explained that efficient governance and an efficient political system are necessary for a profitable tax system in developing countries. Government effort to collect tax revenues will also be disrupted if the administration and governance are poor (Prichard, 2010). The results in this study are also consistent with Alm, Martinez-Vazquez and McClellan (2015), who explained that the presence of tax inspectors who asked for bribes resulted in a higher level of tax evasion. Hunady and Orviska (2015) emphasized that

increasing levels of corruption among officials can harm tax administration and tax audits and undermine the state's credibility.

Furthermore, table 3 (models 7-12) also presents the results from the first-stage regression of IV estimations. We use civil liberties and political rights to instrument governance and corruption across all models. The coefficient signs of the excluded instruments ($CVL_{it}$ and $PR_{it}$) are as predicted and mostly significant at the 1% level. This implies that civil liberties and political rights are particularly strong predictors of the institutional environment. Good governance and effective prevention of corruption will be easier to achieve in countries that uphold the freedom of their citizens to voice and participate in politics. Moreover, our under- and weak-identification tests also reveal congruent results. The *p*-values and *F*-statistics of the respective tests reject the null hypothesis, which indicates that both excluded instruments are relevant and satisfactory (well-performed) for determining institutional variables. The Hansen J test failed to reject the null hypothesis of the joint exogeneity of instruments for all models (*p*-values > 0.1). This indicates that our instruments are valid, meaning orthogonal to the endogenous regressors. Thus, two eligible instrument requirements have been met.

In addition, table 3 also reports the estimations results of a series of control variables on aggregate tax revenue. All the coefficient signs are in accordance with the hypothesis except for the population, which may be because an increase in population is not always accompanied by an increase in compliance, especially in developing countries. Per capita GDP was found to have a positive and significant relationship with total tax revenues. This result is in line with Karagöz (2013) and Ayenew (2016), who noted that economic development improves public services and taxpayers' ability to pay, which increases the efficiency of tax authorities in collecting taxing that intended to finance increased demand for spending. The industrial sector's contribution to GDP was also found to have a positive and significant impact on total tax revenue across all specifications. The industrial sector is typically easier to monitor and tax compared to the agricultural sector, and a larger share of manufacturing in GDP reflects more remarkable economic development and the formal (taxable) sector (Gaalya, 2015; Morrissey et al., 2016). In addition, if production is efficient, manufacturing activities can generate higher taxable income through sales, excise, and corporate income taxes (Ahmed and Mohammed, 2010).

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**TABLE 3**
*Regression results of total tax revenue and the first stage: IV estimations*

| Models | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE First | IV + FE First | IV + FE First | IV + FE First | IV + FE First | IV + FE First |
| **D.V.** | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $GVN_{it}$ | $GVN_{it}$ | $GVN_{it}$ | $CC_{it}$ | $CC_{it}$ | $CC_{it}$ |
| $GVN_{it}$ | 3.843*** | 2.726*** | 2.159* | | | | | | | | | |
| | (1.215) | (0.963) | (1.114) | | | | | | | | | |
| $CC_{it}$ | | | | 6.284*** | 4.789*** | 3.231** | | | | | | |
| | | | | (1.813) | (1.620) | (1.542) | | | | | | |
| $CVL_{it}$ | | | | | | | -0.083*** | -0.116*** | -0.128*** | -0.042*** | -0.055*** | -0.071*** |
| | | | | | | | (0.027) | (0.031) | (0.043) | (0.015) | (0.017) | (0.027) |
| $PR_{it}$ | | | | | | | -0.073*** | -0.084*** | -0.031 | -0.049*** | -0.052*** | -0.017 |
| | | | | | | | (0.018) | (0.022) | (0.023) | (0.011) | (0.013) | (0.015) |
| $LOG\_ICAP_{it}$ | 2.307*** | | | 2.060*** | | | 0.402*** | | | 0.207*** | | |
| | (0.796) | | | (0.700) | | | (0.067) | | | (0.043) | | |
| $IND_{it}$ | 0.146*** | | | 0.130*** | | | -0.011*** | | | -0.004** | | |
| | (0.035) | | | (0.035) | | | (0.003) | | | (0.002) | | |
| $INF_{it}$ | -0.002 | | | -0.003 | | | -0.072 | | | -0.164 | | |
| | (0.057) | | | (0.092) | | | (0.424) | | | (0.605) | | |
| $TOP_{it}$ | 0.063*** | | | 0.063*** | | | 0.003 | | | 0.002 | | |
| | (0.009) | | | (0.009) | | | (0.009) | | | (0.006) | | |
| $LOG\_POP_{it}$ | -0.322 | | | -0.904 | | | -0.980*** | | | -0.410*** | | |
| | (2.144) | | | (1.856) | | | (0.192) | | | (0.100) | | |
| $SHD_{it}$ | | -0.399*** | | | -0.358*** | | | -0.027** | | | -0.024*** | |
| | | (0.092) | | | (0.095) | | | (0.011) | | | (0.007) | |

| Models | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE First | IV + FE First | IV + FE First | IV + FE First | IV + FE First | IV + FE First |
| D.V. | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $GVN_{it}$ | $GVN_{it}$ | $GVN_{it}$ | $CC_{it}$ | $CC_{it}$ | $CC_{it}$ |
| $TIP_{it}$ | | | 0.598** | | | 0.598* | | | 0.104*** | | | 0.096*** |
| | | | (0.257) | | | (0.324) | | | (0.030) | | | (0.017) |
| U.ID (p-val.) | | | | | | | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.005 |
| W.ID (F-stat.) | | | | | | | 23,194 | 26,484 | 27,160 | 29,742 | 32,775 | 27,377 |
| Hansen (p-val.) | | | | | | | 0.678 | 0.382 | 0.310 | 0.500 | 0.287 | 0.314 |
| Observations | 968 | 874 | 575 | 968 | 874 | 575 | 968 | 874 | 575 | 968 | 874 | 575 |
| Countries | 78 | 75 | 66 | 78 | 75 | 66 | 78 | 75 | 66 | 78 | 75 | 66 |

*Explanation: T-statistics based on HAC standard errors are reported in parentheses. Both country and time effects are included. D.V. = Dependent variables. U.ID = The p-values associated with the Kleibergen-Paap underidentification test. W.ID = The F-statistics associated with the Kleibergen-Paap weak identification test. Hansen = The p-values associated with the Hansen overisdentification test. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.*

*Source: Own calculation.*

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**TABLE 4**

*Regression results of total tax revenue: SGMM estimations*

| Models | (1) SGMM One-Step | (2) SGMM Two-Step | (3) SGMM One-Step | (4) SGMM Two-Step | (5) SGMM One-Step | (6) SGMM Two-Step | (7) SGMM One-Step | (8) SGMM Two-Step | (9) SGMM One-Step | (10) SGMM Two-Step | (11) SGMM One-Step | (12) SGMM Two-Step |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **D.V.** | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ |
| $TR_{it-1}$ | 0.788*** | 0.776*** | 0.869*** | 0.932*** | 0.855*** | 0.856*** | 0.823*** | 0.852*** | 0.866*** | 0.940*** | 0.887*** | 0.982*** |
|  | (0.098) | (0.120) | (0.092) | (0.094) | (0.137) | (0.183) | (0.081) | (0.120) | (0.076) | (0.085) | (0.102) | (0.097) |
| $GVN_{it}$ | 1.105** | 1.251** | 1.158** | 1.217** | 1.102* | 1.424** |  |  |  |  |  |  |
|  | (0.555) | (0.488) | (0.583) | (0.493) | (0.633) | (0.720) |  |  |  |  |  |  |
| $CC_{it}$ |  |  |  |  |  |  | 1.457** | 1.668** | 1.395* | 1.174* | 1.164 | 1.061 |
|  |  |  |  |  |  |  | (0.716) | (0.789) | (0.771) | (0.707) | (0.822) | (0.804) |
| $GVN_{it-1}$ | 1.525*** | 1.328*** | 1.659*** | 1.473*** | 1.513*** | 1.277** |  |  |  |  |  |  |
|  | (0.392) | (0.361) | (0.411) | (0.365) | (0.547) | (0.551) |  |  |  |  |  |  |
| $CC_{it-1}$ |  |  |  |  |  |  | 1.677** | 1.211** | 1.686*** | 1.438** | 1.617*** | 1.147** |
|  |  |  |  |  |  |  | (0.528) | (0.550) | (0.571) | (0.594) | (0.574) | (0.581) |
| $LOG\_ICAP_{it}$ | 1.069*** | 1.073*** |  |  |  |  | 1.057*** | 1.043*** |  |  |  |  |
|  | (0.209) | (0.151) |  |  |  |  | (0.147) | (0.161) |  |  |  |  |
| $IND_{it}$ | 0.222* | 0.232** |  |  |  |  | 0.220** | 0.218* |  |  |  |  |
|  | (0.116) | (0.118) |  |  |  |  | (0.114) | (0.120) |  |  |  |  |
| $INF_{it}$ | -0.005 | -0.006 |  |  |  |  | -0.008 | -0.007 |  |  |  |  |
|  | (0.047) | (0.041) |  |  |  |  | (0.051) | (0.049) |  |  |  |  |
| $TOP_{it}$ | 0.111*** | 0.112*** |  |  |  |  | 0.110*** | 0.112*** |  |  |  |  |
|  | (0.019) | (0.010) |  |  |  |  | (0.018) | (0.011) |  |  |  |  |
| $LOG\_POP_{it}$ | -0.136 | -0.129 |  |  |  |  | -0.057 | -0.041 |  |  |  |  |
|  | (0.106) | (0.107) |  |  |  |  | (0.089) | (0.107) |  |  |  |  |

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| Models | (1) SGMM One-Step | (2) SGMM Two-Step | (3) SGMM One-Step | (4) SGMM Two-Step | (5) SGMM One-Step | (6) SGMM Two-Step | (7) SGMM One-Step | (8) SGMM Two-Step | (9) SGMM One-Step | (10) SGMM Two-Step | (11) SGMM One-Step | (12) SGMM Two-Step |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D.V. | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ | $TR_{it}$ |
| $SHD_{it}$ | | | -0.123*** (0.014) | -0.115*** (0.014) | | | | | -0.120** (0.010) | -0.115*** (0.010) | | |
| $TIP_{it}$ | | | | | 0.514** (0.232) | 0.630** (0.270) | | | | | 0.559*** (0.180) | 0.644*** (0.188) |
| AR2 (p-val.) | 0.726 | 0.727 | 0.588 | 0.592 | 0.292 | 0.303 | 0.738 | 0.717 | 0.595 | 0.602 | 0.296 | 0.307 |
| Hansen (p-val.) | 0.791 | 0.791 | 0.593 | 0.593 | 0.541 | 0.541 | 0.330 | 0.330 | 0.264 | 0.264 | 0.614 | 0.614 |
| Diff. in Hansen (p-val.) | 0.477 | 0.477 | 0.265 | 0.265 | 0.342 | 0.342 | 0.120 | 0.120 | 0.111 | 0.111 | 0.335 | 0.335 |
| Instruments | 32 | 32 | 27 | 27 | 22 | 22 | 32 | 32 | 27 | 27 | 22 | 22 |
| Observations | 875 | 875 | 785 | 785 | 544 | 544 | 875 | 875 | 785 | 785 | 544 | 544 |
| Countries | 77 | 77 | 75 | 75 | 67 | 67 | 77 | 77 | 75 | 75 | 67 | 67 |

*Explanation: HAC and Windmeijer's (2005) robust standard errors are reported in parentheses on one-step and two-step estimations, respectively. Both country and time effects are included. D.V. = Dependent variables. U.ID = The p-values associated with the Kleibergen-Paap underidentification test. W.ID = The F-statistics associated with the Kleibergen-Paap weak identification test. Hansen = The p-values associated with the Hansen overidentification test. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.*

*Source: Own calculation.*

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In all specifications, inflation has a weak negative effect on total tax revenue. It is evident that inflation undermines people's purchasing power, thereby distorting the measurement of tax income bases (Immervoll, 2005; Ayenew, 2016). These results are congruent with Ghura (1998) and Agbeyegbe, Stotsky and WoldeMariam (2004), who posited that with skyrocketing prices, the intention of entrepreneurs to avoid taxes would increase, such as splitting the parent company into several smaller companies engaged in the informal economy, while consumers can switch to spending on goods that are less likely to be taxed. Our findings also reveal a positive and significant relationship between trade openness and aggregate tax revenue. A possible plausible reason is that trade liberalization can generate broader revenue bases since the transaction volume in such an economic environment tends to be greater (Agbeyegbe, Stotsky and WoldeMariam, 2004; Castro and Camarillo, 2014). In addition, imports and exports are easier to collect because they are carried out in specific locations (Gupta, 2007). The shadow economy as expected worsens tax performance. This result is in line with Cobham (2005), who estimated that developing countries lose USD 285 billion per year due to tax avoidance in the domestic shadow economy. Lastly, political trust has proven to be an important determinant in increasing a country's tax revenues.

Table 4 displays results from the SGMM estimations, which now investigate the contemporaneous and lagged effects of institutional variables on total tax revenue in a dynamic framework as defined in equation 2. According to the results shown in table 4, we find that the Hansen J test across all specifications failed to reject the null hypothesis of the exogeneity of all instruments since their $p$-values are above 0.1. It provides some evidence that our instruments are uncorrelated with the outcome of interest. The difference-in-Hansen tests also reveal that our GMM-style instruments are valid, meaning that they are orthogonal to tax performance variables ($p$-value > 0.1). Moreover, the Arellano-Bond test for AR (2) across all regressions failed to reject the null hypothesis of no second-order serial correlation ($p$-value > 0.1). This implies that the original disturbances are serially uncorrelated, and the moment conditions are correctly specified, making our estimations safe from bias.

Some essential findings emerge in table 4. The positive and significant effect ($p$-value < 0.01) of the first-lag of tax revenue in its contemporaneous form in all estimations (both one-step and two-step) provides strong evidence for the persistent nature of tax revenue over time. Overall, the estimated (positive) lagged effects of governance and corruption on total tax revenues are more prominent in magnitude and statistically more significant than their respective contemporaneous effects. These results are robust across all models. Quantitatively, a 1-point increase in the lagged and contemporary governance indexes resulted in a rise in approximately 1.1-1.4 percentage points and 1.3-1.7 percentage points in aggregate tax revenue, respectively (based on models 1-6). Under the same scenario, a 1-point increase in the lagged and contemporary corruption control indexes can be associated with an increase of approximately 1.2-1.7 percentage points and 1.1-1.7 percentage points in total tax generation, respectively (based on models 7-12). As noted earlier, the lagged effects of governance and control of corruption are preferred because they will provide better and more logical guidance for public authorities. Any public policy that is being executed today can generate benefit only in the future. Thus,

improving the institutional environment by fighting corruption and increasing governance effectiveness must be considered and implemented in advance so that the tax collection can be realized immediately.

## 4.3 REGRESSION ANALYSIS OF THREE TYPES OF TAX REVENUE

To further explore which types of taxes are most influenced by the institutional environment, we also break down the regression according to three familiar sources of tax revenue: direct tax, indirect tax, and trade tax. The analysis was executed with IV estimation and the results are reported in table 5. Civil liberties and political rights show consistency as adequate instruments for governance and corruption across all regressions. It is indicated by the $p$-value of the over-identification test results which are not significant at the 5% level almost in all regressions. The impact of governance and corruption are evidenced in direct taxes, indirect taxes, and trade taxes across models until public trust in politicians is used as the only control variable. Statistically, the significance levels of the governance and corruption effects vary depending on the type of tax. As we see, the tax revenue response to governance and corruption appears to be more substantial in indirect taxes ($p$-value < 0.01) than in trade taxes ($p$-value < 0.05) and direct taxes ($p$-value < 0.1). These results are somewhat similar to what Epaphra and Massawe (2017) found in Africa. They consider institutional variables are important determinants of indirect taxes and trade taxes but not direct taxes. It implies that direct taxes tend to be more resilient when corruption is rampant, and the quality of governance is unsatisfactory. Thus, if governments need to increase tax revenue by minimizing distortions and maximizing social welfare, they must implement reforms that reduce corruption or increase revenues from tax categories less prone to corruption (Imam and Jacobs, 2014). In the case of this study, revenue-raising efforts might focus on direct taxes, which have the weakest response to corruption compared to other types of taxes.

Table 5 also delivers the estimation results of other exogenous variables. The percentage of industrial value-added in GDP, economic openness, shadow economy, and public trust have coefficient signs under the hypothesis in all regressions but with varying effect sizes and significance levels. Income per capita has a positive and significant effect on direct taxes ($p$-value < 0.01) and indirect taxes ($p$-value < 0.05) but has an opposite direction and insignificant effect on trade taxes ($p$-value > 0.1). The negative relationship of GDP per capita and trade tax revenue confirms the findings of Epaphra and Massawe (2017), who argued that developing countries that are still in the early stages of development have poor tax administration capabilities. Consequently, they rely heavily on trade taxes as their source of revenue which is easier to collect and enforce than domestic taxes. Inflation has a weak negative effect on direct taxes and indirect taxes. However, the opposite empirical results were found on inflation in the trade tax revenue regression. The positive impact of inflation may indicate that an increase in the price of domestic goods triggers a shift in consumer preferences towards imported goods, which in turn increases the trade tax base. Population has a positive and significant effect ($p$-value < 0.05) only on indirect taxes and has the opposite direction to direct taxes. These results corroborate the two earlier analyzes: (1) the direct taxes are very vulnerable to evasion, and (2) population growth does not necessarily go hand in hand with increased taxpayer compliance.

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**TABLE 5**
*Regression results of three types of tax revenue: IV estimations*

| Models | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE |
| D.V. | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ |
| $GIN_{it}$ | 0.888* | 0.789* | 0.534 |  |  |  | 2.635*** | 1.570*** | 1.251 |  |  |  | 1.010** | 0.824** | 0.669 |  |  |  |
|  | (0.538) | (0.461) | (0.697) |  |  |  | (0.772) | (0.587) | (0.976) |  |  |  | (0.482) | (0.334) | (0.749) |  |  |  |
| $CC_{it}$ |  |  |  | 1.442* | 1.378* | 0.987 |  |  |  | 4.343*** | 2.763*** | 2.483 |  |  |  | 1.635*** | 1.404** | 1.190 |
|  |  |  |  | (0.868) | (0.796) | (1.296) |  |  |  | (1.184) | (1.013) | (1.788) |  |  |  | (0.758) | (0.598) | (1.335) |
| $LOG\_ICAP_{it}$ | 1.208*** |  |  | 1.233*** |  |  | 1.142** |  |  | 1.094** |  |  | -0.158 |  |  | -0.227 |  |  |
|  | (0.418) |  |  | (0.396) |  |  | (0.024) |  |  | (0.433) |  |  | (0.363) |  |  | (0.338) |  |  |
| $IND_{it}$ | 0.171*** |  |  | 0.170*** |  |  | 0.084*** |  |  | 0.075*** |  |  | 0.029** |  |  | 0.023** |  |  |
|  | (0.023) |  |  | (0.023) |  |  | (0.017) |  |  | (0.016) |  |  | (0.012) |  |  | (0.011) |  |  |
| $INF_{it}$ | -0.003 |  |  | -0.004 |  |  | -0.016 |  |  | -0.021 |  |  | 0.006 |  |  | 0.003 |  |  |
|  | (0.002) |  |  | (0.003) |  |  | (0.403) |  |  | (0.627) |  |  | (0.016) |  |  | (0.024) |  |  |
| $TOP_{it}$ | 0.030*** |  |  | 0.030*** |  |  | 0.020*** |  |  | 0.020*** |  |  | 0.012*** |  |  | 0.012*** |  |  |
|  | (0.005) |  |  | (0.005) |  |  | (0.005) |  |  | (0.005) |  |  | (0.003) |  |  | (0.003) |  |  |
| $LOG\_POP_{it}$ | -1.359 |  |  | -1.465 |  |  | 0.011** |  |  | 0.017** |  |  | 1.003 |  |  | 0.674 |  |  |
|  | (1.143) |  |  | (1.053) |  |  | (0.005) |  |  | (0.008) |  |  | (0.798) |  |  | (0.734) |  |  |
| $SHD_{it}$ |  | -0.233*** |  |  | -0.227*** |  |  | -0.096* |  |  | -0.072 |  |  | -0.064** |  |  | -0.052* |  |
|  |  | (0.051) |  |  | (0.053) |  |  | (0.052) |  |  | (0.056) |  |  | (0.026) |  |  | (0.027) |  |
| $TIP_{it}$ |  |  | 0.087** |  |  | 0.048** |  |  | 0.243* |  |  | 0.263 |  |  | 0.324** |  |  | 0.377** |
|  |  |  | (0.036) |  |  | (0.024) |  |  | (0.143) |  |  | (0.192) |  |  | (0.149) |  |  | (0.181) |
| U.ID (p-val.) | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.005 |
| W.ID (F-stat.) | 23,194 | 26,484 | 7,160 | 29,742 | 32,775 | 7,377 | 23,194 | 32,775 | 7,377 | 29,742 | 32,775 | 7,377 | 23,194 | 26,484 | 7,160 | 29,742 | 32,775 | 7,377 |

| Models | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE | IV + FE |
| D.V. | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ |
| Hansen (p-val.) | 0.615 | 0.294 | 0.578 | 0.591 | 0.266 | 0.583 | 0.968 | 0.340 | 0.095 | 0.767 | 0.340 | 0.100 | 0.640 | 0.939 | 4.696 | 0.555 | 0.934 | 0.027 |
| Observations | 968 | 874 | 575 | 968 | 874 | 575 | 968 | 874 | 575 | 968 | 874 | 575 | 968 | 874 | 575 | 968 | 874 | 575 |
| Countries | 78 | 75 | 66 | 78 | 75 | 66 | 78 | 75 | 66 | 78 | 75 | 66 | 78 | 75 | 66 | 78 | 75 | 66 |

*Explanation: T-statistics based on HAC standard errors are reported in parentheses. Both country and time effects are included. D.V. = Dependent variables. U.ID = The p-values associated with the Kleibergen-Paap underidentification test. W.ID = The F-statistics associated with the Kleibergen-Paap weak identification test. Hansen = The p-values associated with the Hansen overidentification test. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.*

*Source: Own calculation.*

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**TABLE 6**
*Regression results of direct tax revenue: SGMM estimations*

| Models | (1) SGMM One-Step | (2) SGMM Two-Step | (3) SGMM One-Step | (4) SGMM Two-Step | (5) SGMM One-Step | (6) SGMM Two-Step | (7) SGMM One-Step | (8) SGMM Two-Step | (9) SGMM One-Step | (10) SGMM Two-Step | (11) SGMM One-Step | (12) SGMM Two-Step |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **D.V.** | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ |
| $DTR_{it-1}$ | 0.681*** | 0.864*** | 0.456* | 0.803*** | 0.515* | 0.895*** | 0.776*** | 0.949*** | 0.591*** | 0.913*** | 0.613*** | 0.796*** |
| | (0.139) | (0.132) | (0.241) | (0.242) | (0.280) | (0.263) | (0.132) | (0.159) | (0.223) | (0.306) | (0.229) | (0.241) |
| $GVN_{it}$ | 0.575*** | 0.647** | 0.734 | 0.752** | 0.837* | 0.821** | | | | | | |
| | (0.294) | (0.258) | (0.451) | (0.371) | (0.478) | (0.392) | | | | | | |
| $CC_{it}$ | | | | | | | 0.613* | 0.537 | 0.677** | 0.582 | 0.825* | 0.715 |
| | | | | | | | (0.357) | (0.422) | (0.311) | (0.425) | (0.465) | (0.687) |
| $GVN_{it-1}$ | 1.303*** | 0.979*** | 1.234** | 0.890*** | 1.376** | 0.992*** | | | | | | |
| | (0.296) | (0.239) | (0.486) | (0.267) | (0.600) | (0.329) | | | | | | |
| $CC_{it-1}$ | | | | | | | 0.980* | 0.725* | 1.199* | 0.895** | 1.292* | 0.884 |
| | | | | | | | (0.520) | (0.431) | (0.644) | (0.433) | (0.734) | (0.629) |
| $LOG\_ICAP_{it}$ | 1.723*** | 1.666*** | | | | | 1.632*** | 1.540*** | | | | |
| | (0.172) | (0.176) | | | | | (0.124) | (0.131) | | | | |
| $IND_{it}$ | 0.233*** | 0.203*** | | | | | 0.200*** | 0.170*** | | | | |
| | (0.024) | (0.018) | | | | | (0.018) | (0.014) | | | | |
| $INF_{it}$ | -0.008 | -0.002 | | | | | -0.003 | -0.003 | | | | |
| | (0.034) | (0.041) | | | | | (0.032) | (0.036) | | | | |
| $TOP_{it}$ | 0.030*** | 0.020*** | | | | | 0.030*** | 0.040*** | | | | |
| | (0.004) | (0.005) | | | | | (0.004) | (0.005) | | | | |
| $LOG\_POP_{it}$ | -0.007 | -0.021 | | | | | -0.044 | -0.033 | | | | |
| | (0.077) | (0.082) | | | | | (0.060) | (0.072) | | | | |
| $SHD_{it}$ | | | -0.160*** | -0.160*** | | | | | -0.090*** | -0.060*** | | |
| | | | (0.016) | (0.018) | | | | | (0.011) | (0.015) | | |

| Models | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SGMM One-Step | SGMM Two-Step | SGMM One-Step | SGMM Two-Step | SGMM One-Step | SGMM Two-Step | SGMM One-Step | SGMM Two-Step | SGMM One-Step | SGMM Two-Step | SGMM One-Step | SGMM Two-Step |
| D.V. | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ | $DTR_{it}$ |
| $TIP_{it}$ | | | | | 0.401* | 0.472* | | | | | 0.600*** | 0.708*** |
| | | | | | (0.229) | (0.269) | | | | | (0.284) | (0.355) |
| AR2 (p-val.) | 0.140 | 0.185 | 0.165 | 0.216 | 0.211 | 0.377 | 0.153 | 0.194 | 0.174 | 0.221 | 0.215 | 0.416 |
| Hansen (p-val.) | 0.265 | 0.265 | 0.198 | 0.198 | 0.376 | 0.376 | 0.083 | 0.083 | 0.140 | 0.140 | 0.123 | 0.123 |
| Diff. in Hansen (p-val.) | 0.086 | 0.086 | 0.061 | 0.061 | 0.158 | 0.158 | 0.081 | 0.081 | 0.213 | 0.213 | 0.088 | 0.088 |
| Instruments | 32 | 32 | 27 | 27 | 22 | 22 | 32 | 32 | 27 | 27 | 22 | 22 |
| Observations | 875 | 875 | 785 | 785 | 544 | 544 | 875 | 875 | 785 | 785 | 544 | 544 |
| Countries | 77 | 77 | 75 | 75 | 67 | 67 | 77 | 77 | 75 | 75 | 67 | 67 |

*Explanation: HAC and Windmeijer's (2005) robust standard errors are reported in parentheses on one-step and two-step estimations, respectively. Both country and time effects are included. D.V. = Dependent variables. U.ID = The p-values associated with the Kleibergen-Paap underidentification test. W.ID = The F-statistics associated with the Kleibergen-Paap weak identification test. Hansen = The p-values associated with the Hansen overidentification test. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.*

*Source: Own calculation.*

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**TABLE 7**

*Regression results of indirect tax revenue: SGMM estimations*

| Models | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SGMM One-Step | SGMM Two-Step | SGMM One-Step | SGMM Two-Step | SGMM One-Step | SGMM Two-Step | SGMM One-Step | SGMM Two-Step | SGMM One-Step | SGMM Two-Step | SGMM One-Step | SGMM Two-Step |
| D.V. | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ |
| $IDTR_{it-1}$ | 0.767*** | 0.751*** | 0.839*** | 0.760*** | 0.695*** | 0.527* | 0.753*** | 0.769*** | 0.842*** | 0.781*** | 0.764*** | 0.781*** |
| | (0.144) | (0.163) | (0.127) | (0.133) | (0.184) | (0.291) | (0.147) | (0.143) | (0.106) | (0.163) | (0.153) | (0.257) |
| $GVN_{it}$ | 1.356*** | 1.366*** | 1.178*** | 1.388*** | 1.616*** | 1.681*** | | | | | | |
| | (0.402) | (0.460) | (0.444) | (0.420) | (0.521) | (0.546) | | | | | | |
| $CC_{it}$ | | | | | | | 1.565*** | 1.948*** | 1.453* | 1.916** | 1.332* | 1.370 |
| | | | | | | | (0.606) | (0.692) | (0.612) | (0.898) | (0.690) | (0.968) |
| $GVN_{it-1}$ | 2.153*** | 2.324*** | 2.206*** | 2.242*** | 2.079*** | 2.346*** | | | | | | |
| | (0.264) | (0.256) | (0.268) | (0.262) | (0.440) | (0.435) | | | | | | |
| $CC_{it-1}$ | | | | | | | 2.024*** | 2.129*** | 2.353*** | 2.299*** | 2.327*** | 2.232*** |
| | | | | | | | (0.393) | (0.435) | (0.412) | (0.453) | (0.533) | (0.422) |
| $LOG\_ICAP_{it}$ | 1.125*** | 1.112*** | | | | | 1.118*** | 1.020*** | | | | |
| | (0.131) | (0.121) | | | | | (0.132) | (0.116) | | | | |
| $IND_{it}$ | 0.144*** | 0.140*** | | | | | 0.144*** | 0.135*** | | | | |
| | (0.024) | (0.024) | | | | | (0.025) | (0.022) | | | | |
| $INF_{it}$ | -0.005 | -0.007 | | | | | -0.007 | -0.001 | | | | |
| | (0.003) | (0.005) | | | | | (0.005) | (0.007) | | | | |
| $TOP_{it}$ | 0.100*** | 0.111*** | | | | | 0.100*** | 0.120*** | | | | |
| | (0.007) | (0.009) | | | | | (0.008) | (0.010) | | | | |
| $LOG\_POP_{it}$ | 0.160** | 0.176** | | | | | 0.143* | 0.144 | | | | |
| | (0.079) | (0.087) | | | | | (0.082) | (0.106) | | | | |

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| Models | (1) SGMM One-Step | (2) SGMM Two-Step | (3) SGMM One-Step | (4) SGMM Two-Step | (5) SGMM One-Step | (6) SGMM Two-Step | (7) SGMM One-Step | (8) SGMM Two-Step | (9) SGMM One-Step | (10) SGMM Two-Step | (11) SGMM One-Step | (12) SGMM Two-Step |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D.V. | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ | $IDTR_{it}$ |
| $SHD_{it}$ | | | -0.120*** (0.017) | -0.131*** (0.017) | | | | | -0.118*** (0.012) | -0.121*** (0.013) | | |
| $TIP_{it}$ | | | | | 0.645* (0.340) | 0.804* (0.482) | | | | | 0.324 (0.283) | 0.232 (0.422) |
| AR2 (p-val.) | 0.609 | 0.604 | 0.569 | 0.613 | 0.607 | 0.751 | 0.629 | 0.596 | 0.582 | 0.592 | 0.583 | 0.561 |
| Hansen (p-val.) | 0.233 | 0.233 | 0.146 | 0.146 | 0.290 | 0.290 | 0.270 | 0.270 | 0.270 | 0.270 | 0.193 | 0.193 |
| Diff. in Hansen (p-val.) | 0.567 | 0.567 | 0.239 | 0.239 | 0.107 | 0.107 | 0.160 | 0.160 | 0.140 | 0.140 | 0.130 | 0.130 |
| Instruments | 32 | 32 | 27 | 27 | 22 | 22 | 32 | 32 | 27 | 27 | 22 | 22 |
| Observations | 875 | 875 | 785 | 785 | 544 | 544 | 875 | 875 | 785 | 785 | 544 | 544 |
| Countries | 77 | 77 | 75 | 75 | 67 | 67 | 77 | 77 | 75 | 75 | 67 | 67 |

*Explanation: HAC and Windmeijer's (2005) robust standard errors are reported in parentheses on one-step and two-step estimations, respectively. Both country and time effects are included. D.V. = Dependent variables. U.ID = The p-values associated with the Kleibergen-Paap underidentification test. W.ID = The F-statistics associated with the Kleibergen-Paap weak identification test. Hansen = The p-values associated with the Hansen overidentification test. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.*

*Source: Own calculation.*

**TABLE 8**

*Regression results of trade tax revenue: SGMM estimations*

| Models | (1) SGMM One-Step | (2) SGMM Two-Step | (3) SGMM One-Step | (4) SGMM Two-Step | (5) SGMM One-Step | (6) SGMM Two-Step | (7) SGMM One-Step | (8) SGMM Two-Step | (9) SGMM One-Step | (10) SGMM Two-Step | (11) SGMM One-Step | (12) SGMM Two-Step |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D.V. | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ |
| $TTR_{it-1}$ | 0.740*** | 0.775*** | 0.749*** | 0.872*** | 0.710*** | 0.771*** | 0.750*** | 0.776*** | 0.735*** | 0.795*** | 0.725*** | 0.817*** |
|  | (0.076) | (0.109) | (0.099) | (0.132) | (0.101) | (0.132) | (0.069) | (0.088) | (0.084) | (0.080) | (0.079) | (0.091) |
| $GVN_{it}$ | 0.834*** | 0.817*** | 0.955*** | 0.953*** | 1.097*** | 1.042*** |  |  |  |  |  |  |
|  | (0.169) | (0.151) | (0.161) | (0.147) | (0.189) | (0.178) |  |  |  |  |  |  |
| $CC_{it}$ |  |  |  |  |  |  | 0.707*** | 0.761*** | 0.808*** | 0.827*** | 0.918*** | 0.915*** |
|  |  |  |  |  |  |  | (0.268) | (0.186) | (0.269) | (0.203) | (0.344) | (0.238) |
| $GVN_{it-1}$ | 1.001*** | 1.030*** | 1.007*** | 1.113*** | 1.116*** | 1.103*** |  |  |  |  |  |  |
|  | (0.175) | (0.173) | (0.183) | (0.178) | (0.234) | (0.156) |  |  |  |  |  |  |
| $CC_{it-1}$ |  |  |  |  |  |  | 1.021*** | 1.082*** | 1.092*** | 0.936*** | 1.214*** | 0.938*** |
|  |  |  |  |  |  |  | (0.349) | (0.198) | (0.310) | (0.200) | (0.450) | (0.270) |
| $LOG\_ICAP_{it}$ | -0.158 | -0.104 |  |  |  |  | -0.142 | -0.117 |  |  |  |  |
|  | (0.136) | (0.107) |  |  |  |  | (0.119) | (0.095) |  |  |  |  |
| $IND_{it}$ | 0.022*** | 0.022*** |  |  |  |  | 0.030*** | 0.020*** |  |  |  |  |
|  | (0.008) | (0.004) |  |  |  |  | (0.008) | (0.005) |  |  |  |  |
| $INF_{it}$ | 0.005 | 0.009 |  |  |  |  | 0.001 | 0.001 |  |  |  |  |
|  | (0.025) | (0.025) |  |  |  |  | (0.033) | (0.022) |  |  |  |  |
| $TOP_{it}$ | 0.020*** | 0.010*** |  |  |  |  | 0.010*** | 0.030*** |  |  |  |  |
|  | (0.002) | (0.002) |  |  |  |  | (0.002) | (0.001) |  |  |  |  |
| $LOG\_POP_{it}$ | 0.081 | 0.074 |  |  |  |  | 0.078 | 0.048 |  |  |  |  |
|  | (0.068) | (0.050) |  |  |  |  | (0.050) | (0.034) |  |  |  |  |

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| Models | (1) SGMM One-Step | (2) SGMM Two-Step | (3) SGMM One-Step | (4) SGMM Two-Step | (5) SGMM One-Step | (6) SGMM Two-Step | (7) SGMM One-Step | (8) SGMM Two-Step | (9) SGMM One-Step | (10) SGMM Two-Step | (11) SGMM One-Step | (12) SGMM Two-Step |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D.V. | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ | $TTR_{it}$ |
| $SHD_{it}$ | | | -0.012** | -0.014*** | | | | | -0.013*** | -0.012*** | | |
| | | | (0.005) | (0.005) | | | | | (0.005) | (0.004) | | |
| $TIP_{it}$ | | | | | 0.172* | 0.140 | | | | | 0.176* | 0.106 |
| | | | | | (0.103) | (0.099) | | | | | (0.094) | (0.108) |
| AR2 (p-val.) | 0.170 | 0.175 | 0.130 | 0.138 | 0.165 | 0.169 | 0.171 | 0.177 | 0.131 | 0.138 | 0.168 | 0.172 |
| Hansen (p-val.) | 0.324 | 0.324 | 0.450 | 0.450 | 0.417 | 0.417 | 0.391 | 0.391 | 0.275 | 0.275 | 0.433 | 0.433 |
| Diff. in Hansen (p-val.) | 0.464 | 0.464 | 0.354 | 0.354 | 0.432 | 0.432 | 0.604 | 0.604 | 0.558 | 0.558 | 0.570 | 0.570 |
| Instruments | 32 | 32 | 27 | 27 | 22 | 22 | 32 | 32 | 27 | 27 | 22 | 22 |
| Observations | 875 | 875 | 785 | 785 | 544 | 544 | 875 | 875 | 785 | 785 | 544 | 544 |
| Countries | 77 | 77 | 75 | 75 | 67 | 67 | 77 | 77 | 75 | 75 | 67 | 67 |

*Explanation: HAC and Windmeijer's (2005) robust standard errors are reported in parentheses on one-step and two-step estimations, respectively. Both country and time effects are included. D.V. = Dependent variables. U.ID = The p-values associated with the Kleibergen-Paap underidentification test. W.ID = The F-statistics associated with the Kleibergen-Paap weak identification test. Hansen = The p-values associated with the Hansen overidentification test. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.*

*Source: Own calculation.*

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We also report the SGMM estimation results of direct tax (table 6), indirect tax (table 7), and trade tax (table 8) regressions. In each table, models 1-6 and models 7-12 summarize the contemporary and lagged effects of the governance and corruption variables on tax performance, respectively. As in the total tax revenue regression, all valid instrument requirements have been met and concerns on the issue of autocorrelation in the disturbance can be ignored in all regressions (see the *p*-values of AR2, Hansen J statistics, and Difference-in-Hansen tests in tables 6-8). The results are still consistent when the dependent variable is split into several taxation categories. The lagged effect of the corruption and governance variables is superior to the contemporary effect. However, there are variations in the magnitude of the effect and the level of significance. In addition, consistent with the results of IV estimations, the contemporary influence of institutional variables (corruption and governance) is more dominant in indirect taxes and trade taxes. Also, the coefficient signs of all control variables included in all regressions have a similar pattern to that of the IV estimations but with minor differences in terms of effect magnitudes and significance levels. Industrial activity, an open economy, and the shadow economy always have a significant effect (at least at the 5% level) and, according to the hypothesis, on all types of taxation. Although public trust in politicians positively affects the three types of tax revenue, the impact is not always significant. Inflation hurts direct and indirect taxes but has a positive and insignificant effect on trade taxes. The income per capita only has a positive and significant effect (*p*-values < 0.01) on direct and indirect taxes. Lastly, population size only has a positive and slightly significant effect on indirect taxes (*p*-values < 0.1). Thus, it is safe to declare that our estimation results are robust.

## 5 CONCLUSION

This paper investigates whether the institutional environment, i.e., governance and corruption, affected tax performance in developing countries in the 2002-2019 period. To obtain more specific results, three types of taxation i.e., direct tax, indirect tax, and trade tax are also used to measure tax performance. In addition, several control variables covering macroeconomic indicators, population size, shadow economy, and public trust are included in the analysis. Since we suspect a bidirectional relationship of institutional variables and tax revenues, we incorporate civil liberties and political rights to instrument corruption and governance. The initial analysis of this study was carried out using the IV estimation model. However, different from previous studies, we provide further analysis by examining the contemporary and lagged effects of institutional variables on tax performance. Therefore, we use both one-step and two-step SGMM models to achieve the final objective of this study.

This study's main result shows that better governance quality and lower levels of corruption benefit governments' overall tax collection. However, the effect of these two institutional variables is more significant in the case of indirect taxes and trade taxes and relatively weak in the case of direct taxes, according to the IV and SGMM models. Intuitively, good governance is frequently associated with an efficient tax administration, speeding up the tax revenue collection process, and encouraging citizens to be more compliant in paying taxes. On the other hand, poor governance is closely related to complex tax regimes, creating more loopholes for tax evasion.

Similarly, a high level of corruption reflects low government accountability, which distorts public trust; hence, voluntary compliance in paying taxes among citizens is undermined. In addition, the SGMM regression results show that the lagged effect is much more substantial than the contemporaneous effect, both in terms of effect magnitude and significance level across all tax revenue measures (total tax, direct tax, indirect tax, and trade tax). This result confirms our assumption of a time-lag symptom of policies directed at institutional environment improvement to support the acquisition of government revenues.

Our empirical results also reveal the critical role of other exogenous variables in determining tax revenue in developing countries. Industrial output as a share of GDP, trade openness, and public trust in politicians have a strong positive effect on all types of tax revenue. On the other hand, the shadow economy consistently has a negative and significant impact on the three categories of tax performance in all regression models. Income per capita only has a positive and significant impact on direct and indirect taxes. In a similar pattern, inflation weakly worsens the performance of direct and indirect taxes but tends to enhance that of trade taxes. Finally, population has a weak positive effect on indirect taxes and trade taxes but has the opposite direction to direct taxes. These results tend to be consistent across all regression models but remain with variation in effect sizes and significance levels.

Our findings may point to some policy implications for governments in developing countries. Reducing corruption and improving governance are the primary efforts that must be implemented to encourage the rate of tax revenue. Given that our empirical results provide evidence that the effect of corruption is substantial on indirect taxes, the government should focus more on fighting bribery practices related to indirect taxes such as value-added tax, sales tax, excise tax, and customs duties. Alternatively, the governments could turn to other sources of tax revenue such as direct taxes which were found to have the weakest response to corruption, implying that this type of tax is less prone to corruption. Corruption in tax administration can be curbed by establishing semi-autonomous tax agencies, higher salaries for tax officers, improved tax services, and reduced interaction of taxpayers and tax officials, for example, by investing in technology and taxes. Moreover, the lagged effects of institutional variables on tax revenue that are much more substantial than their contemporaneous effects in most regressions deliver a valuable insight. The efforts to improve the institutional environment that have been mentioned before must be executed as early as possible to achieve optimal tax performance in the future. Efforts to increase tax revenues also need to be addressed by increasing economic development through increasing per capita income, transforming the economic structure towards industrialization, increasing economic openness, improving public trust, curbing inflation and the proliferation of shadow economic activity, and keep the population size at the ideal level.

**Disclosure statement**
The authors declare that there is no conflict of interest.

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# Aggregate marginal costs
# of public funds

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**Abstract**

*In this paper, we discuss aggregate measures of marginal costs of public funds (MCF) in populations that are heterogeneous with respect to observed as well as unobserved characteristics. We first discuss how to compute MCF in selected examples of traditional (textbook) labour supply models. Next, we review two types of discrete labour supply models proposed in the literature. Subsequently, we discuss how to calculate aggregate measures of MCF for discrete labour supply models. Finally, we apply an estimated two-sector discrete labour supply model to compute MCF based on Norwegian data.*

*Keywords: marginal costs of public funds, discrete choice labour supply, compensated labour supply*

## 1 INTRODUCTION

Pigou (1947), Harberger (1964), and Browning (1976, 1987) introduced the concept of (compensated) marginal cost of public funds (MCF) as a measure of the cost of a marginal change in public revenue, defined as the reduction in consumers' surplus relative to the increase in tax revenue. In the case of redistributing the revenue to the consumers as a lump-sum tax, the income effects of the tax change are neutralized, and the marginal cost of public funds relates only to the distortionary effect of the tax change. Subsequently, Mayshar (1990), Kleven and Kreiner (2006), and Jacobs (2018), have discussed how MCF can be obtained. Figari, Gandullia and Lezzi (2018) have discussed and calculated MCF for Italy, and Kleven and Kreiner (2006) have calculated MCF for five European countries (Denmark, France, Germany, Italy, and the UK). See Ballard and Fullerton (1992), Dahlby (2008), and Jacobs (2009) for reviews.

Nowadays, MCF is widely used in cost-benefit analysis. A well-known example where MCF is useful is in assessment of the toll price to finance a new road or bridge. It is important to stress that MCF is the marginal cost of taxation, given the existing tax system. It is not a tool adequate for evaluating tax reforms.

Most of the previous works on MCF assume that a representative agent represents the behaviour of a population of individuals. However, this assumption is controversial. In fact, a representative agent does not exist unless very strong and unrealistic assumptions are met (Kirman, 1992; 2010). As shown in the critique of Kleven and Kreiner (2006), most works also ignore labour supply responses at the extensive margin.

Jacobs (2018) has proposed and discussed an aggregate measure of MCF based on a labour supply model in which utilities and wages depend on individual skills. In this paper, we propose an analogous aggregate measure of MCF.[1] In principle, one can use any empirical labour supply model to calculate MCF, if it accounts for observed and unobserved heterogeneity in preferences, such as the traditional

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[1] Some of the results in this paper were also obtained in Dagsvik, Strøm and Locatelli (2019).

textbook model. Unfortunately, the textbook labour supply model is highly stylized. Specifically, it ignores key features of the labour market, namely that workers have preferences over type of jobs and that the set of jobs that are available to a worker is limited. Furthermore, the textbook model ignores that the choice of hours of work is typically constrained, and often limited to full-time or part-time hours.

In recent years, many empirical analyses of labour supply have been based on the discrete choice framework (standard discrete labour supply model), pioneered by van Soest (1995). The standard discrete labour supply model can easily accommodate non-linear and non-convex budget sets, which represents a major difficulty in the traditional model. It is therefore very convenient for use in empirical applications. However, an essential shortcoming of the standard discrete labour supply model is that it is, similarly to the traditional model, unable to deal with the restrictions mentioned above that workers face in the labour market.

A model that accounts for choice restrictions in the labour market is a modification of the standard discrete labour supply model, called the job choice model, proposed by Dagsvik (1994) and Dagsvik et al. (1988). For a review, see Dagsvik et al. (2014). Specifically, the job choice model is an extension of the standard discrete labour supply model that accounts for restrictions on workers' choice sets of jobs. For example, due to institutional regulations and agreements between labour unions there are typically more jobs that offer full time and part time hours of work than jobs that offer other work schedules.

In the next section, we review briefly how previous measures of MCF have been defined and calculated based on the traditional textbook labour supply model for a representative agent (worker). In section 3, we discuss implementation of aggregate MCF in populations with heterogeneous workers. In section 4, we discuss the calculation of MCF for traditional labour supply models and in section 5 we review the discrete labour supply model and the job choice model, respectively. Section 6 discusses how MCF can be computed based on the standard discrete choice- and the job choice model, while section 7 reports the calculation of MCF for Norway based on the estimated two-sector job choice model.

## 2 MARGINAL COST OF PUBLIC FUNDS BASED ON THE REPRESENTATIVE AGENT ASSUMPTION

Consider the choice of labour supply of a representative agent and assume that the tax function is differentiable and convex, and can be represented by a scalar $t$. Let $V(t, y)$ denote this indirect utility that corresponds to the direct utility of hours of work and let $e(t, u)$ be the corresponding expenditure function, where $u$ denotes utility. The indirect utility and the expenditure function depend on the tax system, the gross wage rate and (*ex-ante*) non-labour income $y$, but the gross wage rate is suppressed in the notation here. Moreover, let $R(t, h, y)$ be the revenue collected by the government, as a function of the tax system, hours of work $h$ and non-labour income $y$. Finally, let $\tilde{h}(\hat{t}, y)$ denote the uncompensated labour supply

function and $\tilde{h}^c(t,u)$ the corresponding compensated labour supply function. Håkonsen (1998), Ballard (1990), and Mayshar (1990), have proposed a measure of MCF given by

$$M_1 =: \frac{\partial e(\hat{t},V(t,y))/\partial \hat{t}\,|_{\hat{t}=t}}{\partial R(\hat{t},\tilde{h}(\hat{t},y),y)/\partial \hat{t}\,|_{\hat{t}=t}} \tag{1}$$

where $\hat{t}$ represents any tax system and $t$ represents the current (optimal) system. Jacobs (2018) argues that the definition above appears to suffer from an inconsistency because the numerator is a compensated measure, whereas the denominator is an uncompensated measure. Instead, one should replace the uncompensated labour supply function in the denominator by the compensated labour supply function. Thus, the modified measure that follows becomes

$$M_2 =: \frac{\partial e(\hat{t},V(t,y))/\partial \hat{t}\,|_{\hat{t}=t}}{\partial R(\hat{t},\tilde{h}^c(\hat{t},V(t,y)),e(\hat{t},V(t,y)))/\partial \hat{t}\,|_{\hat{t}=t}}. \tag{2}$$

Note that in (2) the compensated supply and expenditure functions are evaluated at the *ex ante* utility level $V(t, y)$. The difference between $M_1$ and $M_2$ is that in the first measure the tax revenue is based on uncompensated labour supply whereas the latter one is based on compensated labour supply and (*ex post*) expenditure.

### 3 MARGINAL COST OF FUNDS IN HETEROGENEOUS POPULATIONS

In this section, we discuss an aggregate measure of MCF for heterogeneous populations that represents an extension of the measure proposed by Jacobs (2018).[2]

Consider a heterogeneous population of individuals who either work or do not work. Here, the possibility of unemployment is ruled out. The individuals are characterized by a vector of socio-economic variables $x$ (say). Let $V(t,y,x)$ denote the individual indirect utility as a function of a vector of individual characteristics $x$ and let $e(t,u,x)$ denote the corresponding expenditure function, given utility level $u$. Atkinson (1983) has proposed a welfare function that is analogous to the following function

$$W(\hat{t}) = \frac{E\{e(\hat{t},V(t,y,x),x)^{1-\varepsilon}\}-1}{1-\varepsilon}$$

for $\varepsilon \neq 1$ and equal to

$$W(\hat{t}) = E(\log e(\hat{t},V(t,y,x),x))$$

for $\varepsilon = 1$ where $E$ is the expectation operator with respect to the population distribution of $(x,y)$ and $\varepsilon$ is a parameter that reflects the inequality aversion of the

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[2] For a recent discussion of applying aggregate money metrics in welfare analysis, see Bosmans, Decancq and Ooghe (2018).

government. However, in this paper, where the focus is on MCF, we need an aggregate money metric cost function, which is obtained by letting $\varepsilon = 0$. Note that when $t = \hat{t}$ then $W(t) = Ey$. Thus $W(\hat{t}) - Ey$ is the aggregate cost of replacing $t$ by $\hat{t}$. If $t$ is optimal then $W(\hat{t}) - Ey$ is always positive. Otherwise, $W(\hat{t}) - Ey$ might be negative if $\hat{t}$ is better than $t$.

The actual tax system may be interpreted as optimally chosen by the authorities. This means that we assume the government has done its best to optimize taxes and redistribute income. We have no reasons to overturn the judgment of the politicians. We also assume that lump-sum taxes are not an alternative.

With $\varepsilon = 0$ it follows that

$$W'(t) = \frac{\partial E(e(\hat{t}, V(t, y.x), x))}{\partial \hat{t}}\Big|_{\hat{t}=t} \tag{3}$$

is the marginal aggregate cost associated with a marginal change of the actual (optimal) tax system $t$.

An obvious extension of the measures discussed in the previous section is

$$M_3 =: \frac{\partial E(e(\hat{t}, V(t, y, x), x))/\partial \hat{t}\,|_{\hat{t}=t}}{\partial E(R(\hat{t}, \tilde{h}^c(\hat{t}, V(t, y, x), x), e(\hat{t}, V(t, y, x), x)))/\partial \hat{t}\,|_{\hat{t}=t}}. \tag{4}$$

In a case in which the tax system is represented by a vector $t$, with components that are functionally dependent, one cannot use the measure in (4). Instead one can use the measure given by

$$M_4 =: \frac{E(e(\hat{t}, V(t, y, x), x) - y)}{E(R(\hat{t}, \tilde{h}^c(\hat{t}, V(t, y, x), x), e(\hat{t}, V(t, y, x), x))) - E(R(t, \tilde{h}(t, y, x), y))} \tag{5}$$

where $\hat{t}$ is "close" to $t$, and where $\hat{t}$ and $t$ now are vectors.

## 4 TRADITIONAL LABOUR SUPPLY MODELS
In empirical analysis and calculation of MCF one needs specifications of functional form expressions for the uncompensated and compensated labour supply and expenditure functions that are reasonably practical to work with. Below we shall briefly discuss two cases where explicit expressions can be obtained. For simplicity, we suppress the vector of individual characteristics in the notation.

### 4.1 LINEAR LABOUR SUPPLY FUNCTION
In this section, we consider the implementation of MCF in the case of the linear textbook labour supply function

$$\tilde{h}(\kappa, y) = \max(a + b\kappa w + c\kappa y, 0)$$

where $1 - \kappa$ is the marginal tax rate (which is known) and $w$ is the individual's wage rate (Hausman, 1980, 1985). One or several of the parameters $a$, $b$ and $c$ may depend on individual characteristics to accommodate observed and unobserved heterogeneity in preferences. Note that the Slutsky conditions imply that the parameters $a$, $b$ and $c$ must satisfy specific inequalities. The expenditure function that corresponds to the linear supply function, as a function of the tax rate and utility level, is (Stern, 1986)

$$e(\kappa,u) = u \exp(-c\kappa w) - \frac{b}{c}\kappa w + \frac{b}{c^2} - \frac{a}{c} \qquad (6)$$

when $w$ is greater than the reservation wage rate. Otherwise, $w$ is to be replaced by the reservation wage rate. By Shephard's lemma it follows from (6) that the compensated labour supply function with tax is

$$\tilde{h}^c(\kappa,u) = \max(uc\exp(-c\kappa w) + \frac{b}{c}, 0) \cdot \qquad (7)$$

Suppose for example that all the parameters $a$, $b$ and $c$ are stochastic. If the joint distribution of $(a, b, c)$ has been estimated, then one can simulate $M_3$, given a sample of individuals who either work or do not work, while accounting for the restrictions implied by the Slutsky conditions.

If the tax function is non-linear, differentiable and convex, the labour supply function admits the form

$$\tilde{h}(t, y) = \max(a + bm(t,hw) + cy(t,hw), 0) \qquad (8)$$

where $m(t, hw)$ is the marginal wage rate at labour income $hw$ and $y(t, hw)$ is the so-called virtual non-labour income. Analogous expressions hold for the expenditure and the compensated labour supply functions. Thus, in this case the labour supply function is only given in implicit form because the right side of (8) depends on hours of work. However, it can still be estimated by known methods, either by using instrument variable techniques or by using the maximum likelihood method combined with the transformation of variables device and the corresponding Jacobian. In this case, it might be cumbersome to simulate $M_3$ because one must solve non-linear equations for expenditure, uncompensated and compensated hours of work for each draw of the stochastic components.

### 4.2 SEMI-LOG LABOUR SUPPLY FUNCTION
In this case, with a linear tax system, the uncompensated labour supply function has the form (Heckman, 1974)

$$\tilde{h}(\kappa, y) = \max(a + b\log(\kappa w) + c\kappa y, 0) \cdot$$

Also, in this case the Slutsky conditions imply restrictions on the parameters, $a$, $b$ and $c$, see Stern (1986). The expenditure function of the wage rate and utility that corresponds to the semi-log supply function has the form (Stern, 1986)

$$e(\kappa,u) = u\exp(-c\kappa w) - \frac{b}{c}\log(\kappa w) + \frac{b}{c}\exp(-c\kappa w)f(c\kappa w) - \frac{a}{c} \quad (9)$$

where

$$f(x) = \int_d^x z^{-1}e^z\,dz$$

and $d$ is a positive constant. The equation in (9) holds when $w$ is greater than the reservation wage rate. Otherwise, $w$ is to be replaced by the reservation wage rate. By Shephard's lemma, it follows that the corresponding compensated labour supply function becomes

$$\tilde{h}^c(\kappa w,u) = \max(uc\exp(-c\kappa w) + b\exp(-c\kappa w)f(c\kappa w), 0).$$

As in the case discussed in section 4.1, $M_3$ can easily be simulated given that the distribution of $(a, b, c)$ has been estimated, and taking account of the restrictions implied by the Slutsky conditions. However, as with the linear labour supply function, when taxes are non-linear, the estimation and simulation might be cumbersome.

## 5 DISCRETE LABOUR SUPPLY MODELS

As mentioned above, there are two types of labour supply models based on the discrete choice framework (McFadden, 1974) proposed in the literature. The standard discrete labour supply model was proposed by van Soest (1995) whereas Dagsvik (1994) and Dagsvik et al. (1988) proposed the job choice model, which contains the standard discrete labour supply model as a special case. For simplicity, we suppress the vector of individual characteristics in the notation also in this section.

### 5.1 THE STANDARD DISCRETE LABOUR SUPPLY MODEL

The standard discrete labour supply model differs from the traditional textbook model in that the set of feasible hours of work is finite, say equal to $D$, and that the stochastic specification of the utility function differs from the traditional labour supply model.

An individual in the labour market faces the budget constraint

$$C(t,h,y) = hw + y - R(t,h,y) \quad (10)$$

where $C(t, h, y)$ is disposable income given the tax system, wage rate, hours of work and non-labour income. Let $U(h)$ be the (conditional indirect) utility of working $h$ hours and assume that

$$U(h) = \mu(C(t,h,y),h) + \varepsilon(h) \quad (11)$$

where $\mu(C, h)$ is a deterministic function that is increasing in disposable income $C$ and decreasing in hours of work $h$, and $\varepsilon(h)$, $h \in D$ are i. i. d. random taste shifters which are distributed according to the standard Gumbel c. d. f. $\exp = (-e^{-x})$ for real $x$. These random variables are supposed to represent unobserved heterogeneity in tastes. To the individual agent the random taste shifters are perfectly known at the moment of choice. It follows from (11) that the probability of working $h$ hours, $\varphi_h(t, y)$, becomes

$$\varphi_h(t, y) = P\left(U(h) = \max_{r \in D} U(r)\right)$$

$$= \frac{\exp(\mu(C(t, h, y), h))}{\exp(\mu(C(t, 0, y), 0)) + \sum_{r \in D \setminus \{0\}} \exp(\mu(C(t, r, y), r))} \tag{12}$$

for $h > 0$ (McFadden, 1974). For $h = 0$, $\varphi_0(t, y)$ is obtained by replacing the numerator in (12) by $\exp(\mu(C(t, 0, y), 0))$, In contrast to the traditional textbook model, the labour supply function cannot be expressed in closed form in this case. Instead, the distribution of labour supply is expressed by the simple formula given in (12), as a function of the systematic part of the utility function and the budget constraint.[3]

### 5.2 THE JOB CHOICE MODEL
The job choice model allows the researcher to account for latent choice restrictions in the labour market. Such restrictions may explain why the distribution of hours of work typically show peaks at full-time and part-time hours of work and that some workers face smaller (latent) sets of job opportunities than other workers. In this model, the household derives utility from household consumption, leisure, and non-pecuniary latent job attributes.

Let $k = 1, 2...$, be an indexation of the jobs (latent) and let $k = 0$ represent no job. The utility function now has a slightly different form than the one given in (12), namely

$$U(h, k) = \mu(C(t, h, y), h) + \varepsilon(k) \tag{13}$$

where, as above, $\mu(C, h)$ is a positive deterministic function that is increasing in $C$ and decreasing in $h$. Evidently, $k = 0$, if and only if $h = 0$. The taste shifters $\{\varepsilon(k)\}$ are i. i. d. with standard Gumbel c. d. f. The taste shifters account for unobserved individual characteristics and unobserved job-specific attributes that affect preferences. The jobs have fixed job-specific hours of work schedules. Let $B(h)$ be the set of jobs with hours of work $h$ that are available to the agent. The sets $B(h)$, $h \in D$, are individual-specific and latent. Moreover, let $\theta$ be the total number of jobs available (to the worker) and $g(h)$ the proportion of jobs in $B(h)$ with hours of work $h$. Thus, $\theta g(h)$ is the number of jobs with hours of work $h$ in the set $B(h)$. From (12)

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[3] In the traditional case utility is assumed to be quasi-concave to ensure a unique maximum. In the discrete case with finite $D$ this assumption is no longer needed.

and (13) it follows that the probability that the agent will choose a specific job $k$ in $B(h)$ is given by the multinomial logit formula, namely

$$P\left(U(h,k)=\max_{r\in D}\max_{j\in B(r)}U(r,j)\right)=\frac{\exp(\mu(C(t,h,y),h))}{\sum_{r\in D}\sum_{k\in B(r)}\exp(\mu(C(t,r,y),r))}$$

$$=\frac{\exp(\mu(C(t,h,y),h))}{\exp(\mu(C(t,0,y),0))+\sum_{r\in D\backslash\{0\}}\theta g(r)\exp(\mu(C(t,r,y),r))}$$

Since the last expression does not depend on $k$ the probability that the agent will choose any job with workload $h$ follows by multiplying the probability above by the number of jobs $\theta\,g(h)$ in $B(h)$, which yields

$$\varphi_h(t,y)=\frac{\theta g(h)\exp(\mu(C(t,h,y),h))}{\exp(\mu(C(t,0,y),0))+\sum_{r\in D\backslash\{0\}}\theta g(r)\exp(\mu(C(t,r,y),r))}\tag{14}$$

For $h = 0$, $\varphi_0(t,y)$ is obtained by replacing the numerator in (14) by $\exp(\mu(C(t,0,y),0))$. We note that (14) differs from (12) in that the exponential of the systematic parts of the utilities are weighted by the opportunity measure, $\{\theta\,g(r)\}$.

The first econometric application of this type of modified logit model with latent "elemental" alternatives appears to be in Ben-Akiva and Watanatada (1981). They discuss both a discrete and a continuous version. Dagsvik et al. (1988) is the first published version of the job choice model applied to analyze labour supply behaviour. Formally, the utility maximization (with respect to hours of work) in the presence of these types of latent constraints can formally be viewed as an unconstrained maximization problem, namely the maximization of

$$\tilde{U}(t,y,h)=:\max_{k\in B(h)}U(h,k)=v(C(t,h,y),h)+\eta(h)$$

with respect to $h$ where $\{\eta(h)\}$ are i. i. d. with standard Gumbel c. d. f. and where the structural part $v$ is given by

$$v(C,h)=\mu(C,h)+\log(\theta g(h))$$

for $h > 0$ and $v(C, 0) = \mu (C, 0)$ for $h = 0$. Thus, mathematically, the model given in (14) can be treated as if it were a standard discrete labour supply model with $\mu(C(t,h,y),h)$ replaced by $v(C(t,h,y),h)$. Dagsvik and Jia (2016) have discussed identification of $\mu$, $\theta$ and $g(h)$ in the job choice model. They also provide a simplified version of the proof originally given by Dagsvik (1994) that the job choice model with discrete/continuous labour supply density follows from utility maximization (supplementary part of Dagsvik and Jia, 2016).

## 6 MARGINAL COSTS OF PUBLIC FUNDS IN THE CASE OF DISCRETE LABOUR SUPPLY MODELS

For simplicity, we also drop the vector of individual characteristics in the notation in this section, but it is evident how the following analysis can be modified to account for observable individual characteristics. In the following, the notion "discrete labour supply model" is to be understood as either the standard discrete labour supply model or the job choice model. In the case of discrete labour supply models, one cannot use the standard approach discussed in section 3 because the utilities, compensated and uncompensated labour supply and expenditure functions are stochastic and cannot be expressed in closed form. Therefore, the usual approach does not apply. Instead, one can use an approach that is analogous to Dagsvik, Strøm and Locatelli (2021).

Define the operator $Z_+$ by $Z_+ = \max(Z, 0)$, and let $y_h(\hat{t})$ be defined by

$$v(C(\hat{t}, h, y_h(\hat{t})), h) = v(C(t, h, y), h).$$

Consider a setting where $\hat{t}$ is any value of the tax parameter, different from $t$, and let

$$Y(\hat{t}) = e(\hat{t}, V(t, y)) \quad \text{and} \quad \psi_h(\hat{t}, z) = \max(v(C(\hat{t}, h, z), h), v(C(t, h, y), h)).$$

Moreover, we assume the existence of a subsistence level of disposable income (minimum income necessary for survival) such that $\mu(x, h) = -\infty$ if disposable income is less than the subsistence level. Let $a$ be a constant such that $v(C(t, h, z), h) = -\infty$ when $z \leq -a$. In the following, if $f(x_1, x_2, ...)$ is a differentiable function of several variables we will use the notation $f'_j(x_1, x_2, ...) = \partial f(x_1, x_2, ...) / \partial x_j$.

**Theorem 1**
Under the assumptions of the discrete labour supply model, we have that

$$EY(\hat{t}) = \sum_{h \in D} \int_{-a}^{y_h(\hat{t})} \frac{\exp(v(C(t, h, y), h)) dz}{\sum_{r \in D} \exp(\psi_r(\hat{t}, z))} - a$$

and

$$ER(\hat{t}, \tilde{h}^c(\hat{t}, V(t, y)), Y(\hat{t})) = \sum_{h \in D} \left\{ \frac{R(\hat{t}, h, y_h(\hat{t})) \exp(v(C(t, h, y), h))}{\sum_{r \in D} \exp(\psi_r(\hat{t}, y_h(\hat{t})))} \right.$$

$$\left. + \sum_{j \in D} \exp(v(C(t, j, y), j)) \int_{y_h(\hat{t})}^{y_j(\hat{t})} R(\hat{t}, h, z) \frac{\exp(v(C(\hat{t}, h, z), h)) v'_1(C(\hat{t}, h, z), h) C'_3(\hat{t}, h, z) dz}{\left\{ \sum_{r \in D} \exp(\psi_r(\hat{t}, z)) \right\}^2} \right\}$$

The proof of Theorem 1 is given in appendix A.

Note that in Theorem 1 the tax system (represented by $t$) does not have to be a scalar, but can be any multidimensional vector. The results in Theorem 1 can be used to compute $M_4$ given by the formula in (5).

Consider next the case where the tax function can be represented by a scalar $t$. This includes a tax system that can be expressed as $t\zeta(y)$ where $\zeta(\cdot)$ is a fixed function of taxable income, $y$ (say).

**Corollary 1**
Assume that $t$ is a scalar. Under the assumptions of the discrete labour supply model we have

$$\frac{\partial EY(t)}{\partial t} = -\sum_{h \in D} \varphi_h(t, y) \gamma_h(t)$$

where

$$\gamma_h(t) = \frac{C_1'(t, h.y)}{C_3'(t, h.y)}$$

The proof of Corollary 1 is given in appendix A.

Before stating the next result, we need to define right and left derivatives. Let $f(x)$ be a function of a real variable and define the right derivative of $f(x)$ by

$$\frac{\partial^+ f(x)}{\partial x} = \lim_{\delta \downarrow 0} \frac{f(x+\delta) - f(x)}{\delta}, \, \delta > 0$$

provided that the limit on the right side above exists. Similarly, define the left derivative of $f(x)$ by

$$\frac{\partial^- f(x)}{\partial x} = \lim_{\delta \uparrow 0} \frac{f(x+\delta) - f(x)}{\delta}, \, \delta < 0,$$

provided the limit on the right side above exists. If $\partial^+ f(x) / \partial x = \partial^- f(x) / \partial x$ then $f(x)$ is differentiable. Let

$$p_h^c(\hat{t}, y) = P(\tilde{h}^c(\hat{t}, V(t, y)) = h)$$

and define

$$\frac{\partial^+ \varphi_h^c(t, y)}{\partial t} =: \frac{\partial^+ p_h^c(\hat{t}, y)}{\partial \hat{t}} \Big|_{\hat{t}=t} \qquad \text{and} \qquad \frac{\partial^- \varphi_h^c(t, y)}{\partial t} =: \frac{\partial^- p_h^c(\hat{t}, y)}{\partial \hat{t}} \Big|_{\hat{t}=t}$$

**Corollary 2**

Under the assumptions of the discrete labour supply model we have, in a case in which $t$ is a scalar, that

$$\frac{\partial^+ \varphi_h^c(t,y)}{\partial t} = \varphi_h(t,y) \sum_{j \in D} \varphi_j(t,y) v_1'(C(t,h,y),h) C_3'(t,h,y)(\gamma_h(t) - \gamma_j(t))_+$$

$$- \varphi_h(t,y) \sum_{j \in D} \varphi_j(t,y) v_1'(C(t,j,y),x) C_3'(t,j,y)(\gamma_j(t) - \gamma_h(t))_+$$

and

$$\frac{\partial^- \varphi_h^c(t,y)}{\partial t} = \varphi_h(t,y) \sum_{j \in D} \varphi_j(t,y) v_1'(C(t,j,y),x) C_3'(t,j,y)(\gamma_h(t) - \gamma_j(t))_+$$

$$- \varphi_h(t,y) \sum_{j \in D} \varphi_j(t,y) v_1'(C(t,h,y),h) C_3'(t,h,y)(\gamma_j(t) - \gamma_h(t))_+$$

The proof of Corollary 2 is given in appendix A. From Corollary 2 we see that the marginal compensated effect $\partial \varphi_h^c(t,y)/\partial t$ does not exist unless the tax function is linear. Instead, one should use the right marginal compensated effect $\partial^+ \varphi_h^c(t,y)/\partial t$ in the case of a tax increase and the left marginal compensated effect $\partial^- \varphi_h^c(t,y)/\partial t$ in the case of a tax decrease. In the present case, it is only relevant to deal with tax increases and one should therefore use the right marginal compensated effect. Regarding the intuition why the left and right marginal effects differ, see Dagsvik, Strøm and Locatelli (2021).

**Corollary 3**

Under the assumptions of the discrete labour supply model we have, in the case where $t$ is a scalar,

$$\frac{\partial^+ E\{R(\hat{t}, \tilde{h}^c(\hat{t}, V(t,y)), Y(\hat{t}))\}}{\partial \hat{t}}\bigg|_{\hat{t}=t} = \sum_{h \in D} R(t,h,y) \frac{\partial^+ \varphi_h^c(t,y)}{\partial t}$$

and

$$\frac{\partial^- \{ER(\hat{t}, \tilde{h}^c(\hat{t}, V(t,y)), Y(\hat{t}))\}}{\partial \hat{t}}\bigg|_{\hat{t}=t} = \sum_{h \in D} R(t,h,y) \frac{\partial^- \varphi_h^c(t,y)}{\partial t}$$

The proof of Corollary 3 is given in appendix A.

Note that an implication of Corollary 3 is that

$$\frac{\partial^\pm \{ER(\hat{t}, \tilde{h}^c(\hat{t}, V(t,y), Y(\hat{t}))\}}{\partial \hat{t}}\bigg|_{\hat{t}=t} = \frac{\partial^\pm \{ER(\hat{t}, \tilde{h}^c(\hat{t}, V(t,y), y))\}}{\partial \hat{t}}\bigg|_{\hat{t}=t}$$

which says that the marginal expected revenue can be computed by replacing $Y(\hat{t})$ by $y$. The results of Corollaries 1 to 3 can be used to compute $M_3$ given in (4).

# 7 COMPUTATION OF MARGINAL COSTS OF PUBLIC FUNDS ASSOCIATED WITH AN INCREASE IN MINIMUM TAX DEDUCTION

In this section, we discuss an evaluation of MCF that corresponds to a marginal increase in the minimum deduction level (below this level taxes on wage income are zero). This application is based on the sectoral job choice model (Dagsvik and Strøm, 2006). In the case of sectoral job choice there are several extensive margins, related to the choice of working or not and the choice of sector. There are two sectors, public and private. This model was estimated by using a sample of married women in Norway. Recall that the job choice model accommodates restrictions on the workers' choice sets and thus enables us to rationalize observed peaks at full-time and part-time hours of work.

Like many countries, Norway has a progressive tax system for taxation of labour income, with stepwise linear parts. The actual structure of the tax system in 1994 is given in appendix B. In general, whenever a tax rate is changed in a piecewise linear tax system one must also change other tax rates too, since the tax function is continuous. This is not necessary when the minimum deduction level is changed. Thus, in this application the tax parameter $t$ is a scalar, equal to the minimum deduction level.

Our estimate of the marginal cost of public funds, given in equation (4), is 1.15, which is in the lower part of the range that others have found, also for Norway. Numerous studies have demonstrated that married women respond more strongly to changes in economic incentives than single women and men, married or not. Since we include only married women in our sample, our estimate is, most likely, higher than if men and single women had been included in the sample. Thus, if the whole population had been used in the calculation of MCF, most likely the estimate of the marginal cost of funds in Norway would have been less than 1.15.

## 8 CONCLUSION

In this paper, we have discussed aggregate measures of MCF, which account for observed as well as unobserved population heterogeneity in preferences, with special reference to discrete labour supply models. In the context of the discrete labour supply model, which are based on a stochastic formulation of primitives, one cannot use the usual approach to calculate MCF because the uncompensated as well as the compensated labour supply and the expenditure functions are stochastic and cannot be expressed in closed form. We have therefore used an alternative approach that enables the calculation of aggregate measures of MCF in the case of discrete labour supply models. Finally, we have used an estimated version of the job choice model to compute the MCF of the Norwegian income tax system that corresponds to a marginal change of the minimum deduction level.

### Disclosure statement

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Recall that $y_h(\hat{t})$ is defined by $v(C(\hat{t}, h, y_h(\hat{t})), h) = v(C(t, h, y), h)$ where $\hat{t}$ is any tax parameter different from $t$, $Y(\hat{t}) = e(\hat{t}, V(t, y))$ and $\psi_h(\hat{t}, z) = \max(v(C(\hat{t}, h, z), h), v(C(t, h, y), h))$. For simplicity we use the notation $dz = (z + dz, z)$.

**Lemma A1**

Suppose $Z$ is a non-negative random variable with *c. d. f. F(z)* where *F(z)= 0* when $z \leq -a$ where *a* is a constant. Then

$$EZ = \int_{-a}^{\infty} z dF(z) = \int_{-a}^{\infty} (1 - F(z)) dz - a.$$

The result of Lemma A1 follows by integration by parts.

**Lemma A2**

Under the assumptions of the discrete labour supply model we have that

$$P(\tilde{h}(t, y) = h, Y(\hat{t}) > z) = \frac{1\{y_h(\hat{t}) > z\} \exp(v(C(t, h, y), h))}{\sum_{r \in D} \exp(\psi_r(\hat{t}, z))}$$

**Lemma A3**

Under the assumptions of the discrete labour supply model we have that

$$q_{jh}^c(\hat{t}, dz) =: P(\tilde{h}(t, y) = j, \tilde{h}^c(\hat{t}, V(t, y)) = h, Y(\hat{t}) \in dz)$$

$$= P(\tilde{h}(t, y) = j, \tilde{h}(\hat{t}, Y(\hat{t})) = h, Y(\hat{t}) \in dz)$$

$$= \frac{1\{y_j(\hat{t}) > z \geq y_h(\hat{t})\} \exp(v(C(t, j, y), j) + v(C(\hat{t}, h, z), h)) v_1'(C(\hat{t}, h, z), h) C_3'(\hat{t}, h, z) dz}{\left( \sum_{r \in D} \exp(\psi_r(\hat{t}, z)) \right)^2}$$

and

$$q_{hh}^c(\hat{t}, z) =: P(\tilde{h}(t, y) = \tilde{h}^c(\hat{t}, V(t, y)) = h, Y(\hat{t}) = z) = \frac{1\{z = y_h(\hat{t})\} \exp(v(C(t, h, y), h))}{\sum_{r \in D} \exp(\psi_r(\hat{t}, y_h(\hat{t})))}.$$

Lemmas A2 and A3 are applications to the i. i. d. Gumbel case of Theorems 3 and 4 of Dagsvik and Karlström (2005). In fact, Lemma A3 corrects Theorem 4 of Dagsvik and Karlström (2005), as the latter claims that

$$q_{hh}^c(\hat{t}, z) = 1\{z = y_h(\hat{t})\} \varphi_h(t, y)$$

which in general is not true as it is not always the case that

$$\psi_r(\hat{t}, y_h(\hat{t})) = \max(v(C(t, r, y), r), v(C(\hat{t}, r, y_h(\hat{t})), r)) = v(C(t, r, y), r)$$

for all *x* in *D*.

**Lemma A4**

Under the assumptions of the discrete labour supply model the *ex post* compensated choice probability of working $h$ hours is given by

$$p_h^c(\hat{t},y) =: P(\tilde{h}^c(\hat{t},V(t,y)) = h) = \sum_{j \in D \setminus \{h\}} \int_{y_h(\hat{t})}^{y_j(\hat{t})} q_{jh}^c(\hat{t},z)dz + q_{hh}^c(\hat{t},y_h(\hat{t}))$$

The result Lemma A4 follows immediately from Lemma A3.

Q. E. D.

**Proof of Theorem 1:**

The first relation in Theorem 1 follows immediately from Lemmas A1 and A2. The second relation in Theorem 1 follows from Lemma A3.

Q. E. D.

**Proof of Corollary 1:**

Assume first that $y_h(\hat{t}) > y$ and that $\Delta t = \hat{t} - t$ is small. It follows that

$$\int_{-a}^{y_h(\hat{t})} \frac{\exp(v(C(t,h,y),h))dz}{\sum_{r \in D} \exp(\psi_r(\hat{t},z))} - (y+a)\varphi_h(t,y) = \int_{y}^{y_h(\hat{t})} \frac{\exp(v(C(t,h,y),h))dz}{\sum_{r \in D} \exp(\psi_r(\hat{t},z))}$$

$$+ \int_{-a}^{y} \left( \frac{\exp(v(C(t,h,y),h))}{\sum_{r \in D} \exp(\psi_r(\hat{t},z))} - \varphi_h(t,y) \right) dz \qquad (A1)$$

We have

$$\frac{\exp(v(C(t,h,y),h))}{\sum_{r \in D} \exp(\psi_r(\hat{t},z))} - \varphi_h(t,y)$$

$$= -\frac{\exp(v(C(t,h,y),h))\sum_{r \in D}[\exp(v(C(\hat{t},r,z),x)) - \exp(v(C(t,r,y),r))]_+}{\sum_{r \in D}\exp(v(C(t,r,y),r))\sum_{s \in D}\exp(\psi_s(\hat{t},z))}$$

$$= -\varphi_h(t,y)\frac{\sum_{r \in D}[\exp(v(C(\hat{t},r,z),r)) - \exp(v(C(t,r,y),x))]\mathbb{1}\{y_r(\hat{t}) < z\}}{\sum_{r \in D}\exp(\psi_r(\hat{t},z))}$$

Using the last relation and the mean value theorem for integrals, we obtain that the following:

$$\frac{1}{\Delta t}\int_{-a}^{y}\left(\frac{\exp(v(C(t,h,y),h))}{\sum_{r\in D}\exp(\psi_r(\hat{t},z))}-\varphi_h(t,y)\right)dz$$

$$=-\int_{-a}^{y}\varphi_h(t,y)\frac{\sum_{r\in D}[\exp(v(C(\hat{t},r,z),r))-\exp(v(C(t,r,y),r))]\mathbb{1}\{z>y_r(\hat{t})\}dz}{\Delta t\sum_{r\in D}\exp(\psi_r(\hat{t},z))}$$

$$=-\varphi_h(t,y)\sum_{j\in D}\int_{y_j(t)}^{y}\frac{[\exp(v(C(\hat{t},j,z),j))-\exp(v(C(t,j,y),j))]dz}{\Delta t\sum_{r\in D}\exp(\psi_r(\hat{t},z))}\qquad\text{(A2)}$$

$$=-\varphi_h(t,y)\sum_{j\in D}\frac{(y-y_j(\hat{t}))[\exp(v(C(\hat{t},j,z^*),j))-\exp(v(C(t,j,y),j))]}{\Delta t\sum_{r\in D}\exp(\psi_r(\hat{t},z^*))}$$

$$=\varphi_h(t,y)\sum_{j\in D}\frac{y_j'(t)[\exp(v(C(\hat{t},j,z^*),j))-\exp(v(C(t,j,y),j))]}{\sum_{r\in D}\exp(\psi_r(\hat{t},z^*))}+\frac{o(\Delta t)}{\Delta t}$$

where $z^*\in(y_x(\hat{t}),y)$. When $\hat{t}\to t$ it follows that $z^*\to y$ Hence,

$$\exp(v(C(\hat{t},j,z^*),j))-\exp(v(C(t,j,y),j))\to 0$$

so that (A.2) implies that

$$\lim_{\Delta t\to 0}\frac{1}{\Delta t}\int_{-a}^{y}\left(\frac{\exp(v(C(t,h,y),h))}{\sum_{r\in D}\exp(\psi_r(\hat{t},z))}-\varphi_h(t,y)\right)dz=0.\qquad\text{(A3)}$$

When $y_h(\hat{t})<y$ a similar argument as above leads to the same result as in (A.3). By implicit differentiation we obtain

$$y_h'(\hat{t})=-\frac{C_1'(\hat{t},h,y_h(\hat{t}))}{C_3'(\hat{t},h,y_h(\hat{t}))}$$

implying that

$$\lim_{\hat{t}\to t}y_h'(\hat{t})=-\frac{C_1'(t,h,y)}{C_3'(t,h,y)}=:-\gamma_h(t).\qquad\text{(A4)}$$

Hence, by Lemma A1, (A.1), (A.3) and (A.4) it follows that

$$\frac{EY(\hat{t})-y}{\Delta t}=\frac{1}{\Delta t}\sum_{h\in D}\left(\int_{-a}^{y_h(\hat{t})}\frac{\exp(v(C(t,h,y),h))dz}{\sum_{r\in D}\exp(\psi_r(\hat{t},z))}-(y+a)\varphi_h(t,y)\right)$$

$$=\sum_{h\in D}\int_{y}^{y_h(\hat{t})}\frac{\exp(v(C(t,h,y),h))dz}{\Delta t\sum_{r\in D}\exp(\psi_r(\hat{t},z))}+\frac{o(\Delta t)}{\Delta t}$$

$$=\sum_{h\in D}\frac{(y_h(\hat{t})-y)}{\Delta t}\varphi_h(t,y)+\frac{o(\Delta t)}{\Delta t}=-\sum_{h\in D}\gamma_h(t)\varphi_h(t,y)+\frac{o(\Delta t)}{\Delta t}$$

which implies the result in Corollary 1.

<div align="right">Q. E. D.</div>

**Proof of Corollary 2:**

When $\hat{t} - t = \Delta t$ is small it follows from Lemma 3 that

$$\int_{y_h(\hat{t})}^{y_j(\hat{t})} q_{jh}^c(\hat{t},z)dz = \exp(v(C(t,j,y),j))$$

$$\int_{y_h(\hat{t})}^{y_j(\hat{t})} \frac{1\{y_j(\hat{t}) > y_h(\hat{t})\}\exp(v(C(\hat{t},h,z),h))v_1'(C(\hat{t},h,z),h)C_3'(\hat{t},h,z)dz}{\left\{\sum_{r \in D}\exp(\psi_r(\hat{t},z))\right\}^2} \tag{A5}$$

$$= (y_j(\hat{t}) - y_h(\hat{t}))_+ \varphi_h(t,y)\varphi_j(t,y)v_1'(C(t,h,y),h)C_3'(t,h,y) + o(\Delta t)$$

$$= \left(\left(y_j'(t) - y_h'(t)\right)\Delta t\right)_+ \varphi_h(t,y)\varphi_j(t,y)v_1'(C(t,h,y),h)C_3'(t,h,y) + o(\Delta t).$$

When $\Delta t > 0$, then

$$\frac{1}{\Delta t}\left(\left(y_j'(t) - y_h'(t)\right)\Delta t\right)_+ = \left(y_j'(t) - y_h'(t)\right)_+ = \left(\gamma_h(t) - \gamma_j(t)\right)_+ \tag{A6}$$

and when $\Delta t < 0$, then

$$\frac{1}{\Delta t}\left(\left(y_j'(t) - y_h'(t)\right)\Delta t\right)_+ = -\left(y_h'(t) - y_j'(t)\right)_+ = -\left(\gamma_j(t) - \gamma_h(t)\right)_+. \tag{A7}$$

Hence, (A.6) implies that when $\Delta t > 0$ then

$$\int_{y_h(\hat{t})}^{y_j(\hat{t})} q_{jh}^c(\hat{t},z)dz = \Delta t\left(\gamma_h(t) - \gamma_j(t)\right)_+ \varphi_h(t,y)\varphi_j(t,y) \tag{A8}$$
$$v_1'(C(t,h,y),h)C_3'(t,h,y) + o(\Delta t)$$

whereas when $\Delta t < 0$ (A.7) yields

$$\int_{y_h(\hat{t})}^{y_j(\hat{t})} q_{jh}^c(\hat{t},z)dz = -\Delta t\left(\gamma_j(t) - \gamma_h(t)\right)_+ \varphi_h(t,y)\varphi_j(t,y) \tag{A9}$$
$$v_1'(C(t,h,y),h)C_3'(t,h,y) + o(\Delta t)$$

Furthermore,

$$q_{hh}^c(\hat{t}, y_h(\hat{t})) - \varphi_h(t, y) = \frac{\exp(v(C(t,h,y),h))}{\sum_{r \in D} \exp(\psi_r(\hat{t}, y_h(\hat{t})))} - \varphi_h(t, y) \qquad (A10)$$

$$= -\varphi_h(t, y) \sum_{j \in D} \varphi_j(t, y) [\exp\{v(C(\hat{t}, j, y_h(\hat{t})), j) - v(C(t, j, y), j)\} - 1]_+ + o(\Delta t)$$

$$= -\varphi_h(t, y) \sum_{j \in D} \varphi_j(t, y) v_1'(C(t, j, y), j) \left( \left( C_1'(t, j, y) + C_3'(t, j, y) y_h'(t) \right) \Delta t \right)_+ + o(\Delta t)$$

$$= -\varphi_h(t, y) \sum_{j \in D} \varphi_j(t, y) v_1'(C(t, j, y), j) C_3'(t, j, y) \left( \left( \gamma_j(t) - \gamma_h(t) \right) \Delta t \right)_+ + o(\Delta t)$$

Hence, when $\Delta t > 0$ (A.10) implies that

$$q_{hh}^c(\hat{t}, y_h(\hat{t})) - \varphi_h(t, y) \qquad (A11)$$

$$= -\Delta t \varphi_h(t, y) \sum_{j \in D} \varphi_j(t, y) v_1'(C(t, j, y), j) C_3'(t, j, y) \left( \gamma_j(t) - \gamma_h(t) \right)_+ + o(\Delta t)$$

whereas when $\Delta t < 0$ then

$$q_{hh}^c(\hat{t}, y_h(\hat{t})) - \varphi_h(t, y) \qquad (A12)$$

$$= \Delta t \varphi_h(t, y) \sum_{j \in D} \varphi_j(t, y) v_1'(C(t, j, y), x) C_3'(t, j, y) \left( \gamma_h(t) - \gamma_j(t) \right)_+ + o(\Delta t)\cdot$$

The result of Corollary 2 now follows from (A.8) and (A.11), and (A.9) and (A.12), respectively.

Q. E. D.

**Proof of Corollary 3:**

Note first that by the mean value theorem for integrals there exists a number, $y^* \in (y_h(\hat{t}), y_x(\hat{t}))$ such that

$$\left| \int_{y_h(\hat{t})}^{y_j(\hat{t})} (R(\hat{t},h,z) - R(t,h,y_h(\hat{t}))) q_{jh}^c(\hat{t},z) dz \right| = \left| (R(\hat{t},h,y^*) - R(t,h,y_h(\hat{t}))) \int_{y_h(\hat{t})}^{y_j(\hat{t})} q_{jh}^c(\hat{t},z) dz \right|$$

$$\leq \left| (R(\hat{t},h,y^*) - R(t,h,y_h(\hat{t}))) \right| \| y_j(\hat{t}) - y_h(\hat{t}) \| \qquad (A13)$$

$$= \left| (R(\hat{t},h,y^*) - R(t,h,y_h(\hat{t}))) \right| \| (y_j'(\hat{t}) - y_h'(\hat{t})) \Delta t + o(\Delta t) \| = o(\Delta t)$$

because $y^* \rightarrow y$, $y_h(\hat{t}) \rightarrow y$ when $\Delta t \rightarrow 0$ so that $R(\hat{t}, h, y^*) - R(t, h, y_h(\hat{t}))$ tends towards zero when $\Delta t \rightarrow 0$ Suppose next that $\Delta t > 0$. By using (A.13) and Lemma A4 we get that

$$ER(\hat{t}, \tilde{h}^c(\hat{t}, V(t,y)), Y(\hat{t})) - ER(t, \tilde{h}(t,y), y)$$

$$= \sum_{h \in D} \left( \sum_{j \in D \setminus \{h\}} \int_{y_h(\hat{t})}^{y_j(\hat{t})} R(\hat{t}, h, z) q_{jh}^c(\hat{t}, z) dz + R(\hat{t}, h, y_h(\hat{t})) q_{hh}^c(\hat{t}, y_h(\hat{t})) - R(t, h, y) \varphi_h(t, y) \right)$$

$$= \sum_{h \in D} \left( R(\hat{t}, h, y_h(\hat{t})) \sum_{j \in D \setminus \{h\}} \int_{y_h(\hat{t})}^{y_j(\hat{t})} q_{jh}^c(\hat{t}, z) dz + R(\hat{t}, h, y_h(\hat{t})) q_{hh}^c(\hat{t}, y_h(\hat{t})) - R(t, h, y) \varphi_h(t, y) \right) + o(\Delta t)$$

$$= \sum_{h \in D} \left( (R(\hat{t}, h, y_h(\hat{t})) p_h^c(\hat{t}, y) - R(t, h, y) \varphi_h(t, y)) \right) + o(\Delta t)$$

$$= \sum_{h \in D} \left( R(\hat{t}, h, y_h(\hat{t}))(p_h^c(\hat{t}, y) - \varphi_h(t, y)) + (R(\hat{t}, h, y_h(\hat{t})) - R(t, h, y)) \varphi_h(t, y) \right) + o(\Delta t)$$

$$= \sum_{h \in D} \left( R(t, h, y) \frac{\partial^+ \varphi_h^c(t, y) \Delta t}{\partial t} + (R(\hat{t}, h, y_h(\hat{t})) - R(t, h, y)) \varphi_h(t, y) \right) + o(\Delta t)$$

$$= \sum_{h \in D} \left( R(t, h, y) \frac{\partial^+ \varphi_h^c(t, y) \Delta t}{\partial t} \right) + o(\Delta t)$$

which leads to the first relation of the corollary. The case in which $\Delta t < 0$ is proved in a similar way and implies the second relation of the corollary.

Q. E. D.

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## TAX FUNCTIONS

The tax functions for married couples are piecewise linear and given in the tables below. The minimum deduction level $t$ referred to in the text equals NOK 41,907 for a married non-working woman and NOK 20,954 for a working woman.

### TABLE B1

*Tax function in 1994 for a married non-working woman whose husband is working, 1994*

| Male income, $Y_{male}$ | Tax T |
|---|---|
| 0 – 41,907 | 0 |
| 41,907 – 140,500 | $0.302Y_{male} - 12,656$ |
| 140,500 – 252,000 | $0.358Y_{male} - 20,524$ |
| 252,000 – 263,000 | $0.453Y_{male} - 44,464$ |
| 263,000 – | $0.495Y_{male} - 55,510$ |

Source: Survey of Income and Wealth, Statistics Norway 1994.

### TABLE B2

*Tax function in 1994 for a married working woman NOK 1994*

| Wage income, Y | Tax T |
|---|---|
| 0 – 20,954 | 0 |
| 20,954 – 140,500 | $0.302Y - 6,328$ |
| 140,500 – 208,000 | $0.358Y - 14,196$ |
| 208,000 – 236,500 | $0.453Y - 33,956$ |
| 236,500 – | $0.495Y - 43,889$ |

Source: Survey of Income and Wealth, Statistics Norway 1994.

# Measuring fiscal
# guidance transparency

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**Abstract**

*The public disclosure of medium-term fiscal plans – "fiscal guidance" – represents an increasingly important, yet understudied element of fiscal transparency frameworks. This article introduces a dataset that contains a large set of forecasts on fiscal and economic items issued by all European Union governments over the period 2001-2018. These forecasts are used to build an index of fiscal guidance transparency and to explore its main characteristics and correlates. The analysis reveals that governments are more transparent in their guidance on fiscal flows and macroeconomic aggregates than on liabilities, assets, and exogenous assumptions. In addition, transparency declines in the forecast horizon and in the strength of the governing coalition. Collectively, the results suggest that fiscal guidance transparency may be a sensitive area of policymaking that deserves scholarly attention. Possible uses of the measure of fiscal guidance transparency in research are discussed.*

*Keywords: fiscal transparency, forecasts, guidance, Stability and Growth Pact, disclosure*

## 1 INTRODUCTION

An extensive literature has studied the important topic of government transparency, so much so that the word has become a "magic concept" in public sector research (Pollitt and Hupe, 2011). Once seen as a monolithic concept and a synonym of good governance, it is now generally acknowledged that transparency is a multifaceted and controversial construct (Alt, 2021). Accordingly, scholars have disaggregated the concept of transparency into smaller "domains" of research (Cucciniello, Porumbescu and Grimmelikhuijsen, 2017). Of these, the fiscal transparency domain has given rise to a vibrant and growing stream of studies reviewed in prior work (Alt, 2019; de Renzio and Wehner, 2017).

This article contributes to fiscal transparency research by introducing an index that measures the extent to which governments are transparent in their "fiscal forward guidance" (Fujiwara and Waki, 2020) – or "fiscal guidance" for short. In the context of this article, fiscal guidance means the disclosure by governments of information that is restricted to politicians and bureaucrats until it is publicly released and that reflects expectations to, and plans for, the *future* fiscal and economic outlook. Such information – contained in fiscal plans and presented in the form of forecasts – should improve the information set of private agents insofar as it quantifies the likely effect of current and future policies on the economy and the budget, ultimately reducing information asymmetry and policy uncertainty.

Not surprisingly, the role of guidance in promoting fiscal transparency was recognized long ago: "transparency requires the provision of reliable information on the government's fiscal policy *intentions* and *forecasts*" (Kopits and Craig, 1998: 1, emphasis added). Yet, empirical evidence does not presently exist about the extent to which governments are transparent in their fiscal guidance. The objective of this

paper is to introduce a measure of fiscal guidance transparency for all the countries that were member states of the European Union (EU) in the period 2001-2018. The measure takes the form of a continuous index that ranks countries based on the quantity of forecasts that they issue in compliance with the reporting regime established by the Stability and Growth Pact (SGP). Since 1997, the SGP reporting regime imposes on EU governments the annual obligation to publish a fiscal plan containing numerical, point forecasts on fiscal stocks and flows, economic aggregates and exogenous assumptions (EU, 1997a; 1997b; 1997c). As fiscal plans published under the SGP are publicly available, these forecasts were retrieved and organized in a dataset usable by researchers. This dataset covers up to 28 EU countries and up to 18 country-year observations. It includes an estimated date (day/month/year) in which the fiscal plan was first made public and numerical, point forecasts on up to 117 unique items ranging from the components of fiscal balance and economic growth to the drivers of stock-flow adjustments and exogenous assumptions with a forecast horizon of four years. Next, a longitudinal, country-level index of fiscal guidance transparency was created by comparing the number of items on which governments issued a forecast in each fiscal plan at each forecast horizon to the number that was recommended by the EU in each year.[1]

Variation in the level of fiscal guidance transparency across countries is made possible by the unique features of the SGP reporting regime. In particular, the SGP mandates all EU governments to release a fiscal plan annually but requires that forecasts on only a few items – such as the fiscal balance and the level of Maastricht debt – be published. While guidance on the remaining items is recommended in the context of the SGP, the recommendation is not enforceable. As the evidence will show, the combination of mandatory disclosure of fiscal plans and voluntary disclosure of item-level forecasts gives rise to valuable cross-sectional and longitudinal variation in the fiscal guidance transparency index for the period under consideration. In particular, the evidence shows that countries are selective in their guidance. On average, guidance is relatively transparent concerning future macroeconomic aggregates – such as gross domestic product (GDP) and its components – and future fiscal flows – revenues, expenditures, and their components. In contrast, guidance is relatively opaque vis-à-vis the drivers of future changes in the level of government debt – such as privatization receipts and stock-flow adjustments – as well as in the assumptions underlying the fiscal plan. Whether selective transparency in fiscal guidance derives from an intention to withhold information or rather reflects uneven difficulty in forecasting individual items is an interesting and important question that future research may address using the fiscal guidance transparency index. In this paper, multivariate analysis will suggest that both drivers may play a role in determining the observed levels of transparency. On the one hand, the quantity of forecasts disclosed declines in the forecast horizon – supporting the notion that forecasting ability partly explains the levels of guidance transparency observed. On the other hand, transparency declines in the strength of the governing coalition and in the level of

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[1] The dataset is available at the journal website.

parliamentary fragmentation, while increasing in the level of democracy. These latter findings – which are consistent with earlier research (Cicatiello, De Simone and Gaeta, 2017; Citro, Cuadrado-Ballesteros and Bisogno, 2021) – indicate that the observed levels of fiscal guidance transparency may be affected by political interference too.

The forward-looking nature of the fiscal guidance transparency index complements other efforts to measure government openness about past fiscal *outcomes* and/or *budgetary processes* (Alt, Lassen and Wehner, 2014; Bastida and Benito, 2007; Hollyer, Rosendorff and Vreeland, 2014; IBP, 2017; Wang, Irwin, and Murata, 2015; Williams, 2015). Due to its unique forward-looking nature, the index lends itself to a variety of novel applications at the intersection of political economy, public finance and accounting, public administration, and political science. An important aspect of the dataset is that each fiscal guidance event is measured at an estimated day/month/year frequency. Accordingly, the data presented in this article can be matched with high frequency variables to examine causes and consequences of forward-looking fiscal disclosure choices. For example, the data can be used to study whether a relation exists between fiscal guidance transparency and changes in government and whether the average forecast horizon of fiscal plans depends on electoral pressures (Aaskoven, 2016). The data can also be used to study whether and how participants in financial markets react to fiscal plans upon their disclosure – a topic that is receiving increasing attention across disciplines (Alt, 2021; Mosley, Paniagua and Wibbels, 2020; Pástor and Veronesi, 2012). Finally, researchers can use the data presented in this article to study the causes and consequences of delay in the release of fiscal plans – which may reflect incumbents' willingness to disclose or withhold information or alternatively, weak governance mechanisms and bottlenecks in the political process (Alt and Lowry, 1994; Andersen, Lassen and Nielsen, 2014; Edmonds et al., 2017).

The paper proceeds as follows. Section 2 argues that public fiscal guidance is an important and separate instrument of fiscal transparency frameworks and reviews extant approaches to measure fiscal transparency. Section 3 explains the steps taken to construct the dataset and presents evidence of its main characteristics. Section 4 presents the results of constructing the fiscal guidance transparency index, conducts descriptive analyses and presents the results of exploratory multivariate regressions. Section 5 briefly concludes.

## 2 RELATED LITERATURE
### 2.1 EXPECTED BENEFITS OF FISCAL TRANSPARENCY
The importance of fiscal transparency as a research topic cannot be overstated. Ever since the 1990s, fiscal transparency has been considered a pillar of good governance because it promotes government accountability by shedding light on the way in which politicians and bureaucrats allocate the resources entrusted to them by taxpayers, legislative assemblies and investors (Hood and Heald, 2006; IMF, 1998; OECD, 2002; World Bank, 1992). Research on fiscal transparency has

evolved hand-in-hand with the growing adoption of transparency best-practices by policymakers. A considerable body of transparency literature now exists that spans multiple disciplines (see, e.g., Alt, 2019, 2021; Cucciniello, Porumbescu and Grimmelikhuijsen, 2017; de Renzio and Wehner, 2017; Khagram, de Renzio and Fung, 2013).

The benefits of fiscal transparency are generally predicated on two outcomes. On the one hand, transparency helps to hold the government accountable because the disclosure of fiscal information acts as a deterrent to the wasteful and opportunistic spending of revenues and the accumulation of private benefits and perquisites (Williams, 2015). Theoretically, the deterrent effect of transparency initiatives is inspired by agency-theory perspectives (Jensen and Meckling, 1976), as the ability to observe information about government operations induces an alignment between the actions taken by the government (the agent) and the interests of taxpayers, firms and investors (the principals) (Milesi-Ferretti, 2004). On the other hand, transparency may serve to provide information on which the public can act and that is private to the government until it is transparently disclosed. Under this perspective, transparency is beneficial insofar as citizens, civil servants, firms and market participants find fiscal information useful to make their own decisions on, e.g., allocating resources, making or withholding investments, and confirming or replacing the governing coalition (Alt, Lassen and Rose, 2006; Berliner, Bagozzi and Palmer-Rubin, 2018). It is noticeable that these two benefits of transparency – favouring *ex-ante* decision-making and promoting *ex-post* accountability – are explicitly recognized in the modern frameworks that govern the construction of public sector financial reports (IPSASB, 2014).

The two expected benefits of fiscal transparency are not novel, as they have been often discussed in relation to the extent to which governments are open about past fiscal outcomes and/or the budgeting processes (de Renzio and Wehner, 2017). What makes fiscal guidance transparency unique, however, is that information on the *future* fiscal and economic outlook is particularly timely. As fiscal guidance consists of in the disclosure of fiscal plans before the effect of policies materialize, transparent guidance allows the public to update their own expectations about future economic and fiscal conditions. Accordingly, fiscal guidance substantially enriches the information set of the public, while reducing information asymmetry vis-à-vis the government. The unique timeliness of fiscal guidance makes it a key instrument of fiscal transparency frameworks. For example, Alt, Lassen and Rose (2006: 31) emphasize that ideally, information provided by governments can only be considered transparent if it provides "voters, observers, financial markets, and sometimes politicians themselves with more information about the *intentions* behind fiscal policy, the actual actions taken, and the immediate and longer-term *consequences* of specific policies" (emphasis added). By its nature, fiscal guidance provides information on intentions and consequences, thus substantially easing "the task of forecasting *future* fiscal policy and of attributing fiscal outcomes to policies, and fiscal policies to particular politicians" (ibid.). Additionally, fiscal

guidance provides a benchmark against which fiscal and economic outcomes can be compared, thus providing a clear benchmark against which to judge the government once outcomes materialize.

It is important to emphasize that arguments about the expected benefits of guidance assume that the audience acts according to *expectations*. By contrast, other instruments of fiscal transparency frameworks, such as the dissemination of comprehensive information on past policy outcomes, the quality of fiscal reports, or the degree of openness of the budgetary process promote fiscal transparency by improving the ability of the public to extract *past* signals from noise (Milesi-Ferretti, 2004). As prior research has primarily studied these alternative pillars, the next section reviews related measures of fiscal transparency.

### 2.2 EXTANT MEASURES OF FISCAL TRANSPARENCY

Prior research has measured fiscal transparency primarily through one of two approaches: the "checklist" and the "missing-data" approach.

Papers adopting a checklist approach measure transparency as the extent to which fiscal/budgetary information follows desirable standards defined in the checklist. For example, the pioneering study by Alt, Lassen and Rose (2006) uses the checklist approach to evaluate the extent to which US state budgetary processes follow best practices on, e.g., reporting based on generally-accepted accounting principles, presence/absence of multi-year expenditure forecasts, and involvement of the legislature in the production of revenue forecasts, among others (Bastida and Benito, 2007; Benito and Bastida, 2009). The Open Budget Index (OBI) released on a biannual basis by the International Budget Partnership (IPB) extends the checklist approach and applies it to a large number of countries (IPB, 2017). Recently, Wang, Irwin and Murata (2015) adopted the checklist approach to rank governments based on the comprehensiveness of fiscal reports by examining the extent to which reporting on fiscal outcomes complies with IMF guidelines on the coverage of fiscal stocks and flows.

Papers adopting a missing-data approach measure transparency by comparing the amount of data that governments make available to the public against a benchmark typically set at a supranational level. The benchmark number of items that should be disclosed allows researchers to form an expectation of the "ideal" level of transparency against which observed levels are compared. Under the missing-data approach, the action of disclosing items increases transparency. Instead, the withholding of items that could have been published by governments decreases transparency. Hollyer, Rosendorff, and Vreeland (2011) use the missing-data approach by collecting the data that governments transmit to the World Bank as part of the World Development Indicators initiative. They measure transparency as the number of items that are shared by governments with the World Bank as a proportion of the total number of items that *should have been* disclosed, attributing greater transparency to governments that withhold comparatively fewer data.

Similarly, Williams (2015) computes the number of economic and financial data-points that governments disseminate to international institutions and codes their presence or absence, thus equating high transparency with a large amount of published information (see also Hollyer, Rosendorff and Vreeland, 2014).

Methodologically, this paper follows the missing-data approach to measuring transparency. Specifically, the level of fiscal guidance transparency in the sample is measured as the extent to which EU governments publish forecasts on the items that are recommended in publicly available guidelines at the time of disclosure. In their most stringent form, these guidelines recommended the publication of 161 items, of which 117 are used to construct the dataset after repeated items and forecasts on items that are applicable only to specific countries or that have unique time horizons are eliminated. The next section elaborates on the steps followed to build the fiscal guidance transparency dataset and to derive the fiscal guidance transparency index.

## 3 CONSTRUCTION OF THE FISCAL GUIDANCE TRANSPARENCY DATASET
### 3.1 RETRIEVING FISCAL PLANS
Pursuant to articles 4 and 7 of Council Regulation (EC) 1466/97 of 7 July 1997 (EU, 1997a), EU governments must publish one fiscal plan every year. These plans are known as either "Stability" or "Convergence" Programmes (in short: SCPs), depending on whether the country adopts the euro as its currency. This unique reporting mandate allows the researcher to obtain access to all the SCP published by EU governments, which are publicly available in the EC online archives dedicated to the European Semester.[2] The dataset is restricted to the SCPs published over the period 2001-2018 because it was only with the 2001 vintage that the EU published guidelines on the format and content of SCPs.[3] In the dataset, each unique SCP is identified through the counter variable $d\_nr$.

Table 1 reports the number of unique SCPs per country that are present in the dataset. Column 2 lists the number of unique SCPs issued by each member state. There is heterogeneity in this number for three reasons. First, while in the period 2001-2003 there were 15 member states of the EU, the number of member states increased over the years. Specifically, a first wave of EU enlargement took place in 2004, when 10 countries joined the EU. A second wave of enlargement took place in 2007 when Bulgaria joined the EU together with Romania. A final addition to the EU membership was Croatia in July 2013. As the obligation to submit SCPs only applies to EU member states, the number of country-specific

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[2] As of the date of writing, all SCPs published between 1998 and 2015 are available at: http://ec.europa.eu/economy_finance/economic_governance/sgp/convergence/programmes/index_en.htm. The remaining SCPs and the CoC are retrievable at: https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/stability-and-growth-pact_en (last accessed: 30 April 2019). After triangulating this search with government-provided information as described below, two additional SCPs were estimated to have been submitted in February 2000 by France and Germany. These SCPs could not be retrieved. In addition, there were six addenda to SCPs published by governments following the European Recovery Programme of 2008, which contained no new forecasts, however, and were, therefore, excluded from the dataset.

[3] This issue is returned to below.

observations partly depends on the date of EU accession, reported in column 5.[4] Second, governments have published additional SCPs beyond those required, on an occasional basis. Out of the 434 SCPs published between 2001 and 2018, 420 were regular SCPs and 14 were ad hoc publications as indicated in columns 3 and 4, respectively. The occasional publications increase the number of SCP observations for the related government. These publications are identified in the dataset through the variable *d_regular*, which takes value 0 if the SCP represents an occasional publication, and 1 otherwise.

TABLE 1

*Stability/Convergence Programmes by country*

| Country | Total | Original | Occasional | EU accession date |
|---|---|---|---|---|
| | | **Number of SCPs** | | |
| Austria | 17 | 17 | 0 | 1/1/1995 |
| Belgium | 18 | 17 | 1 | 1/1/1957 |
| Bulgaria | 12 | 12 | 0 | 1/1/2007 |
| Croatia | 5 | 5 | 0 | 1/7/2013 |
| Cyprus | 12 | 11 | 1 | 1/5/2004 |
| Czech Republic | 15 | 15 | 0 | 1/5/2004 |
| Denmark | 17 | 17 | 0 | 1/1/1973 |
| Estonia | 15 | 15 | 0 | 1/5/2004 |
| Finland | 17 | 17 | 0 | 1/1/1995 |
| France | 17 | 17 | 0 | 1/1/1957 |
| Germany | 19 | 17 | 2 | 1/1/1957 |
| Greece | 11 | 10 | 1 | 1/1/1981 |
| Hungary | 16 | 15 | 1 | 1/5/2004 |
| Ireland | 18 | 17 | 1 | 1/1/1973 |
| Italy | 17 | 17 | 0 | 1/1/1957 |
| Latvia | 15 | 14 | 1 | 105/2004 |
| Lithuania | 15 | 15 | 0 | 1/5/2004 |
| Luxembourg | 18 | 17 | 1 | 1/1/1957 |
| Malta | 15 | 15 | 0 | 1/5/2004 |
| Netherlands | 19 | 16 | 3 | 1/1/1957 |
| Poland | 16 | 15 | 1 | 1/5/2004 |
| Portugal | 17 | 16 | 1 | 1/1/1986 |
| Romania | 12 | 12 | 0 | 1/1/2007 |
| Slovakia | 15 | 15 | 0 | 1/5/2004 |
| Slovenia | 15 | 15 | 0 | 1/5/2004 |
| Spain | 17 | 17 | 0 | 1/1/1986 |
| Sweden | 17 | 17 | 0 | 1/1/1995 |
| UK | 17 | 17 | 0 | 1/1/1973 |
| Total | 434 | 420 | 14 | |

*Note: This table reports the number of Stability/Convergence Programmes published by the EU member states between 2001 and 2018. Columns 3 and 4 report the number of original and occasional SCPs, respectively. Column 5 lists the date of accession into the EU.*

[4] The accession dates were retrieved from European Commission (2019).

Table 2 lists the occasional publications, identified in the dataset by the variable *d_status*. Each of them was analysed in depth to understand their rationale. The analysis indicates that there were three occasional publications following a request by the Council that the government resubmits the SCP because inadequate or insufficient information was disclosed in the prior issuance. Whether the Council makes such request can be observed by retrieving the Council Opinion that closes the SGP cycle, which is public information. Four additional publications represent updates of the SCP published between December 2008 and February 2009 to incorporate the EU-wide strategy of fiscal expansion that followed the 2008 financial crisis. Six publications represent resubmissions of earlier SCPs issued by governments voluntarily, typically because of a change in the parliamentary majority or in the cabinet after an election. Finally, one occasional publication represents Portugal's voluntary submissions of a fiscal plan in 2014 when the country was exempted from SCP disclosure because it was under a financial assistance program. This was an exception, however. Indeed, the third and final reason why there is heterogeneity in the number of SCPs across countries is that governments halt the publication of SCPs when they are under external financial assistance. This is the reason why the number of observations for Greece and Cyprus is lower than that of other countries that began publishing SCPs in the same year.

**TABLE 2**

*Description of ad hoc Stability/Convergence Programmes*

| Country | Year | Description | Rationale |
|---------|------|-------------|-----------|
| Belgium | 2009 | Restatement | Request from the Council of the EU |
| Cyprus | 2009 | Addendum with updated projections | Addendum following the EERP |
| Germany | 2004 | Revision | Revision following political negotiations |
| Germany | 2009 | Addendum with updated projections | Addendum following the EERP |
| Greece | 2005 | Revision | Revision following concerns related to budgetary statistics |
| Hungary | 2006 | Restatement | Request from the Council of the EU |
| Ireland | 2009 | Addendum with updated projections | Addendum following the EERP |
| Latvia | 2009 | Revision | Revision following economic downturn |
| Luxembourg | 2009 | Addendum with updated projections | Addendum following the EERP |
| Netherlands | 2003 | Revision | Revision following political negotiations |
| Netherlands | 2008 | Addendum with updated projections | Addendum following the EERP |
| Netherlands | 2012 | Restatement | Request from the Council of the EU |
| Poland | 2008 | Revision | Revision of the budgetary strategy |
| Portugal | 2014 | Voluntary Submission | Voluntary Submission of fiscal strategy |

*Note: This table reports the rationale for the publication of the occasional SCPs that contain forecasts. In column 2 the year of publication of ad hoc SCPs is provided. Column 3 describes the nature of the occasional SCPs. Column 4 provides a brief indication of the rationale for the publication of the occasional SCP. EERP stands for European Economic Recovery Plan.*

## 3.2 ESTIMATING THE PUBLICATION DATE OF FISCAL PLANS

The second step of the data collection process involved estimating the dates on which each SCP was first made public by the government. Research on SCPs typically assumes a publication date at the year or quarter-year level, in line with the SGP requirements (Frankel and Schreger, 2013; Paredes, Pérez and Perez-Quiros, 2015). Yet, no study has previously assembled a dataset of these dates at the day/month/year level. Such an effort provides important benefits to researchers interested in working with daily data, while revealing that a considerable number of SCPs were not publicly disclosed when they were due.

To retrieve the publication dates, the relevant administration of each EU government was contacted by e-mail with a request for the day/month/year in which each SCP was publicly disclosed. While the relevant administration was typically the Ministry of Finance, the final source of information varied somewhat.[5] A total of 10 out of 28 governments responded, for a 35.7 percent response rate. Of these responses, six contained the information and one pointed to a webpage containing the information. The remaining three provided an incomplete answer. In the absence of a (complete) response, the administration was contacted by phone. Following this second round of requests, the publication dates were most often obtained by email. Alternatively, a web source was provided that clarified how the information could be retrieved. At the end of the process, which lasted approximately two months between March and May 2016, 21 out of 28 governments responded to the request for information, for a 75% positive response rate. Overall, the interaction with governments returned 176 SCPs associated with unique publication dates.

The second step involved a news search conducted using Thomson Reuters EIKON via the app "Newsroom". Newsroom was interrogated for any piece of news containing the words "Stability Programme, Stability Program, Stability Report, Stability Plan" in a period starting on the first day of the month preceding the month of submission of the document to the EC and ending on the day of the Council Opinion.[6] As will be explained below, the latter two sets of dates were retrieved from the EC online archives. The news search returned 209 articles that allow the precise dating of the first-time publication of the SCP. There are 73 cases in which both government sources and the press search resulted in a publication date. In 31 out of these 73 cases (42.4 percent), the publication date is exactly the same according to both the government and the press. On average, the government-provided publication date follows the press-estimated publication date by 1.47 days. The estimates from an intercept-only regression reported in column 1 of table 3 do not allow rejection of the hypothesis of this difference being zero. Thus, when the publication date was available either from the press or from both sources, the press-provided publication date was privileged. The government-provided date was used to replace missing cases when the press publication date was not available.

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[5] When collecting these publication dates, the SCPs published in the period 1998-2000 were included, too. The numbers reported throughout refer only to the SCPs included in the final dataset.
[6] The word "Stability" was replaced with "Convergence" when the country was not a euro adopter.

**TABLE 3**

*Differences in event dates*

|  | (1) | (2) | (3) |
|---|---|---|---|
| Constant | 1.47 | 0.66 | 3.09*** |
|  | [1.14] | [0.75] | [0.77] |
| R-squared | 0.030 | 0.011 | 0.124 |
| Observations | 73 | 123 | 203 |
| Cluster | Country | Country | Country |

*Note: This table reports the results of an intercept-only OLS regression that tests whether there are significant differences in the dates at which governments approve, submit, and publish their Stability/Convergence Programmes. Column 1 reports the difference between the publication date reported by the government and that reported by the press. Column 2 reports the difference between the date at which the government approves the SCP and the publication date. Column 3 reports the difference between the date at which the government submits the SCP to the European Commission and the publication date. Standard errors in brackets are clustered at the dimension indicated at the bottom of the table. $^+ p < 0.10$, $^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$.*

When neither the press nor the government provided a publication date, the missing dates were replaced with the day in which the government approved the SCP, denoted in the dataset with *d_cabday*. Information on cabinet-approval dates was either contained in the SCP itself or provided by governments. Once more, the regression results reported in column 2 of table 3 reveal that the difference between the cabinet approval date and the press publication date has a mean value of 0.66, not significantly different from zero. Therefore, the cabinet approval date was used to fill the publication date when this was missing. The data collection procedure was finalized by consulting EC online archives, and the date on which the government transmitted each SCP to the EC was retrieved. This date – denoted in the dataset with *d_subday* – may differ from both the cabinet approval and the publication date. Informal conversation with staff involved in the process indicated that governments typically submit the SCP to the EC about three days after the approval of the document by the cabinet. Column 3 of table 3 shows that the difference between the submission date and the press-provided publication date indeed returns a mean value of 3.09 days, which is statistically significant. The publication date was replaced with the submission date when neither the cabinet approval date nor the publication date was available.

The resulting variable *d_day* represents the best estimate of the publication date for the entire sample of SCPs. Researchers can use the other dates reported in the dataset for specific purposes. At the end of this second step, it was possible to assign a publication date to each of the 434 SCPs included in the dataset between 2001 and 2018. In the 8 cases in which the publication date fell on a weekend, it was attributed to the following Monday.

The dataset also includes the date on which the European Commission made its recommendation to the Council of the EU – denoted with *d_recday* – as well as the date on which the latter released its Opinion – denoted with *d_opday*. The first refers

to the date contained in the EC recommendations. The second refers to the day the Council Opinion was first published in the Official Gazette of the European Union. These dates are both public information. The data indicate that on average, 32 days separate the EC recommendation from the Council Opinion date. In turn, the average difference between the EC recommendation date and the estimated publication date is 44 days. Hence, the whole SGP cycle runs for 76 days on average.

The availability of the submission date allows the construction of a measure of the number of days between the date of submission of the SCP to the EC and the deadline for the submission itself. This measure can be of interest to researchers because it may reflect incumbents' willingness to disclose or withhold information or alternatively, weak governance mechanisms (Andersen, Lassen and Nielsen, 2014; Edmonds et al., 2017). To construct this measure, a deadline must be attributed to each SCP submission. These deadlines are imposed by the EU and are public information. Between 2001 and 2010, they could be submitted to the EC any time between October 15 and December 1. Since 2011, SCPs have to be submitted by April 30. In addition, specific country-years had exceptional deadlines. For instance, exceptional deadlines were set for the 2008 and 2009 submissions, which could be sent to the EC by the end of December and the end of January, respectively (EU, 2008; 2009). In addition, the Eastern European governments that entered the EU in 2004 had their first submission deadline set on May 15, 2004. Until 2010, the governments of the UK and Ireland could submit their SCP by the time of the approval of the budget and pre-budget statements – usually discussed in Parliament by the first week of December. For the UK, these dates were retrieved from parliamentary sources (House of Commons Information Office, 2010; House of Commons Library, 2018).[7] For Ireland, information is available at the government-dedicated webpage.[8] Other "ad hoc" deadlines were established in a case in which the Council requested the resubmission of a non-compliant SCP. The variable *d_deadline* reflects each of these idiosyncrasies and it captures the SCP-specific deadline. A measure of delay can be calculated as the submission date less the deadline, which is available for 412 SCPs. Alternatively, using the publication date in place of the submission date makes a measure of delay available for 423 SCPs.

### 3.3 ORGANIZING THE DATASET OF FISCAL PLANS

As noted earlier, SCPs are published approximately once a year, although late submissions and occasional publications may translate into an imbalance in the number of annual SCPs publications. This implies that in a given year, no SCP of a given country may be present in the dataset, or alternatively it may appear more than once. In other words, there may be a discrepancy between the expected year of publication – denoted in the dataset with *d_expyear* – and the actual publication year – *d_year*. The discrepancy prevents one from organizing SCP data using years as the time index as it would be characterized by either gaps or repeated observations. In addition, the forecasts that each SCP should contain based on EU recommendation have

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[7] The 2018 date of the Spring budget was retrieved from Gov.uk (2018).
[8] See Gov.ie (2010).

changed since the first vintage of SCPs was published in 1998. The content and format of presentation of SCPs have been periodically set in documents known as Guidelines on the format and content of Stability and Convergence Programmes, also known as Codes of Conduct (hereafter referred to as "CoC") – endorsed following a proposal by ECOFIN.[9] As it will be explained in what follows, the SCP data are best organized using the changing CoC requirements as anchor.

Technically, the CoCs are considered a "complement" to the SGP (EU, 2005). Specifically, it is in the CoCs that one finds details on the items on which EU governments should issue a forecast. In line with Regulation 1466/97 (Article 3.2a), EU governments are subject to the obligation to issue a forecast on the budget balance and on government debt.[10] The regulation also imposes the publication of the "main assumptions about expected economic developments and important economic variables which are relevant to the realization of the stability programme *such as* government investment expenditure, real gross domestic product growth, employment and inflation" (Article 3.2b, emphasis added).[11] Note that, while the Regulation is clear as to the budgetary variables that should be included in the SCP reports and its provisions have legal force, the list of "main" and "important economic variables" to be reported is indicative. The CoC, therefore, serve to clarify the set of additional economic and financial information that governments should include in their annual SCP reports as well as their measurement basis, which is typically based on the European System of Accounts (ESA) concepts. In this sense, the CoCs represent "guidelines" on the content of SCPs. In turn, the CoCs also clarify the "format" for presenting the information. In what follows, both the format and the content are described, alongside an explanation of their use in giving structure to the dataset.

All CoCs were retrieved from the online archives of the EC. There have been eight CoCs issued since 1998. All CoCs – except for the 1998 ones – specify the tabular format to be used for the submission of SCPs. They further contain guidelines over the applicable measurement basis of economic and budgetary items, and the "required" vs. "optional" nature of each item. The first CoC, applicable to the submission between 1998 and 2000, did not contain disclosure requirements that are sufficiently unambiguous to generate a coherent list of items that were expected to be disclosed. Beginning with the second CoC, however, the class of items to be disclosed was harmonized and a list of required items was made explicit. Each iteration of the CoC slightly modified the recommended set of items on which a

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[9] The ECOFIN is the forum where the heads of the Ministries of Finance of the EU member states are represented.

[10] The budget balance is known in the Government Finance Statistics Manual as the "net lending/net borrowing" of the general government and it is expressed in percentage of gross domestic product at market prices. The debt ratio is obtained by dividing the total amount of loans and bonds outstanding in the year by gross domestic product at market prices. See IMF (2014, chapter 4). In the EU, these variables include some specific items as determined by Eurostat and are known informally as the "Maastricht" debt and deficit ratios. See Savage (2005) for a detailed discussion of the accounting treatment of fiscal figures under the SGP.

[11] Article 7 applies these requirements to Convergence Programmes issued by governments of countries not adopting the euro as their currency.

forecast should be made. At the date of writing, the applicable CoC has reached its eighth iteration, approved in May 2017. In the dataset, each CoC iteration is indexed by the counter variable *d_coc*.

Because EU sources include the date on which each CoC was endorsed by the Council, it is possible to match the disclosure requirements of each SCP with the date of publication estimated in the previous sub-section. It is, therefore, possible to use the format introduced in each CoC as a template that sets out the expected format and content of each SCP at any specific date. Crucially, this strategy ensures that two SCPs published in the same year are organized according to two different CoCs *if* a new CoC was endorsed in the meanwhile.

This strategy is used to give structure to the data collection process. First, a spread-sheet was built that contain as many worksheets as the number of years of SCP submissions ranging from 2001 to 2018. Because information is disclosed in each SCP of year *t* at the horizons *t*-1, *t*, *t*+1, *t*+2, and *t*+3, plus information on *t*-1 levels (for a limited set of items), each of the worksheets contains up to six observations per country and as many countries as there were member states of the EU in year *t*. Each column contains one item that was recommended for publication in line with the CoC applicable at the SCP disclosure date. For this reason, the number of columns changes across worksheets in line with the number of items required by the different CoC iterations over the 2001-2018 period.

In the dataset, each item is attributed a name that resembles the item name under the ESA nomenclature. A number always precedes variable names, which refers to the number of the relevant table according to the applicable CoC. For example, real GDP growth rates are typically found in table 1 and are coded as *t1_realgr*, while the general government budget balance is found in table 2 and is coded as *t2_netlendggov*, etc.[12] In turn, each cell contains one numerical value that reflects the forecast for that item as disclosed in the related SCP. If the forecast is missing, the cell is set to missing. With this procedure, if an item is disclosed, say, for fore-cast horizon *t*, *t+1* and *t+2*, but not *t+3*, the cells that correspond to that item in *t*, *t+1* and *t+2* receive a numerical value, while the cell in *t+3* is set to missing. In this way, the dataset preserves within-country-SCP variation in the number of forecasts issued at different forecast horizons. A dataset containing the original, numerical forecasts accompanies the dataset recording their presence/absence. Forecast horizons are captured by a discrete variable denoted with *f_hor* that takes value 0 in year *t* and value 4 in year *t+3*. The variable *f_year* records the year to which the forecast refers.

The inclusion of data points in the final dataset required some judgment. First, when a government has a fiscal year that differs from the calendar year and reports

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[12] The only exception is that for the years 2001-2005, where tables 3, 4, and 5 are renumbered to 4, 5, and 6, respectively, to allow comparison with later submissions of the SCP. This is because beginning in Stage 3, the third table of the CoC includes "Government expenditure by function", which is excluded from the data collection (see above).

forecasts as referring to, say the *t/t+1* period, that forecast was attributed to year *t* if the fiscal year ends before June 30. Second, when forecasts are presented as ranges, approximate values, or as average of multiple horizons, the corresponding values were noted in the dataset and coded to missing afterwards. The rationale is that no CoC allows publishing range or approximate forecasts, nor does it allow for the collapsing of information that pertains to multiple forecast horizons. When items are reported as the sum of multiple items, they are coded as missing because the CoC does not allow collapsing across items. When a forecast is presented as referring to an item indicated in the related CoC, but the government specifies that its value refers to an item not included in the CoC, the cell is set to missing. Also, when the CoC allows the same item (say, government revenue) to be presented multiple times in the SCP, the data points are coded as not missing if the item is present at least once, to avoid double-counting. This procedure applies only when the CoC explicitly states that the item code refers to the same measure in all the tables where it appears. The "item code" is the official ESA code. When items are reported outside of the table in which they should be presented, their values count as not missing. In addition, values that are not reported although they would have been equal to zero had they been reported, are set to missing. Finally, to guarantee uniformity within the dataset, all items reported for years *t*-1 are recorded but not included in the final dataset because they do not represent forecasts.

Three categories of items were excluded from the data collection process. These are "Government Expenditure by Function", which only contain data points related to years *t*-2 and *t*+3, and "Long-Term Projections" which contain forecasts for decades ahead. Also, forecasts included in the table titled "Comparison with Prior Update" were excluded from the final dataset because they relate to forecasts for real GDP growth, the debt and the budget balance already present in other tables. One additional item was excluded – the budget balance of state governments – because it only applies to countries with a federalist structure and may thus over- or underestimate the level of transparency of these countries. For the same reason, items were excluded that were required only for a limited set of governments.

The resulting complete dataset contains 434 unique SCPs and 1,674 observations, for a final number of 195,858 data-points disclosed by up to 28 countries and that relate to 117 unique items, with a forecast horizon of up to 4 years.

## 4 EVIDENCE
### 4.1 DISTRIBUTION OF FISCAL GUIDANCE DISCLOSURE DATES
Table 4 reports the distribution of the full sample of fiscal plans by year, quarter, month, and day of the week. The table shows substantial heterogeneity in the disclosure dates. This heterogeneity partly reflects some institutional idiosyncrasies of the SGP process that are important to consider when using the dataset in empirical work.

The increase in the number of fiscal plans registered in 2004 and 2007 is due to the enlargement of EU membership to several Eastern European nations, which was

accompanied by two SCP reports, one published in spring and the other in autumn.[13] In 2010, SCP submissions were suspended as part of a reform to the SGP monitoring cycle known as the "European Semester". Yet, the table reports 25 SCPs published in 2010. This is due to the fact that most governments published in early 2010 those SCPs that belonged to the 2009 cycle, for which the EU authorized the exceptional deadline of January 31, 2010 (EU, 2009).[14] Also, between 2012 and 2018, Greece did not publish its SCP because it underwent a financial assistance program characterized by separate disclosure requirements. Cyprus was subject to the same exemption in the years 2013-2015; hence, the number of observations in those years declines. In terms of distribution of SCP by quarters, publication dates are clustered in the second and fourth quarter. This is to be expected because unless explicit exceptions were granted to governments, SCPs had to be submitted between October 15 and December 1 in the 2001-2009 period. Accordingly, the large number of submissions in the first quarter of the year partly reflects late publications taking place in January. From 2011 onwards, the deadline was moved to April 30 to align SCP submissions with the European Semester. The monthly breakdown of observations reflects these idiosyncrasies. Note that the somewhat large number of observations in the month of May is primarily due to the year 2004, when the first SCP of the new EU member states was to be submitted. In terms of weekdays, the publication of SCPs appears to be relatively uniform, with a somewhat larger number of SCPs published on Wednesdays and Thursdays.

TABLE 4

*Distribution of fiscal plans by publication year, quarter, month, and day*

| Year | N | Quarter | N | Month | N | Day | N |
|---|---|---|---|---|---|---|---|
| 2001 | 14 | 1 | 61 | 1 | 36 | Monday | 60 |
| 2002 | 12 | 2 | 225 | 2 | 13 | Tuesday | 71 |
| 2003 | 17 | 3 | 2 | 3 | 12 | Wednesday | 100 |
| 2004 | 33 | 4 | 146 | 4 | 189 | Thursday | 109 |
| 2005 | 27 | | | 5 | 31 | Friday | 94 |
| 2006 | 27 | | | 6 | 5 | | |
| 2007 | 31 | | | 7 | 0 | | |
| 2008 | 18 | | | 8 | 1 | | |
| 2009 | 18 | | | 9 | 1 | | |
| 2010 | 25 | | | 10 | 6 | | |
| 2011 | 27 | | | 11 | 58 | | |
| 2012 | 27 | | | 12 | 82 | | |
| 2013 | 25 | | | | | | |
| 2014 | 26 | | | | | | |
| 2015 | 26 | | | | | | |
| 2016 | 27 | | | | | | |
| 2017 | 27 | | | | | | |
| 2018 | 27 | | | | | | |
| Total | 434 | Total | 434 | Total | 434 | Total | 434 |

*Note: This table shows the distribution of all Stability/Convergence Programmes in the sample by year, quarter, month, and day of publication.*

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[13] See the factsheet at European Commission (2019).
[14] In 2008, the deadline for submission of SCPs was moved to December 31. See European Commission (2008).

## 4.2 ITEMS INCLUDED IN THE DATASET

Table 5 reports summary statistics of each item included in the dataset. The first column indicates the category in which each item falls based on the coding. This categorization broadly follows the structure of SCPs indicated by the CoCs published over the years. However, it departs from it in the coding of forecasts on cyclically-adjusted and structural components of the fiscal and economic outlook – such as the structural balance and the components of potential output growth. In this case, the forecast was categorized under the heading that reflects the variable that is being expressed after cyclical or structural adjustment. For example, the potential GDP is categorized within the forecasts of the "Economic outlook", while the cyclical unemployment benefits fall within the "Fiscal outlook" category.

**TABLE 5**

*Summary statistics of items included in the dataset*

| Category | # | Item name | N | Mean | St. dev. |
|---|---|---|---|---|---|
| Economic outlook | 1 | Real GDP | 1,674 | 0.97 | 0.16 |
| | 2 | Nominal GDP | 1,674 | 0.94 | 0.24 |
| | 3 | GDP deflator | 1,674 | 0.96 | 0.20 |
| | 4 | Private consumption expenditure | 1,674 | 0.95 | 0.21 |
| | 5 | Government consumption expenditure | 1,674 | 0.97 | 0.18 |
| | 6 | Gross Fixed Capital Formation | 1,674 | 0.95 | 0.22 |
| | 7 | Inventory and valuable | 1,674 | 0.93 | 0.26 |
| | 8 | Exports | 1,674 | 0.95 | 0.22 |
| | 9 | Imports | 1,674 | 0.95 | 0.22 |
| | 10 | Final domestic demand | 1,674 | 0.95 | 0.22 |
| | 11 | External balance | 1,674 | 0.96 | 0.20 |
| | 12 | Private consumption deflator | 1,363 | 0.94 | 0.23 |
| | 13 | Public consumption deflator | 1,363 | 0.88 | 0.33 |
| | 14 | Investment deflator | 1,363 | 0.88 | 0.33 |
| | 15 | Export deflator | 1,363 | 0.96 | 0.19 |
| | 16 | Import deflator | 1,363 | 0.96 | 0.20 |
| | 17 | Harmonized Consumer Price Inflation rate | 311 | 0.50 | 0.50 |
| | 18 | Employment growth | 1,674 | 0.94 | 0.24 |
| | 19 | Labour productivity growth | 1,674 | 0.90 | 0.29 |
| | 20 | Employment hours worked | 1,363 | 0.59 | 0.49 |
| | 21 | Unemployment rate | 1,363 | 0.91 | 0.28 |
| | 22 | Labour productivity per hour | 1,363 | 0.57 | 0.49 |
| | 23 | Compensation of employees | 1,363 | 0.93 | 0.26 |
| | 24 | Compensation per employee | 931 | 0.93 | 0.25 |
| | 25 | Balance of goods and services | 1,363 | 0.83 | 0.38 |
| | 26 | Balance of income flows | 1,363 | 0.79 | 0.40 |
| | 27 | Capital account | 1,363 | 0.72 | 0.45 |
| | 28 | Net lending – Rest of the World | 1,363 | 0.83 | 0.37 |
| | 29 | Net lending – Private sector | 1,363 | 0.69 | 0.46 |
| | 30 | Statistical discrepancy | 1,363 | 0.36 | 0.48 |

| Category | # | Item name | N | Mean | St. dev. |
|---|---|---|---|---|---|
| | 31 | Potential GDP | 1,674 | 0.87 | 0.34 |
| | 32 | Output gap | 1,674 | 0.93 | 0.25 |
| | 33 | Potential GDP – labour | 1,363 | 0.68 | 0.47 |
| | 34 | Potential GDP – capital | 1,363 | 0.68 | 0.47 |
| | 35 | Potential GDP – productivity | 1,363 | 0.68 | 0.47 |
| Fiscal outlook | 36 | Net lending – general government | 1,674 | 1.00 | 0.07 |
| | 37 | Net lending – central government | 1,674 | 0.94 | 0.23 |
| | 38 | Net lending – local governments | 1,674 | 0.90 | 0.30 |
| | 39 | Net lending – social security funds | 1,674 | 0.88 | 0.33 |
| | 40 | Total revenues | 1,674 | 0.97 | 0.17 |
| | 41 | Total expenditures | 1,674 | 0.98 | 0.15 |
| | 42 | Net interest payments | 1,674 | 0.97 | 0.17 |
| | 43 | Primary balance | 1,674 | 0.99 | 0.09 |
| | 44 | Taxes | 1,674 | 0.90 | 0.30 |
| | 45 | Taxes on production and imports | 1,363 | 0.95 | 0.21 |
| | 46 | Taxes on income and wealth | 1,363 | 0.94 | 0.24 |
| | 47 | Capital taxes | 1,363 | 0.90 | 0.30 |
| | 48 | Property income | 1,363 | 0.92 | 0.27 |
| | 49 | p.m. Tax burden | 1,363 | 0.91 | 0.28 |
| | 50 | Social contributions | 1,674 | 0.94 | 0.24 |
| | 51 | Interest income | 311 | 0.44 | 0.50 |
| | 52 | Other revenues | 1,674 | 0.93 | 0.25 |
| | 53 | Collective consumption | 743 | 0.50 | 0.50 |
| | 54 | Social transfers. in kind | 1,674 | 0.78 | 0.42 |
| | 55 | Social transfers. not in kind | 1,674 | 0.84 | 0.37 |
| | 56 | Interest expenditure | 311 | 0.96 | 0.20 |
| | 57 | p.m. FISIM | 432 | 0.21 | 0.41 |
| | 58 | Social payments | 1,363 | 0.94 | 0.23 |
| | 59 | Of which: unemployment benefits | 636 | 0.75 | 0.43 |
| | 60 | Capital transfers | 636 | 0.86 | 0.35 |
| | 61 | Subsidies | 1,674 | 0.94 | 0.23 |
| | 62 | Government Gross Fixed Capital Formation | 1,674 | 0.96 | 0.20 |
| | 63 | Compensation of employees plus intermediate consumption | 931 | 0.90 | 0.30 |
| | 64 | Compensation of employees | 931 | 0.90 | 0.31 |
| | 65 | Intermediate consumption | 931 | 0.90 | 0.31 |
| | 66 | p.m. Government consumption | 931 | 0.69 | 0.46 |
| | 67 | p.m. Compensation of government employees | 432 | 0.67 | 0.47 |
| | 68 | Other expenditures | 1,674 | 0.93 | 0.26 |
| | 69 | Cyclical budgetary component | 1,674 | 0.88 | 0.33 |
| | 70 | Cyclically adjusted balance | 1,674 | 0.87 | 0.34 |
| | 71 | Cyclically adjusted primary balance | 1,674 | 0.80 | 0.40 |
| | 72 | Cyclical unemployment benefits | 636 | 0.88 | 0.32 |
| | 73 | One-off items | 931 | 0.76 | 0.43 |
| | 74 | Of which: one-off expenditure | 108 | 0.41 | 0.49 |
| | 75 | Of which: one-off revenue | 108 | 0.41 | 0.49 |
| | 76 | Structural balance | 931 | 0.93 | 0.26 |

| Category | # | Item name | N | Mean | St. dev. |
|---|---|---|---|---|---|
| | 77 | Total revenues at unchanged policies | 636 | 0.95 | 0.21 |
| | 78 | Total expenditures at unchanged policies | 636 | 0.75 | 0.43 |
| | 79 | Effect of discretionary revenues | 636 | 0.89 | 0.31 |
| | 80 | Revenue increases mandated by law | 636 | 0.54 | 0.50 |
| | 81 | Expenditures on EU programmes | 636 | 0.91 | 0.28 |
| | 82 | Of which: investments on EU programmes | 108 | 0.59 | 0.49 |
| Debt outlook | 83 | Gross debt | 1,674 | 0.99 | 0.08 |
| | 84 | Change in the debt ratio | 1,674 | 0.97 | 0.16 |
| | 85 | Percentage of debt denominated in foreign currency | 636 | 0.29 | 0.45 |
| | 86 | Average debt maturity | 636 | 0.15 | 0.36 |
| | 87 | Primary balance | 311 | 0.94 | 0.24 |
| | 88 | Nominal GDP growth | 311 | 0.91 | 0.28 |
| | 89 | p.m. implicit interest | 1,674 | 0.91 | 0.29 |
| | 90 | Liquid financial assets | 1,363 | 0.21 | 0.41 |
| | 91 | Net financial debt | 1,363 | 0.21 | 0.40 |
| | 92 | Debt amortization | 636 | 0.33 | 0.47 |
| | 93 | Stock-flow adjustments | 1,674 | 0.89 | 0.31 |
| | 94 | Of which: privatization receipts | 1,674 | 0.33 | 0.47 |
| | 95 | Of which: cash-accruals reconciliation | 1,363 | 0.32 | 0.47 |
| | 96 | Of which: accumulation of financial assets | 1,363 | 0.34 | 0.47 |
| | 97 | Of which: valuation effects | 1,363 | 0.29 | 0.45 |
| | 98 | Public guarantees | 636 | 0.10 | 0.30 |
| | 99 | Of which: to financial sector | 636 | 0.07 | 0.26 |
| Assumptions | 100 | Short term interest rates | 1,674 | 0.59 | 0.49 |
| | 101 | Long term interest rates | 1,674 | 0.66 | 0.47 |
| | 102 | USA Short term interest rates | 311 | 0.15 | 0.36 |
| | 103 | USA Long term interest rates | 311 | 0.18 | 0.38 |
| | 104 | USD EUR exchange rate | 311 | 0.68 | 0.47 |
| | 105 | Effective exchange rate: euro | 311 | 0.10 | 0.30 |
| | 106 | Effective exchange rate: EU | 311 | 0.07 | 0.25 |
| | 107 | Exchange rate – National Currency – Euro | 311 | 0.27 | 0.45 |
| | 108 | Real GDP: World | 1,674 | 0.67 | 0.47 |
| | 109 | Real GDP: US | 311 | 0.30 | 0.46 |
| | 110 | Real GDP: Japan | 311 | 0.24 | 0.43 |
| | 111 | Real GDP: EU15 | 1,674 | 0.70 | 0.46 |
| | 112 | Real GDP: relevant markets | 1,674 | 0.65 | 0.48 |
| | 113 | Import world volume | 1,674 | 0.55 | 0.50 |
| | 114 | Import world prices | 311 | 0.14 | 0.35 |
| | 115 | Commodity prices | 311 | 0.23 | 0.42 |
| | 116 | Oil prices | 1,674 | 0.82 | 0.38 |
| | 117 | Effective exchange rate | 1,363 | 0.59 | 0.49 |

*Note: This table reports descriptive statistics of each item included in the dataset. The first column reports the category to which items are assigned. Column 2 includes the item number. Column 3 provides a short description of the item. Each item is coded as either present (1) or absent (0).*

**4.3 CONSTRUCTING THE FISCAL GUIDANCE TRANSPARENCY INDEX**

The data in the final dataset appear in the form of a nested, unbalanced panel sorted by country, publication day and forecast horizon. Each country $c$ appears in the dataset on as many days $d$ as a SCP was published, and four times – one for each forecast horizon $k = 0, ..., 3$. Each item $i$ indicated in the previous table is, therefore, indexed by $i_{c,k,d}$ and nested within unique country-day pairs. There are $R$ items recommended by the CoC that was applicable to SCPs published on the day $d$, with $R$ increasing over time. Against this benchmark number, each item appears in the dataset as either missing or present, noted by 0 and 1, respectively. Therefore, $i \in (0,1)$, and an intuitive measure of fiscal guidance transparency is:

$$FGT_{c,k,d} = 100 * (\frac{1}{R} \sum_{i=1}^{R} i_{c,k,d}) \tag{1}$$

With $FGT$ denoting the "fiscal guidance transparency" index. The $FGT$ index rewards governments that publish a number of forecasts close to that recommended by the applicable CoC, denoted with $R$. The granularity of the measure is evident by the subscripts in equation (1). These remind the user that $FGT$ takes unique values for each country-day-forecast horizon triad. This feature allows researchers to compute several alternative measures of transparency in the disclosure of government forecasts. For example, researchers could measure fiscal guidance transparency at specific forecast horizons of interests. Alternatively, researchers could construct measures of transparency on specific group of variables, such as components of stock-flow adjustment, depending on the research question. As recommended in recent work (de Renzio and Wehner, 2017) and in line with prior research (e.g., Wang, Irwin, and Murata, 2015), it is also intuitive to build a series of sub-indices of $FGT$ that aggregate forecasts by the categories shown in table 5. To exemplify this particular use of the index, $FGT$ is here constructed by separating the forecasts on the economic, fiscal, debt and assumption outlook by computing $100 * (\frac{1}{R} \sum_{i=1}^{R} i_{c,k,d})$ for forecasts belonging to each category.

Figure 1, panel A shows the ranking of $FGT$ by country, while Panel B shows the evolution of the $FGT$ index over the sample years. The country rankings may appear surprising at first, given the relative position of some large economies at the bottom of the table. While no attempt has been made to evaluate the degree to which the $FGT$ index overlaps with alternative transparency measures, some comments can be made based on the data collection process. In particular, the low transparency score on the UK does not necessarily reflect a scarcity of data in the Convergence Programme that the country has published over the years. Rather, the score is explained by the fact that the Convergence Programme of the UK has, for many of the initial years of the SGP framework, reported most forecasts using definitions and measurement criteria inconsistent with those required by the applicable CoC. Indeed, it was not uncommon for the UK to publish only the Maastricht debt and deficit required under Regulation 1466/97, while not disclosing the ESA-compliant breakdown of these figures. As a result, many UK Convergence

Programmes are characterized by limited *FGT* scores. The case of Germany – also a relatively low scorer – is somewhat different. In the case of Germany, in many years the government chose to publish forecasts on several prominent items in the form of averages that cover multiple forecast horizons. Accordingly, while an average forecast often existed for the entire period *t-t*+3, it was counted as missing when constructing the *FGT* index because the averaging of annual, point forecasts is forbidden under the CoC as it leads to a loss of information from the point of view of users (see section 3.3).

Apart from these idiosyncratic considerations, the relative *FGT* ranking of countries may suggest that there are some structural dynamics at play that do not characterize alternative measures of fiscal transparency. In particular, the ranking appears to vindicate the view that being open about the future fiscal and economic outlook reflects a unique transparency phenomenon from the point of view of the government. The next section presents an exploratory analysis of the *FGT* index to gain some insights on this intuition.

**Figure 1**

*Features of the fiscal guidance transparency index (FGT index)*



Panel A: Ranking of average FGT index, by country

Panel B: Evolution of the average FGT index, by years
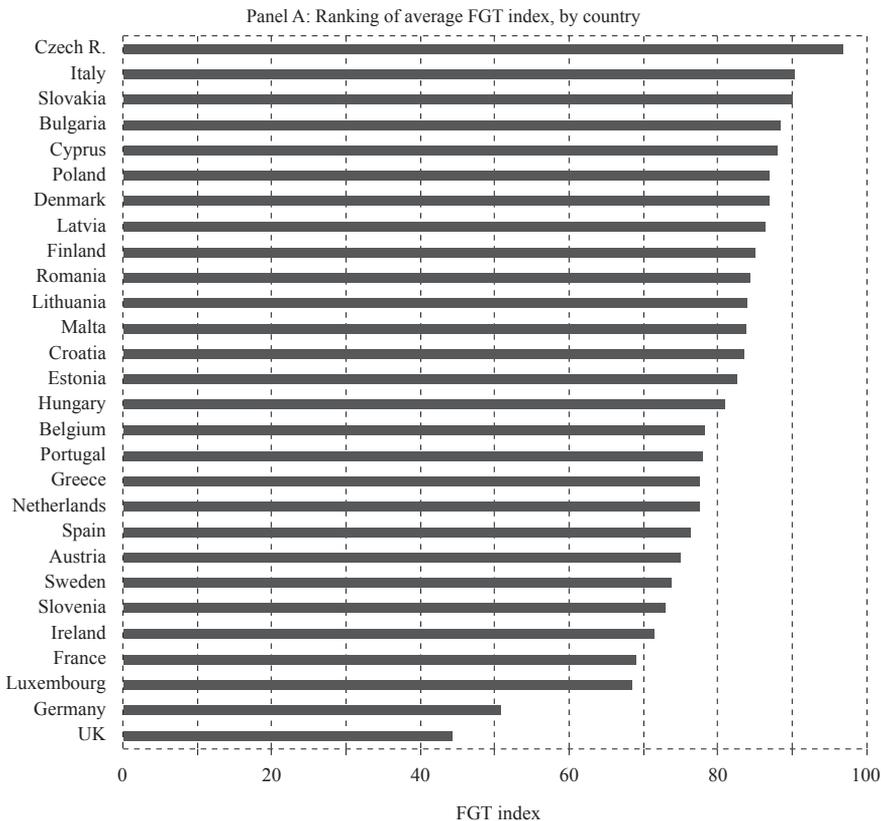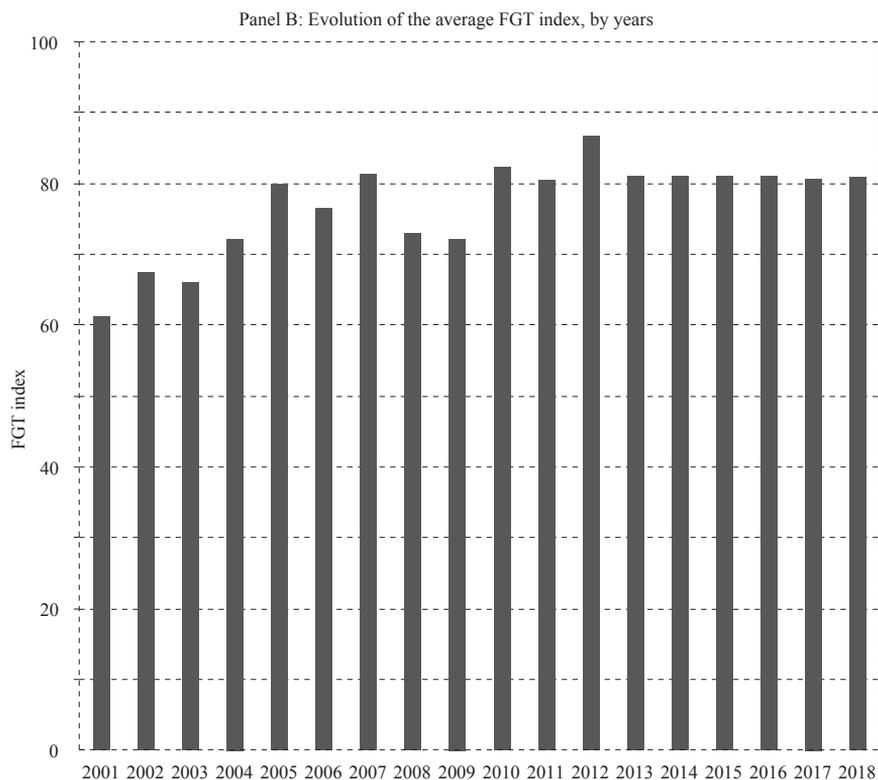


*Note: This figure shows the average value of the FGT index for each country in the sample (panel A) and for each year in the sample (panel B). FGT is defined in equation (1).*

### 4.4 ANALYSIS OF THE FISCAL GUIDANCE TRANSPARENCY INDEX

Table 6 reports summary statistics of the *FGT* index and of the four sub-indices. The overall *FGT* index score is 78, meaning that on average, 78 percent of the items recommended by the applicable CoC are disclosed by governments in their SCPs. The percentage is driven upwards by the relatively high level of transparency on items related to the expected economic and fiscal outlook – both disclosed more than 85 percent of the times. In turn, the percentage is driven downwards by the relatively low level of transparency on the debt outlook and on assumptions – reported 55 and 62 percent of the times, respectively. The latter two categories of forecasts are not only reported relatively seldom, but also with significant variability. In the sample, transparency on the debt outlook exhibits a standard deviation of 25, compared to an average standard deviation of 16. The variability is strikingly high when it comes to the disclosure of assumptions, which exceeds two times the standard deviation of the *FGT* score. As shown in table 5, forecasts on items such as government surplus/deficit, the level of government debt, and the rate of economic growth are virtually always disclosed in SCPs. On the contrary, the evidence indicates substantial underreporting of forecasts for items related to the fiscal position of the government. For example, governments publish forecasts on the future evolution of guarantees only 10 percent of the time, and only 7 percent of the time do they explicitly identify which amount covered the needs of

financial institutions. It is also interesting to note that governments almost always (89 percent of the times) report the discrepancy between change in debt and the deficit – known as the debt-deficit or "stock-flow" adjustment (SFA). As the SFA is considered a way to hide the "true" fiscal picture (Alt, Lassen and Wehner, 2014), it may be promising to see that governments frequently issue guidance on it. Yet, the individual components of the SFA are systematically *under*-reported. For example, the contribution of privatization receipts, the reconciliation between cash and accrual, the acquisition of financial assets, and valuation effects are reported only 30 percent of the times.

TABLE 6

*Summary statistics of the fiscal guidance transparency index*

| Variable | Mean | St. dev. |
|----------|------|----------|
| FGT | 78.12 | 15.87 |
| Economic outlook | 85.42 | 19.00 |
| Fiscal outlook | 87.31 | 16.69 |
| Debt outlook | 54.93 | 25.11 |
| Assumptions | 61.82 | 34.37 |

*Note: This table provides summary statistics of the FGT index and of the sub-indices of FGT that measure transparency in the release of forecast of coherent items. FGT is defined in equation (1). Minimum and maximum values are 0 and 100, respectively, for all variables. N=1674.*

Next, table 7 examines if the *FGT* index varies depending on the forecast horizon. Panel A reports the value of *FGT* at each forecast horizon *k*. There is an evident, monotonic decrease in transparency as the forecast horizon lengthens – from 80 to 76 percent. That is, countries are more likely to issue short-term rather than medium-term forecasts. This is accompanied by a monotonic increase in the variability around the mean from 14 to 18 percent. In panel B, the descriptive evidence is confirmed through an OLS regression of *FGT* on an indicator variable capturing the forecast horizon. In the OLS specification, a full set of country and year fixed effects is included, and standard errors are clustered two-way at the country-date level. Country and year fixed effects are included to control for unobserved heterogeneity and common shocks affecting the ability (and willingness) to issue forecasts at different horizons. Two-way clustering at the country-date level is advisable because *FGT* is nested within unique country-date pairs (Angrist and Pischke, 2009). All forecast horizon indicators have a negative coefficient that is significant at conventional levels, which confirms that fiscal guidance transparency is approximately 4 percentage points lower for medium-term than for short-term forecasts. This fact is interesting and somewhat worrisome given that the SGP mandate aims at increasing transparency over the medium-term outlook. It may be a sign that governments find that issuing SCP forecasts is consequential and that at least some countries prefer to avoid publishing fiscal and economic plans with a medium-term horizon as these may overly commit the government to a rigid course of action (Laffont and Tirole, 1992). Alternatively, it may reflect the relatively difficulty of acquiring precise medium-term compared to short-term information.

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*Transparency declines as the forecast horizon lengthens*

*Panel A: Descriptive statistics*

| Forecast horizon | N | Mean | Std. dev. | Min | Max |
|---|---|---|---|---|---|
| 0 | 434 | 79.96 | 13.91 | 6.32 | 100 |
| 1 | 434 | 79.19 | 14.73 | 6.32 | 100 |
| 2 | 434 | 77.22 | 16.80 | 0 | 100 |
| 3 | 372 | 75.78 | 17.74 | 0 | 100 |

*Panel B: OLS results*

| | (1) |
|---|---|
| | FGT |
| *Forecast horizon t+k=1* | -0.78*** |
| | [0.21] |
| *Forecast horizon t+k=2* | -2.74** |
| | [0.96] |
| *Forecast horizon t+k=3* | -4.11*** |
| | [1.00] |
| *Intercept (Forecast horizon t+0)* | 65.25*** |
| | [2.99] |
| N | 1674 |
| Adj. R2 | 0.62 |
| Country FE | Yes |
| Year FE | Yes |
| Cluster | Country & Date |

*Note: This table reports descriptive statistics of FGT by forecast horizon (panel A) and the results of an OLS regression of FGT on country, year, and forecast horizon fixed effects (panel B). Only the forecast horizon fixed effects are reported. The base level of the forecast horizon is the forecast for the current year t=0. Standard errors in brackets are clustered at the dimension indicated at the bottom of the table. FGT is defined in equation (1).*
$^{+} p < 0.10,$ $^{*} p < 0.05,$ $^{**} p < 0.01,$ $^{***} p < 0.001.$

Next, the main correlates of the *FGT* index are explored. In line with prior literature, the dependent variable is modelled as a function of economic, fiscal and political determinants (Khagram, de Renzio and Fung, 2013). Specifically, the model builds on three recent articles that use panel data to examine if government transparency is endogenous to governments' incentives (Berliner, 2014; Cicatiello, De Simone and Gaeta, 2017; Hollyer, Rosendorff and Vreeland, 2011). OLS is used to estimate:

$$FGT_{c,k,d} = a_c + h_k + t_t + \text{Government Strenght}_{c,t} + \text{Fragmentation of Parliament}_{c,t} + \text{Electoral Pressure}_{c,t} + \text{Democracy}_{c,t-1} + \text{GDP per capita}_{c,t-1} + \text{Debt}_{c,t-1} + \text{Budget Balance}_{c,t-1} + \text{Trade}_{c,t-1} + \text{EU Funds}_{c,t-1} + \text{Euro Adopter}_{c,t-1} + \varepsilon_{c,k,d} \qquad (2)$$

where $a_c$, $h_k$, and $t_t$ denote country, horizon, and year fixed effects. *Government Strenght* is the percentage of seats in the legislative chambers that are occupied by

members loyal to the government. This variable captures the strength of governments because it is highest in a one-party system – where *Government Strenght* would be equal to 100 percent – and becomes progressively lower as the government's majority in the legislative chamber falls below 50 percent (Cicatiello, De Simone and Gaeta, 2017). *Fragmentation of Parliament* is the probability that two deputies picked at random from the legislature belong to different parties. This measure captures the concept of fragmentation in the legislature: it is highest in the (unlikely) event that each member of parliament belongs to a different party, while it is lowest in a one-party parliament (Cicatiello, De Simone and Gaeta, 2017; Wehner and de Renzio, 2013). As noted by Wehner and de Renzio (2013), the variable is particularly fit for comparative studies of multi-party political systems as a measure of constraints on the government. Together, *Government Strenght* and *Fragmentation of Parliament* capture the extent of legislative control by the executive branch. According to prior literature, the higher the degree of control, the lower the level of transparency (e.g., Alt, Lassen and Rose, 2006; Alt and Lassen, 2006). A variable is also added that captures the *Electoral Pressure*, calculated as negative one times the number of years that separate year *t* from the next election (Cicatiello, De Simone and Gaeta, 2017). These variables are sourced from the Database of Political Institutions (DPI). Next, *Democracy* is measured by the Polity 2 composite score from the Polity IV dataset (Berliner, 2014). *Democracy* in the sample is high and relatively uniform, ranging from 8 to 10 as one would expect given that the sample consists of EU countries. Based on prior work, *Democracy* should correlate positively with *FGT* (Berliner, 2014; Hollyer, Rosendorff and Vreeland, 2011).

The model also includes economic and financial conditions. *GDP per capita* is included because the level of economic development should affect both the capacity of governments to collect and disseminate data, while reflecting citizens' demand for information (Berliner, 2014; Cicatiello, De Simone and Gaeta, 2017; Hollyer, Rosendorff and Vreeland, 2011; Khagram, de Renzio and Fung, 2013). *GDP per capita* is measured as gross domestic product per capita at constant 2010 US dollars as reported by the World Bank. *Debt* and *Budget Balance* are the level of the general government gross debt and deficit as percentage of GDP as reported by Eurostat. These are included for two reasons. First, debt and deficit are the two indicators on which governments' compliance with SGP fiscal rules is evaluated. Second, prior literature finds inconsistent results on the relation between governments' financial conditions and transparency. For instance, Alt, Lassen and Rose (2006) report a negative effect of debt, and a positive effect of both surpluses and deficits on the level of transparency in the budgetary process of U.S. states. However, other studies do not find such a clear effect of financial conditions on transparency (Ríos, Bastida and Benito, 2016). Others exclude these variables from their models (Berliner, 2014; Wehner and de Renzio, 2013).

*Trade* – the sum of exports and imports divided by nominal GDP – is also included and is obtained through Eurostat. *EU Funds* – the annual amount of funds disbursed by the EU to the country divided by nominal GDP – is sourced from the

EC. These variables capture the dependence of the country on external funding, which should correlate positively with transparency (Berliner, 2014; Khagram, de Renzio and Fung, 2013). Finally, a *Euro Adopter* binary indicator is added to denote members of the euro area that face relatively more stringent SGP requirements (Frankel and Schreger, 2013). The euro indicator switches on in country-years in which the country is a euro member. Dates of entry into the euro area are retrieved from the European Central Bank. All variables are lagged by one year, with the exception of the DPI measures that are measured as of January $1^{st}$ of year $t$ in the original dataset (Berliner, 2014). Table 8 describes the variables and their sources. It should be noted that the model excludes measures of institutional and cultural aspects of the country environment which may explain observed transparency levels (Khagram, de Renzio and Fung, 2013). Yet, the inclusion of country fixed effects absorbs any of these time-invariant effects. Table 9 presents pairwise correlations between all variables.

**TABLE 8**

*Description and source of variables*

| Variable | Description | Source |
|---|---|---|
| *FGT* | The number of non-missing items in a SCP divided by the total number of SCP-specific required items | Author's own elaboration on primary data collected from Stability/Convergence Programmes. See equation (1) |
| *Government Strength* | The percentage of seats in the legislative chamber(s) that are occupied by members loyal to the incumbent governing coalition | Database of Political Institutions 2021: variable name *MAJ* |
| *Fragmentation of Parliament* | The probability that two deputies picked at random from the legislature belong to different political parties | Database of Political Institutions 2021: variable name *FRAC* |
| *Electoral Pressure* | Negative one times the number of years left in the term of the government | Database of Political Institutions 2021: variable name *YRCURNT* |
| *Democracy* | The Polity 2 score | Polity IV database, variable *polity2* |
| *GDP per capita* | Natural logarithm of GDP per capita in constant 2010 U.S. $ | World Bank Development Indicators, series *NY.GDP.PCAP.KD* |
| *Debt* | General Government Consolidated Gross Debt, divided by GDP at current market prices | Eurostat, series *gov_10dd_edpt1* |
| *Budget Balance* | General Government Net Lending/Net Borrowing, divided by GDP at current market prices | Eurostat, series *gov_10dd_edpt1* |

| Variable | Description | Source |
|---|---|---|
| *Trade* | The sum of exports and imports of goods services, divided by GDP at current market prices | Eurostat, series *nama10_gdp* |
| *EU Funds* | EU payments to member states, divided by GDP at current market prices | European Commission, DG Regional Policy at: https://cohesiondata.ec.europa.eu/Other/Historic-EU-payments-regionalised-and-modelled/tc55-7ysv |
| *Euro Adopter* | 1 if the country is a member of the euro area, 0 otherwise | European Central Bank |

*Note: This table presents the definition and source of variables used in the analysis.*

Table 10 reports the results of estimating model (2). The five variations of the model report estimated coefficients without and with country fixed effects in columns 1/3 and 2/4, respectively. In columns 1 and 2, errors are clustered only on the country dimension, while in the remaining columns they are clustered two-ways at the country-date level. The estimates indicate that fiscal guidance transparency is largely a function of political dynamics at the time of disclosure. At the same time, time-invariant, country-specific characteristics should be controlled for in order to derive appropriate inferences. In particular, the percentage of seats held by parties supporting the government is negatively associated with transparency, but the coefficient is inflated when country indicators are not estimated. In addition, the effect sign of parliamentary fragmentation depends on the estimation of country parameters. Whereas fragmentation has a weakly positive association with *FGT* when fixed effects are not estimated, the association turns negative once fixed effects are included. The estimated coefficient suggests that for any percentage point increase in the probability that members of parliament belong to different parties, transparency declines by about a little more than a third of a percentage point. As the legislative chamber becomes more fragmented, its ability to demand information from governments declines substantially. This finding is similar both in sign and in magnitude to that reported by Cicatiello, De Simone and Gaeta (2017) who implement a similar panel specification. However, it differs markedly from earlier, cross-sectional findings (Alt and Lassen, 2006; Wehner and de Renzio, 2013). Also, a weakly positive effect of electoral pressure on transparency is recorded. As elections approach, governments increase transparency by about half a percentage point.

**TABLE 9**
*Pairwise correlations*

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *(1) FGT* | 1.000 | | | | | | | | | | |
| *(2) Government Strength* | -0.118 | 1.000 | | | | | | | | | |
| | 0.000 | | | | | | | | | | |
| *(3) Fragmentation of Parliament* | 0.157 | -0.008 | 1.000 | | | | | | | | |
| | 0.000 | 0.734 | | | | | | | | | |
| *(4) Electoral Pressure* | -0.012 | 0.037 | 0.007 | 1.000 | | | | | | | |
| | 0.616 | 0.135 | 0.784 | | | | | | | | |
| *(5) Democracy* | -0.128 | -0.184 | -0.224 | 0.022 | 1.000 | | | | | | |
| | 0.000 | 0.000 | 0.000 | 0.379 | | | | | | | |
| *(6) GDP per capita* | -0.314 | -0.066 | 0.139 | 0.062 | 0.352 | 1.000 | | | | | |
| | 0.000 | 0.007 | 0.000 | 0.011 | 0.000 | | | | | | |
| *(7) Debt* | -0.033 | 0.001 | -0.303 | 0.018 | 0.141 | 0.201 | 1.000 | | | | |
| | 0.191 | 0.969 | 0.000 | 0.467 | 0.000 | 0.000 | | | | | |
| *(8) Budget Balance* | -0.038 | 0.045 | 0.304 | 0.064 | -0.039 | 0.226 | -0.430 | 1.000 | | | |
| | 0.136 | 0.078 | 0.000 | 0.011 | 0.127 | 0.000 | 0.000 | | | | |
| *(9) Trade* | 0.096 | 0.071 | 0.088 | 0.006 | -0.016 | 0.162 | -0.291 | 0.197 | 1.000 | | |
| | 0.000 | 0.004 | 0.000 | 0.796 | 0.512 | 0.000 | 0.000 | 0.000 | | | |
| *(10) EU Funds* | 0.265 | 0.096 | -0.102 | -0.033 | -0.201 | -0.587 | -0.133 | -0.187 | 0.071 | 1.000 | |
| | 0.000 | 0.000 | 0.000 | 0.195 | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | | |
| *(11) Euro Adopter* | 0.134 | -0.072 | -0.003 | -0.036 | -0.188 | -0.516 | -0.413 | 0.034 | -0.109 | 0.240 | 1.000 |
| | 0.000 | 0.003 | 0.907 | 0.138 | 0.000 | 0.000 | 0.000 | 0.177 | 0.000 | 0.000 | |

*Note: This table presents pairwise correlations of the variables used in the analysis. Variables are defined in table 8.*

Finally, a strong and positive effect of *Democracy* on *FGT* is documented. This finding agrees with earlier evidence by Hollyer, Rosendorff and Vreeland (2011), seemingly suggesting that the drivers of transparency in the dissemination of information on economic and fiscal outcomes somewhat overlap with the drivers of transparency in guidance. While the evidence is consistent with prior work, it is notable that it is replicated in this sample of EU countries. Turning to the remaining variables, their effect is generally not significant. A negative association is reported between *GDP per capita* and *FGT*, but the effect is not robust to the inclusion of fixed effects. Similarly, there is a positive effect of *Debt* and *Budget Balance*, but only when time-invariant heterogeneity is not controlled for.

**TABLE 10**

*Fiscal guidance transparency depends on political dynamics*

|  | **(1)** | **(2)** | **(3)** | **(4)** |
|---|---|---|---|---|
| Government Strength | -0.42$^*$ | -0.16$^+$ | -0.42$^{**}$ | -0.16$^+$ |
|  | [0.15] | [0.08] | [0.15] | [0.08] |
| Fragmentation of Parliament | 0.31$^+$ | -0.35$^*$ | 0.31$^+$ | -0.35$^*$ |
|  | [0.17] | [0.16] | [0.17] | [0.16] |
| Electoral Pressure | 0.44 | 0.30 | 0.44 | 0.30 |
|  | [0.59] | [0.31] | [0.57] | [0.30] |
| Democracy | 1.17 | 5.39 | 1.17 | 5.39$^+$ |
|  | [1.96] | [3.35] | [1.90] | [3.17] |
| GDP per capita | -10.92$^{**}$ | -8.77 | -10.92$^{**}$ | -8.77 |
|  | [3.92] | [9.89] | [3.82] | [9.24] |
| Debt | 0.12$^+$ | -0.06 | 0.12$^+$ | -0.06 |
|  | [0.06] | [0.08] | [0.06] | [0.08] |
| Budget Balance | 0.95$^+$ | 0.28 | 0.95$^*$ | 0.28 |
|  | [0.47] | [0.22] | [0.46] | [0.21] |
| Trade | 0.04 | -0.04 | 0.04 | -0.04 |
|  | [0.03] | [0.05] | [0.03] | [0.04] |
| EU Funds | 0.66 | -0.96 | 0.66 | -0.96 |
|  | [0.71] | [0.77] | [0.69] | [0.73] |
| Euro Adopter | -1.36 | 3.54 | -1.36 | 3.54 |
|  | [5.23] | [2.72] | [5.07] | [2.77] |
| Constant | 157.53$^{***}$ | 147.29 | 157.53$^{***}$ | 147.29 |
|  | [40.26] | [108.15] | [39.34] | [102.85] |
| N | 1,469 | 1,469 | 1,469 | 1,469 |
| Adj. R2 | 0.31 | 0.64 | 0.31 | 0.64 |
| Country FE | No | Yes | No | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Horizon FE | Yes | Yes | Yes | Yes |
| Cluster | Country | Country | Country & Date | Country & Date |

*Note: This table reports estimates of OLS regressions of the FGT index on measures of economic wealth, financial pressures and political dynamics and fixed effects. All fixed effects are unreported for presentation purpose. Standard errors in brackets are clustered at the dimension indicated at the bottom of the table. Variables are defined in table 8.*
$^+ p < 0.10$, $^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$.

# 5 CONCLUSIONS

This paper has introduced a novel dataset that contains the full set of economic and fiscal forecasts that EU governments disclosed over the period 2001-2018 in compliance with the requirements of the SGP fiscal reporting regime. The dataset is structured as an unbalanced panel of 434 fiscal plans that contain forecasts released by up to 28 countries on up to 117 unique items over a forecast horizon of up to 4 years. It is the first dataset to be solely dedicated to measuring the quantity of forecasts disclosed by EU governments over a large number of years. The dataset has important benefits from the point of view of researchers. It is amenable to cross-sectional, time-series applications, complementing other efforts in this direction (Cicatiello, De Simone and Gaeta, 2017; Wang, Irwin and Murata, 2015). It also presents important sources of variation at theoretically-salient dimensions – e.g., whether short- or medium-term forecasts are released and the extent to which transparency differs across kinds of forecasts – economic or fiscal. Finally, the dataset contains estimates of the precise dates – day/month/year – at which fiscal plans were first disclosed to the public. These dates can be easily matched with data on, e.g., key political cycle dates or financial market movements.

In this article, the dataset was used to measure the degree of transparency of government fiscal guidance. Fiscal guidance refers to the public disclosure of information that is restricted to the government until it is disclosed and that informs the public about the expected (by the government) evolution of *future* fiscal and economic aggregates (Fujiwara and Waki, 2020). In this paper, a measure of fiscal guidance transparency (the *FGT* index) was proposed that compares the quantity of items on which a government issues a forecast at a given forecast horizon to the quantity that was recommended in the SGP reporting guidelines in force at the time of disclosure. The evidence indicates that fiscal guidance transparency is relatively high – at 85 percent on average. However, this average value hides substantial heterogeneity across countries, years, forecast horizon and category. In particular, the analysis presented in this paper indicates that guidance on sensitive items – such as forecasts on the drivers of stock-flow adjustments – is generally withheld by governments. In addition, the *FGT* index correlates negatively with the forecast horizon, signalling that governments are comparatively less able – or less willing – to share their medium-term expectations with the public. Finally, the evidence shows that country-year variation in the *FGT* index is largely a function of contemporaneous political dynamics. Most notably, fiscal guidance transparency declines when governments possess a strong majority of seats in parliament and when the parliament is fragmented. Importantly, the results indicate that democracy positively correlates with fiscal guidance transparency. Future research may explore the robustness of these results and identify the mechanisms that make governments more or less willing and able to be open about their economic and fiscal plans.

In closing, three caveats are in order. First, in line with prior research using a "missing-data" approach, transparency is operationalized in this paper as the *quantity* of information that governments make available to the public (Hollyer,

Rosendorff and Vreeland, 2014; Williams, 2015). This approach has the benefit of objectively identifying the extent to which governments choose to – or are able to – share their private expectations with the public. In the context of fiscal guidance, the primary drawback of this approach is that no attempt is made to measure the *quality* of forecasts by measuring, e.g., their *ex-post* accuracy. A second limitation of the fiscal guidance transparency measure and underlying dataset is its EU focus. This focus derives from the fact that the SGP reporting regime generates a benchmark for measuring fiscal guidance transparency in EU countries but not elsewhere. While the EU character of the *FGT* index certainly limits its use in comparative work, recent contributions underline that a relatively narrow institutional focus may actually promote a relatively more meaningful interpretation of results, thus promoting internal validity at the expense of external generalizability (Alt, 2019; de Renzio and Wehner, 2017). Indeed, the detailed explanation of the data collection process aimed at sensitizing the reader about the importance of duly considering the details of the institutional process that accompanied the evolution of the SGP reporting mandate over the years. A third limitation of the dataset introduced in this paper is that it only includes the forecasts contained in the Stability/Convergence Programmes released in compliance with the SGP requirements. Naturally, these are not the only forecasts that EU governments publish during the year. Indeed, it may be interesting to compare the forecasts introduced in the dataset to, e.g., those issued as part of the Excessive Deficit Procedure (Merola and Pérez, 2013).

Provided that these limitations are acknowledged, the dataset represents an important addition to research on fiscal transparency as it allows researchers to analyse the causes and consequences of transparency in fiscal guidance – an important, yet understudied pillar of advanced fiscal transparency frameworks. The dataset presents several attractive features. First, similar to a recent dataset – focused, however, on the reporting of past fiscal *outcomes* (Wang, Irwin, and Murata, 2015) – it contains a panel of multiple countries followed over multiple years. Second, the dataset presents country-level forecasts on a large number of unique, disaggregated items ranging from the components of fiscal balance and economic growth to the components of stock-flow adjustments and exogenous assumptions. This feature gives researchers considerable flexibility in studying the causes and consequences of specific phenomena that fall within the broader concepts of fiscal guidance transparency. Third, the dataset contains forecasts on each item at forecast horizons of up to four years. This feature allows studying the conditions that make governments more or less prone to commit to a medium-term as opposed to a short-term fiscal plan depending on the stage of the political budget cycle. Fourth, the dataset contains a publication date of SCPs estimated at the day/month/year level, which allows researchers to match the dataset with data on post-disclosure financial market trends, election outcomes and investment decisions (Aaskoven, 2016; Arbatli and Escolano, 2015; Bastida, Guillamón and Benito, 2017; Benito, Guillamón and Bastida, 2016; Glennerster and Shin, 2008; Gulen and Ion, 2016). These are only examples, and other uses of the dataset and the

*FGT* index are likely to arise as research on fiscal guidance transparency matures. Scholars are encouraged to use the fiscal guidance transparency dataset and the *FGT* index to study the effectiveness, desirability, and (unintended) consequences of government transparency on fiscal and economic outcomes that have yet to materialize – a distinct and possibly subtle form of transparency.

### Disclosure statement
There are no conflicts of interest to disclose.

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# What do human rights have to offer to fiscal policy? Implications of fiscal transparency, participation and accountability

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**Abstract**

*This paper highlights the relationship between fiscal transparency, participation and accountability (FTPA) and human rights. It argues that human rights provide guidance on the scope of FTPA, and tools for citizens to demand more transparent fiscal decisions. By ensuring FTPA, states discharge their international human rights' obligations and enhance representation and legitimacy in their fiscal policy. Because of these and other benefits, human rights are a useful framework to overcome the gap between FTPA commitments on paper and their implementation in practice. The paper zooms into Principle 7 of the "Principles for Human Rights in Fiscal Policy", which unpacks the multiple implications that human rights' standards have for FTPA and provides guidance to governments on discharging their relevant obligations. The paper presents illustrative cases showing how civil society organizations in two countries have used the human rights framework to advocate successfully for more transparency around different items of tax information.*

*Keywords: fiscal policy, human rights, tax benefits, accountability, transparency, participation*

## 1 INTRODUCTION

The aim of this paper is to discuss the often-overlooked relationship between human rights and fiscal policy. It will do so by presenting the benefits of framing transparency, participation and accountability in fiscal policy (to which we will refer as FTPA) as a human rights issue. The paper will provide a theoretical overview of this relationship and present a recent effort oriented at examining in detail the connection between human rights and fiscal policy in all its relevant aspects: the Principles for Human Rights in Fiscal Policy.[1] It will then illustrate how human rights principles can be used to enhance FTPA through two relevant cases from Argentina and Mexico.

FTPA have numerous, well-known benefits. Among other things, they allow for informed and efficient decision making, and provides people with an opportunity to examine and have a say about decisions that, even though often presented as technical and detached from real-world experiences, impact their lives in very concrete ways. FTPA is also a pre-requisite for healthy democracies, and for legitimating fiscal decisions.

However, governments around the world often do not secure FTPA in practice (IBP, 2006). The consequences of not complying with FTPA standards are varied, and range from very specific issues to broad political conflicts. Recent examples from three countries in Latin America illustrate the potentially serious political consequences of not observing FTPA.

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[1] For an overview of the project through which the Principles were launched, see: https://derechosypoliticafiscal.org/en/.

In Chile, in 2019, the government announced that it would increase the price of subway tickets significantly (BBC, 2019). The decision, of relevant fiscal consequences, was informed by a recommendation from "a panel of experts" but did not arise from a process in which the people affected engaged in any way (lack of participation). With few formal options to challenge the decisions (lack of accountability), people – especially students – started demanding accountability through massive protests. Protests increased, and the government responded with violence. After a vicious circle of increased protest and institutional violence, the government had to take a step back and announce that it would "undo" its decision to increase train fares. However, it was already too late as a discrete fiscal issue (increase in train fares) became the tip of the iceberg of broader problems of fiscal policies that did not address issues such as high inequality nor provide finance for services such as higher education. Opposition to the government triggered debates around fiscal policy and many human rights issues inseparable from it. The debates were so widespread and intense as to lead to a process of constitutional reform that is now starting to take place.

The case of Ecuador is also illustrative of the relevance of FTPA, and their connection with human rights. In 2019, protests in Ecuador started after the government announced a traditional "austerity package", with substantial cuts in subsidies to gas, and labor and tax reforms (Manetto, 2019). Measures were announced after an agreement with the International Monetary Fund (IMF), which requested such measures. The decision, informed more by the IMF's needs than by the perspective of those impacted by it, triggered protests in sectors as diverse as taxi and bus drivers, students, and indigenous communities' leaders. Among other things, many sectors in civil society demanded that negotiations and agreements with the IMF, which had a very significant impact on fiscal policy in the country, be conducted in a more transparent and participatory manner.

In the case of Colombia, protests triggered in 2021 by a proposed tax reform showed how distrust of the government – which FTPA could have addressed – made the proposed measures hard to apply in practice.[2]

These and other examples prove that while transparency, participation and accountability are widely regarded as valuable standards that governments should introduce in their fiscal policy, they are often unobserved in practice. The gap between acknowledging FTPA's importance on paper and the barriers to its implementation in practice demonstrates the need to find frameworks that incentivize the actual application of FTPA standards.

This paper argues that framing FTPA as a human rights issue can help in closing that gap, and therefore for a closer connection between fiscal transparency and human rights debates. Human rights are "mandatory", and therefore provide a normative

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[2] For a reference to the fiscal dimensions of the Colombian example, see: Derechosypoliticafiscal.org (2021).

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language and institutional channels to demand FTPA. Furthermore, they can provide guidance to governments on what FTPA means in practice and how to interpret general standards, enhancing their ability to put transparency in practice.

To unpack these arguments, section two of this paper starts by giving basic definitions of human rights and of FTPA, and how both concepts are interrelated. It then moves to argue for a closer connection between the two fields, to then explain the effects of framing FTPA as a human rights issue. Section three presents a concrete effort to link FTPA and human rights better: the Principles for Human Right in Fiscal Policy, adopted in 2021 by an interdisciplinary group of experts and civil society organizations from various countries of Latin America. It zooms into the guidance that the Principles provide on what FTPA means. Section four discusses two cases where civil society organizations used the human rights framework to advocate successfully for more fiscal transparency (in particular around tax benefits). Finally, section five draws some conclusions and briefly presents some policy implications of the paper.

## 2 FISCAL TRANSPARENCY, PARTICIPATION AND ACCOUNTABILITY AS HUMAN RIGHTS

### 2.1 BASIC NOTIONS OF TRANSPARENCY, PARTICIPATION AND ACCOUNTABILITY AND HUMAN RIGHTS

To develop the connection between FTPA and human rights, we will start by defining the basic notions. "Transparency" is understood as government actions that provide people with access to government information (Birkinshaw, 2006); "participation" refers to the involvement of stakeholders in a decision-making process (Social Protection and Human Rights Platform, n.d); and "accountability" is defined as the "justification of an actor's performance vis-à-vis others, the assessment or judgment of that performance against certain standards, and the imposition of consequences if the actors fail to meet applicable standards" (UN, 2018). These three concepts are interrelated: information is necessary for effective participation, which in turn can foster accountability (Social Protection and Human Rights Platform, n.d); and are often considered together with other rights such as the right to assembly or to an effective remedy (ibid).

FTPA can be seen as broad values to guide public policy interventions, but also as core human rights principles. Human rights are the rights that every person has for being such, regardless of any status, such as the right to education, the right to life, or political rights. Human rights embody the values of dignity and equality among all human beings and are characterized as universal (every person is entitled to human rights), inalienable (they cannot be taken away as a general rule), indivisible and interdependent among each other, and equal and non-discriminatory (Office of the United Nations High Commissioner for Human Rights, n.d).

In the context of the Organization of the United Nations, several decades ago different instruments started recognizing a broad range of rights (civil and political,

and economic, social and cultural rights), which were widely ratified by states from all over the world.[3] In turn, many countries also recognized human rights in their domestic legal systems.

Human rights were recognized in such instruments as normative tools, meaning that they entailed responsibilities for states – they were obliged to discharge their human rights commitments – and that rights-holders could resort to mechanisms such as courts to claim their rights. Usually, due to the interpretation given to international instruments in which human rights are recognized, states have obligations to respect (not to interfere in the enjoyment), protect (from third parties interference) and fulfill (actively secure) human rights (Office of the United Nations High Commissioner for Human Rights, n.d).

Since human rights are binding, states must take steps of all kinds to ensure that no aspect of governmental action infringes human rights. In other words, states must refrain from violating human rights when they act in any sphere of public intervention (including fiscal policy), since human rights standards are applicable to all forms of governmental action.

In consequence, there are no theoretical reasons to exclude fiscal policy, as a form of governmental action, from the application of human rights principles (Balakrishnan and Heintz, 2020). The fact that public resources are involved in a certain area of public intervention does not mean that such an intervention can ignore human rights obligations. This has been increasingly recognized by the oversight bodies in charge of monitoring states' compliance with their human rights commitments, such as the United Nations Committee on Economic, Social and Cultural Rights[4] and also by domestic courts in many countries.

In consequence, human rights standards apply to all aspects of fiscal policy, its formulation, implementation and monitoring (IACHR, 2017). While human rights principles do not indicate precise policies that states should pursue, they do limit states' discretion in making policy choices (Balakrishnan and Elson, 2008). For example, states must not take their fiscal policy decisions through secret or completely opaque channels, as that would equate to a violation of their obligations regarding transparency. However, states have a margin of discretion in their choices among tools to ensure that their fiscal decisions are transparent, as human rights do not indicate inflexible ways to ensure transparency.

There are widely-recognized human rights standards that limit states' discretion and are of particular relevance for fiscal policy, which include the principles of equality and non-discrimination; the duty to use the maximum available resources[5];

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[3] To consult the ratification status of core human rights instruments by different countries, see UN (2022b).
[4] An international experts body that has the mandate of receiving reports (and in some cases, individual petitions) to monitor States parties compliance with the United Nations International Covenant on Economic, Social and Cultural Rights.
[5] International Covenant on Economic, Social and Cultural Rights, art. 2.1.

the principles of progressive realization of social and economic rights[6]; and the principles of FTPA, which will be developed in more detail below.

While all these human rights standards, as currently interpreted by authoritative bodies, have substantive and procedural implications for fiscal policies, in practice they have traditionally been ignored in fiscal debates. The following chapter discusses the reasons for overcoming such a gap, and for building a consistent dialogue between the worlds of fiscal policy and of human rights.

### 2.2 WHY THE TRADITIONAL DIVORCE BETWEEN HUMAN RIGHTS AND FISCAL POLICY SHOULD BE CHALLENGED?

While it is common to consider FTPA as important values to apply to fiscal policy, the idea that states are bound to secure such values as part of their human rights commitments is less developed. More broadly, fiscal debates would typically ignore altogether the human rights implications of fiscal decisions, which are often considered highly discretional (despite the limitations to governmental discretion already discussed), and very technical, only accessible to a small group of experts from the fiscal field.

The divorce between human rights and fiscal policy is problematic for different reasons. In fact, the two fields are both conceptually and normatively connected. From one side, fiscal policy is subject to mandatory human rights standards, and states must be held accountable for aligning fiscal decisions with such standards. From this point of view, human rights become one of the functions or goals that fiscal policy must pursue (together with other more commonly recognized goals, such as fostering economic growth).

On the other side of the coin, human rights need aligned fiscal policies for their implementation. First, they need resources for their funding. They also call for fiscal decisions that promote equality, and resources distribution impacts significantly the recognition of rights in practice. Fiscal policy can also be a tool to incentivize or disincentivize conduct that is necessary to ensure human rights (for instance, with taxes on tobacco oriented at securing the right to health).

Given these points of connection, a growing body of standards recognizing that fiscal policy needs to be aligned with human rights and interpreting how such alignment could take place started to emerge from the work of courts, international human rights bodies, and even civil society organizations. The ultimate example of such efforts, which systematized existing standards on the issue, is the Principles for Human Rights in Fiscal Policy, which will be presented in more detail in coming sections. Before engaging on this exercise, however, we will briefly survey some of the effects that use of the human rights framework can have when designing, implementing and monitoring fiscal policy.

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[6] Ibid.

## 2.3 THE EFFECTS AND IMPLICATIONS OF FRAMING FTPA AS A HUMAN RIGHTS ISSUE

Seeing FTPA through a human rights lens has several implications that can help secure a better implementation of such standards in practice, both by creating a normative architecture around FTPA, and by providing criteria to determine what actually counts as transparency and what does not (as anticipating, limiting governmental discretion). The following sections briefly explore such benefits and present some of the indirect benefits that the human rights framework can have for FTPA discussions.

### 2.3.1 POLITICAL EFFECTS OF USING A HUMAN RIGHTS FRAMEWORK FOR FTPA: COMPLYING WITH STATES' INTERNATIONAL OBLIGATIONS AND CREATING MUTUAL LEARNING PROCESSES

The core international human rights treaties that provide the basis for the human rights standards that apply to FTPA are a widely recognized and mandatory framework. Just to mention an example, there are 173 states parties to the United Nations International Covenant on Civil and Political Rights[7], which sets the general normative basis for FTPA standards. As international treaties are binding, they trigger review procedures around which countries can engage in a learning process to identify which FTPA policies are aligned with their commitments and which are not. As review processes are universal, they also have the potential to be used as sources to learn from comparative experiences. This comparative exercise can create incentives to put FTPA standards into practice.

As normative tools, human rights can further trigger political effects, creating mobilization around them. The case studies presented below exemplify how the normative value of human rights has been used in litigation, which further led to more robust standards regarding fiscal transparency. Other forms of mobilization, such as naming and shaming in the case of noncompliance with international binding standards, show other examples of the potential political effects of framing FTPA as a human rights issue.

### 2.3.2 POLITICAL EFFECTS OF HUMANRIGHTS-ALIGNED FTPA: ENHANCING REPRESENTATION AND LEGITIMACY OF FISCAL POLICY AND SECURING HEALTHY DEMOCRACIES

As explained in the introductory section of this paper, many of the current "crises" of democracy connect with issues related to fiscal policy. This is a matter of the utmost importance, given the often-recognized tendency, in the last few years, for democratic "backsliding", or the crisis of democracies in different regions of the world.

One of the clearest expressions of the current crisis of democracies is extended and systematic distrust of governments. Using human rights to guide FTPA, instead of thinking of it as a technical matter, unrelated to the real life experiences of constituencies, can help address the current crisis of democracies.

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[7] See information available at UN (2022b).

**2.3.3 PRACTICAL EFFECT OF USING HUMAN RIGHTS TO GUIDE FTPA: PROVIDING GUIDANCE ON THE SCOPE AND GOALS OF FTPA**

While human rights do not set detailed rules on how states should conduct their fiscal policy, they do limit discretion on which measures are acceptable and which are not. In setting those "boundaries", they give hints to governments to guide their behavior regarding FTPA.

The "guidelines" that will be presented below, all derived from the human rights framework, are a good example of such guidance. They range from detailing what impact assessments should be like to which budgetary information shall be made public. Similarly, human rights explain that states not only need to secure "participation", but "meaningful participation", which requires that certain substantive and procedural conditions are met.

### 3 FROM THEORY TO PRACTICE – TRANSPARENCY, PARTICIPATION AND ACCOUNTABILITY IN FISCAL POLICY AS A HUMAN RIGHTS ISSUE: THE PRINCIPLES FOR HUMAN RIGHT IN FISCAL POLICY

This section discusses a recently launched tool oriented at systematizing and analyzing existing human rights standards applicable to fiscal policy, the "Principles for Human Rights in Fiscal Policy" ("the Principles"). It will first provide a short overview of the Principles, to then focus on Principle number 7, which details human rights obligations regarding FTPA.

#### 3.1 BRIEF OVERVIEW OF THE PRINCIPLES FOR HUMAN RIGHTS IN FISCAL POLICY

Considering the importance of strengthening the relationship between human rights and fiscal policy, a group of organizations from all over Latin America started advocating several years ago for a better alignment of fiscal policy with human rights in countries of the region. In particular, they advocated (successfully) before the Inter-American Commission on Human Rights for the recognition of such connections. Based on these and other precedents[8], in 2018 seven civil society organizations[9] gathered in Buenos Aires to launch an initiative oriented at building through a collective and participatory process a set of principles and guidelines that would condense the most progressive human rights standards for the sake of providing guidance for fiscal policy. The organizations paired up with a group of experts from all over Latin America who would guide the process of drafting the set of Principles. After almost three years of dialogues and debates, the Principles for Human Rights in Fiscal Policy were launched and adopted in May 2021 through a week-long series of events that assembled over 1,000 participants and gathered consistent support for the Principles.

The Principles provide 15 standards to guide different aspects of fiscal policy. They are paired with more precise guidelines, to guide the implementation of the

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[8] For an overview of such precedents, see: https://derechosypoliticafiscal.org/en/the-project/history.
[9] ACIJ, CELS, CESR, DEJUSTICIA, FUNDAR, INESC and the Red de Justicia Fiscal de América Latina y el Caribe.

Principles in practice. The compendium of principles and guidelines can serve two goals: providing guidance to decision makers who seek to align fiscal policy with human rights in their realm of action; and facilitating tools to promote accountability from judicial and quasi-judicial actors, international institutions, and civil society.

Some of the Principles relate to specific topics such as the environment or gender equality, while some others are more general and refer to issues such as how to promote equality through fiscal policy. One of such overarching issues relates to FTPA, consolidated in Principle 7, as explained in further detail in the following section.

### 3.2 PRINCIPLE 7 OF THE PRINCIPLES FOR HUMAN RIGHTS IN FISCAL POLICY

Principle 7 of the Principles for Human Rights in Fiscal Policy states that "Fiscal policy must be transparent, participatory and accountable. People have a right to fiscal information". It further engages with different aspects that derive from such general standards, such as: (a) states' need to strengthen fiscal culture; (b) their obligation to produce, publish and provide access to good quality fiscal information; (c) states' obligation to disaggregate information in a way that permits analysis of how fiscal policy impacts different people or groups; (d) the need to produce high-quality indicators; (e) states' duty to limit access to fiscal information only in very exceptional cases, and subject to strict limitations; (f) states' duty to ensure that fiscal policy decision-making processes are open to an informed public debate, through meaningful, inclusive, broad, transparent and deliberative participation.

The Principle builds on numerous sources such as the International Covenant on Civil and Political Rights, Inter-American Court of Human Rights case law, several general comments and concluding observations of United Nation Treaty Bodies, and reports of United Nations Independent Experts and Special Rapporteurs[10]. Together with the Principles, the associated guidelines provide an array of concrete implications that human rights standards in the field have for policymakers. The guidelines are a good example of how decision makers can extract concrete policy recommendations from general human rights standards. We will take a closer look at them to show how much can be unpacked from human rights.

Regarding **transparency**, human rights norms and related sources indicate that states should "produce and give the broadest possible access to quality fiscal information", establishing that, as a rule, fiscal information should be publicly available (guideline 1). Such information should include measurable goals for fiscal policy, on which progress is measured and reported. Human rights also indicate that information should be reliable, timely, accessible, published in open and reusable formats, and adequately disaggregated to account for the different impacts of fiscal policy on different people, groups and populations.

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[10] For an overview of the sources consulted for the elaboration of this Principle, see: Derechosypoliticafiscal.org (2022).

"Human rights-aligned" transparency also indicates how to translate transparency into concrete guidelines for budgets, which would include measures such as using "program budgeting", "multi-annual budgeting", or "results-based budget systems" based on indicators of the effective enjoyment of rights that are sufficiently detailed to respond to the needs of specific populations; using budget lines and codes that are consistent among the national and subnational levels, or mark expenditures that have the potential to promote the rights of certain people, groups, and populations (guideline 2).

Human rights also challenge the idea of "tax secrecy", requiring that secrecy regulations are harmonized with the right to access public information, for example, by interpreting secrecy in the strictest way possible, opting for transparency in case of doubt, or excluding tax amnesties, tax expenditures and differentiated treatments from secrecy (guideline 4). Fiscal transparency must not only pertain to governmental information, but also certain information from corporations, intermediaries, and other non-state actors (guideline 5).

In terms of **participation**, human rights standards would enjoin states to ensure a participatory budgetary process which allows for "meaningful" participation, including by people who face structural discrimination. To secure meaningful participation, states can conduct education and awareness initiatives, and generally promote fiscal education, culture, and democracy. They should ensure that fiscal decision-making processes are based on the broadest possible national dialogue, for instance by adopting specific measures to guarantee equal access and opportunities to participate in fiscal decision-making, particularly for people living in poverty or facing structural discrimination; encouraging independent civil society organizations and academia to develop alternative fiscal policies and undertake research; promoting fiscal education and providing access to all relevant information in an accessible and understandable format with the aim of generating awareness of how taxes benefit society and how fiscal policy affects the realization of human rights; formalizing the role of civil society in fiscal policy processes, or implementing communications campaigns.

Finally, in terms of **accountability**, human rights standards indicate that states, among other things, may carry out human rights impact assessments of fiscal policy, which should be comprehensive, participatory, regular, informed, transparent, subject to independent verification, and estimate the differentiated impacts on specific groups (guideline 6).

## 4 ILLUSTRATIVE CASES

FTPA are especially important in countries where fiscal policy has the biggest room for improvement. This is the case in Latin America, the most unequal region of the globe, where regressive tax systems, high reliance on consumption taxes and exploitation of non-renewable resources, and worrisome levels of tax abuse are prevalent. In the region, recurrent economic crises and macroeconomic

instability often prompt governments to condemn fiscal deficits and single out fiscal austerity as "the only way out". Still, every year institutions such as the Economic Commission for Latin America and the Caribbean (ECLAC) or the Organisation for Economic Co-operation and Development (OECD)[11] and several civil society organizations highlight tax revenue collection in countries from Latin America as being far below what is sufficient and below the average for country members of the OECD. Indeed, Latin America was the region that gave birth to the Principles for Human Rights in Fiscal Policy, building on decades-long efforts of civil society to tackle some of the mentioned problems.

This regional context makes FTPA not only particularly relevant, but also more challenging to implement. It is therefore crucial to explore ways in which different actors and stakeholders can gather efforts to bring into practice the Principles described in the previous sections of this paper. With this aim, this section presents two case studies that illustrate how non-state actors can rely on the human rights framework to increase FTPA in practice.

The selected cases come from Latin America, to show how even in a challenging context reliance on the human rights framework can prove useful. They also model initiatives that seek to make fiscal policy fairer through FTPA, increasing their relevance. The cases were selected for the mentioned reasons and because there is enough public information about them to build a solid account. The selection does not aim to make the cases representative of others or of general trends, and does not imply that there are no other relevant cases either in Latin America or other regions of the world.

In these cases, the non-governmental organisations (NGOs) involved worked under the assumption that fiscal austerity cannot be the only alternative for states to fulfill their obligation to mobilize resources. On the contrary, before taking regressive measures such as cutting budgets, according to the human rights framework, states should assess other more progressive alternatives, such as taxing the rich or combating tax evasion.

Accessing relevant fiscal information (increasing transparency) was a way to effectively show that there are alternatives to mobilize resources, specifically through reviewing the tax benefits that are usually granted without seriously evaluating their trade-offs. Tax benefits may include a wide range of fiscal instruments, such as tax exemptions, condonations and amnesties. Although they are not bad *per se* (for example, there are exemptions or deductions for low-income people) they are not always considered as an expenditure by governments. As a consequence, tax benefits are usually subject to less strict standards or processes of evaluation and accountability.

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[11] See IADB et al., 2021.

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For the same reasons, accessing information on tax benefits is a difficult task in countries from Latin America. Strong regulations on tax secrecy, low levels of accountability, transparency and disaggregation of information make it difficult for civil society to control where public money is going. The following cases illustrate how to challenge these barriers successfully, relying on the human rights framework.

### 4.1 CASE ONE: HOW MUCH DO TAX BENEFITS COST ARGENTINA?

Despite the obstacles to accessing relevant fiscal information, in 2015 the Civil Association for Equality and Justice (ACIJ) estimated that tax benefits amounted to 2.64% of Argentina's GDP and 10.8% of the federal budget (ACIJ, 2018). When compared to other expenditures, ACIJ could find that tax benefits equaled the resources allocated to tackle food insecurities of the most vulnerable and represented almost 40% of public expenditures on pensions and retirements – the costliest federal program. This same tendency was shown for the following years[12].

According to ACIJ, in Argentina at least 21% of tax benefits are granted through economic promotion regimes, largely regulated by the executive and without any control from the legislature and/or the public at large (ACIJ, 2018). An example of this is the fact that the most relevant economic promotion regime (involving exemptions to a wide range of taxes) was established in 1973 to enhance the population of an isolated area of the country. However, after more than 40 years, there has been no public report or public assessment justifying its continuity.

These rough estimates convinced ACIJ of how powerful it could be to access more information about tax benefits and to analyse this data through a human rights lens. To start with, it could be used to show how much money the government could be allocating to ensure rights. Also, it could also be a strong basis to demonstrate that Argentina was not properly evaluating all the available alternatives to mobilize resources.

#### 4.1.1 FIRST ROUND

Despite having a robust federal law on access to public information, accessing fiscal information is a challenge in Argentina. When asked for fiscal information, the federal tax agency usually argues that it is "technically difficult" to provide it without violating tax secrecy and that the obligation to provide public information does not entail the duty to produce information.

In 2017 ACIJ submitted a request to the federal tax agency asking for disaggregated data regarding the amounts of tax condonations made by the federal government during the years 2010-2016. The aim of the request was to determine how much money Argentina spends every year in condoning tax obligations: condonations that are usually granted without any transparency or impact assessments and

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[12] For example, in 2019 ACIJ showed that tax exemptions amounted to 2.33% of the national GDP and 8.9% of public revenues.

on a very discretionary basis. For ACIJ, revealing that information would actually help to find out whether Argentina is violating its obligation to mobilize the maximum of available resources to realize rights (ACIJ, 2018).

Although the government refused to deliver (even global) data on condonations, the judicial process itself led to a series of dialogues and exchanges of information between the two parties. The case is still waiting for a final decision from the Court of Appeals.

### 4.1.2 SECOND ROUND: PART "A"

In order to avoid the usual defense regarding the difficulties in processing fiscal data, ACIJ decided to make a second, more focused request for information. This time, ACJI asked the federal tax agency for specific data on the export subsidies directed at benefiting a group of big companies in the south of the country ("reembolsos a las exportaciones por puertos patagónicos"). Drawing on budgetary information, the claim noted that the treasury was losing around three billion pesos each year due to these tax expenditures. The federal government refused to answer the request and argued that data was protected by tax secrecy regulations (ACIJ, 2020).

The Court of Appeals entered judgment for ACIJ, accepting innovative arguments introduced by ACIJ that narrowed the scope of tax secrecy. In the core of the decision, the judges understood that whenever a person agrees to receive tax exemptions he or she is benefiting from an exception to a general rule: the rule that everyone should pay taxes on an equal basis. Thus, in a way, beneficiaries are "receiving" public funds that should be subject to the public scrutiny (ibid).

### 4.1.3 SECOND ROUND: PART "B"

In a separate claim, ACIJ challenged the federal tax agency's refusal to deliver information regarding a regime of tax benefits directed at aiding small and medium- sized companies. This time, the federal agency's defenses were grounded on tax secrecy allegations but also added that the claim concerned sensitive per-sonal information (ibid).

The court confirmed the arguments made by the national agency on access to infor-mation and ordered the federal tax agency to deliver the information requested. Drawing on principles mainly developed in the Inter-American system of human rights – the Principles of presumption of disclosure and maximum disclosure – the decision considered that data on the identification and amounts of benefits received by the beneficiaries of tax benefits are public information. According to the national agency, rules governing tax secrecy must be interpreted strictly and cannot be an obstacle to scrutinize the use of public allocations. Similarly, the agency considered that whenever a person applies for tax benefits, he or she agrees to submit his or her personal information to public scrutiny (ibid).

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**4.2 CASE TWO: CHANGING THE NARRATIVES IN MEXICO – FROM TAX BENEFITS TO TAX PRIVILEGES**

In México tax benefits are an even more worrisome issue than in Argentina. Mexico's percentage of revenue collection per GDP is much lower than Latin America's average – which, in turn, is already low when compared to OECD countries. According to the OECD, Mexico collected a total of 16.3% of GDP, compared to an average of 33.4% in OECD countries and 22.9% in Latin America (OECD, 2019). However, it was not until 2007 – when a national monitoring body reported that "certain taxpayers have been consistently avoiding their tax duties without the government enforcing actions against them"– that Fundar and allies became aware of the serious implications that tax benefits may have for the financing of human rights (Fundar, 2016). In this context, Fundar and allies started a successful campaign and litigation strategy against the federal government to access information about tax condonations[13] and cancellations[14] (hereafter referred to as tax amnesties). Given the refusal of the federal administration to provide any information, Fundar challenged the constitutionality of the law governing tax secrecy. Although the Supreme Court considered that the law was not unconstitutional, it provided an interpretation that narrowed the scope of tax secrecy on the grounds that "an absolute and general reserve of information is in violation of the principle of maximum disclosure".

This decision contrasted with the continued application of tax secrecy by the federal tax agency. This prompted a public campaign to change the rules governing tax secrecy and led to a 2013 modification that required the tax agency to publish the names of the beneficiaries. The reform included an Executive message stating that the policy had "the aim of making a more transparent application of [cancellations and condonations] and was in response to the social demands to scrutinize these fiscal decisions". Social demands continued and eventually led to new regulations requiring the federal government to publish not only the names but also amounts of tax benefits received in the concepts of cancellation and condonation (Fundar, 2016).

More institutional reforms in the field of access to information and transparency also strengthened these social demands. For example, the constitutional reform of 2014 granted autonomy to the federal agency on transparency and access to information which in turn, allowed the agency to make strong statements and urge the tax federal agency to adequately motivate the granting of tax benefits. According to this agency, transparency was deeply linked to an efficient allocation of resources and to the fight against tax avoidance.

In May 2019, influenced by the success of Fundar's campaign, the new president, López Obrador, issued a decree stating that there would be no tax cancellations and condonations in the future. Following that, in 2020 tax benefits were prohibited through a constitutional amendment.

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[13] Tax condonations are usually granted to increase public revenues in a short term, or to promote certain economic activities.
[14] Tax cancellations are tax debts that the government decides not to enforce provided its small amount or the insolvency of the debtor. They are not condonations, as the credit continues to exist in favor of the government.

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### 4.2.1 WHAT WAS BEHIND TAX SECRECY?

After many years of struggle, in 2019 the federal tax agency finally released part of the information requested. This allowed Fundar to process data and revealed that 26% of the total money amounting for tax cancellations had been granted to only 10 people, representing 0.1% of the beneficiaries. One company alone received in tax benefits the as much as had been allocated to infrastructure for running water in 2015.

Given that the tax administration did not explain the regulation or reasons that justified the cancellations in each particular case, it was not possible to assess their legality and legitimacy. However, based on additional requests for information made to the federal tax agency, Fundar concluded that there were no criteria for decisions about tax cancellations, and no methodology.

These decisions were rather made on a discretionary, non-systematic and irregular basis. The lack of impact assessments impeded evaluation of whether there was any public benefit derived from these massive cancellations. Similarly, the little information provided by the tax federal agency regarding the tax condonations that took place in 2007 and 2013, suggested that many taxpayers had benefited from more than one program of condonations. Far beyond the goal of providing the treasury with short-term revenue, this could create bad incentives for taxpayers and may ultimately affect the revenue collection.

### 4.3 LEARNING FROM THE CASES

In Argentina, the outlined decisions show how courts are starting to accept that rules governing tax secrecy must be strictly interpreted when it comes to regimes that provide some companies or persons with special benefits. Accepting that tax benefits and exemptions are public expenditures may have the powerful potential to: (a) provide civil society with useful information to evaluate governmental priorities and compare these kinds of expenditures to others; (b) create awareness of the fact that tax benefits should not be considered as a complete discretionary tool for governments to use without any human rights impact assessments and/or procedural and/or substantial limitations. Rather, governments should develop adequate tools and mechanisms to assess their impacts on a permanent basis and under objective criteria. Similarly to the cases litigated in Mexico, ACIJ highlighted the relevance of the human rights principles to achieve these goals (ACIJ, 2018).

In Mexico, the collective efforts made by Fundar and allies helped to change the narratives from the idea of "tax benefits" to "tax privileges". This meant creating public awareness of the fact that tax benefits can be unfair when granted without any transparency, or human rights impact assessments. As reported by the International Budget Partnership, "through its efforts to highlight the unfairness of tax amnesty programs' concentrated benefits, Fundar educated the public about the importance of being able to see precisely not only how the state spends public money, but also how it collects it" (IBP, 2017: 3).

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In turn, the human rights framework helped to demonstrate that an efficient allocation of public resources is not only about how the government makes its budgetary decisions. It also requires that revenues are collected through ensuring the principles of equality and non discrimination, transparency and accountability. This is why "the campaign advanced not only the specific goal of tax transparency, but also the broader cause of equitable fiscal policy. Their efforts made the issue of economic inequality in the country more evident and demonstrated that while some benefited from tax amnesties – often with no apparent reason – others regularly met their tax obligations."

## 5 CONCLUSIONS

As shown in this article, transparency, participation and accountability are widely regarded as valuable standards that governments should introduce in their fiscal policy. However, they are often unobserved in practice as there is a gap between acknowledging the importance of FTPA on paper and their implementation in practice. The human rights framework can be a powerful tool to achieve the actual incorporation of FTPA standards into fiscal policy.

Over the last years, a growing body of standards recognizing that fiscal policy needs to be aligned with human rights, and interpreting how such alignment could take place, started to emerge from the work of courts, international human rights bodies, and even civil society organizations. The ultimate example of such efforts, which systematized existing standards on the issue, are the Principles for Human Rights in Fiscal Policy.

The Principles contain a specific standard (Principle 7) that demands "transparent, participatory and accountable" fiscal policies. It also recognizes the right to access fiscal information. As shown throughout the paper, this Principle has several implications as it requests states to: (a) strengthen fiscal culture; (b) produce, publish and provide access to good quality fiscal information; (c) disaggregate information in a way that permits analysis of how fiscal policy impacts different people or groups; (d) produce high-quality indicators; (e) limit access to fiscal information only in very exceptional cases, and subject to strict limitations; (f) ensure that fiscal policy decision-making processes are open to an informed public debate, through meaningful, inclusive, broad, transparent and deliberative participation; (g) carry out human rights impact assessments of fiscal policy, which should be comprehensive, participatory, regular, informed, transparent, subject to independent verification, and estimate the differentiated impacts on specific groups.

As shown in the illustrative cases, the normative value of human rights was also used to engage in litigation, which ultimately led to more robust standards regarding fiscal transparency. This shows the potential of human rights to provide civil society and decision-makers with flexible standards to adapt to the changing needs of the times and properly channel the current social demands.

The analysis provided in this paper, however, has limitations in its scope. The cases presented are few, and not analyzed in full detail. They do not seek to work as full "case studies" that provide empirical support to the arguments made, but only to illustrate how general standards can play out in practice. Future research could explore cases from other parts of the world, and cases that explicitly engage the Principles for Human Rights in Fiscal Policy. Furthermore, future research could analyze how other initiatives can interact with the aforementioned Principles to increase FTPA.

The arguments made in this paper have at least two relevant policy implications. First, they require better and more institutionalized coordination among different areas of government that usually work in silos (e.g., offices with the authority to implement human rights and those with competence to make fiscal decisions). Second, more capacity-building and awareness-raising activities are needed, geared to government agents' understanding of the binding and normative nature of human rights, and the particular implications for all the spheres of governmental action in fiscal policy.

**Disclosure statement**
The authors declare that they have no conflict of interest.

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# Local Public Finance –
# An International Comparative
# Regulatory Perspective

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The regulation of local public finance is an issue of increasing importance. Local governments provide a wide range of public services, ensure critical infrastructure, and are key to citizens' trust in government. However, budgetary constraints and overarching regulations affect their functioning and often impair them significantly. The number of budgetary regulations is increasing and the quality of their implementation is also increasing. Considering how important local public finance regulation is to both centralised and federalized national governments, there is surprisingly little research on local government finance from a comparative European perspective and, in particular, on its effective regulation.

The book *Local Public Finance – An International Comparative Regulatory Perspective* brings together the work of forty experts in the disciplines of political science, economics, and public administration who approach the topic of local financial regulation at different levels and in different contexts in Europe. The book's editors are highly respected professors and scholars from Germany: René Geissler is a professor of public management at the Technical University of Applied Sciences in Wildau; Gerhard Hammerschmid is a professor of public and financial management at the Hertie School and Director of its Centre for Digital Governance in Berlin, and Christian Raffer is a local government finance expert at the German Institute of Urban Affairs in Berlin.

As can be seen from the title and subtitle of the book, almost all chapters deal in one way or another with the problems of financial decentralisation and financial regulation. Despite the numerous publications by experts and scholars on the regulation and supervision of local government, there is still a lack of clarity about the concept of a modern regulatory and supervisory framework. Most authors have focused on the research question: Which drivers have influenced the development of local public finance regulatory systems and how regulatory systems have changed over time as a result of the 2008 crisis?

In addition to an introductory text written by editors Geissler, Hammerschmid and Raffer, the book contains eighteen more chapters organized in three parts: Concepts of Regulation, Bailouts and Insolvency, and Local Public Finance in Times of Crisis. The chapters include tabular and graphical presentations as well as reference lists.

In the introduction, the editors explain that this volume is guided by a discussion of two key concepts: financial decentralisation and financial regulation. They define financial decentralisation as the process of reassigning expenditure functions and revenue sources to lower levels of government. They define financial regulation as all forms of national authority that are intentionally used to influence the revenue and spending patterns of local governments. This interference inevitably leads to a restriction of local autonomy and is therefore a thoroughly controversial political issue.

In the first part of the book, titled *Concepts of Regulation*, the authors introduce the basic ideas and concepts of fiscal regulation, present new evidence from country cases and comparative analyses and suggest policy guidelines based on lessons learned from best practices. All seven chapters in the first part of the book show that fiscal crises, EU legislation, administrative traditions and path dependencies strongly influence the development of local public finance regulatory systems. After the 2008 financial crisis, local fiscal rules are common in all EU member states, with the fiscal balance rule and borrowing and debt constraints being the most widespread. The main conclusion is that well-designed local tax structures prevent cyclical revenue fluctuations and reduce the need for local public finance regulation.

According to Raffer and Ponce, an interesting paradox has emerged: countries with strong fiscal stability (e.g., the Scandinavian countries) tend to have less stringent regulatory systems, while countries with a history of financial instability in local governments (e.g., Hungary, Italy) have more restrictive regulatory systems. The authors suggest that this may indicate that fiscal regulation has limited impact, that its implementation only follows budget crises rather than preventing them. Denmark, on the other hand, seems to have taken a different path, as evidenced by high fiscal autonomy in the early 2000s and declining freedom in recent years.

As for the public finances of local governments, Bronić et al. found that EU accession was an important historical driver for countries' regulatory systems and has improved the quality of public administration in general. EU accession was a catalyst that led to stricter fiscal control in Slovenia and Croatia than in Serbia.

De Widt et al. point out that the different approaches in England and the Netherlands reflect different perceptions of risk in each country. In England, strict budget rules reduce the likelihood of a fiscal crisis. Each local government must ensure that planned expenditures for a single year do not exceed total revenues. In the Netherlands, by contrast, the focus is on ensuring that local government borrowing and borrowing costs remain sustainable by taking into account the related concepts of debt ratios, solvency and liquidity.

According to Roesel, government authorities in Austria and Germany monitor local governments continuously and closely, but financial supervisors are linked to political parties, which leads to collusion and contributes to less sustainable fiscal management. Both countries have already begun introducing reforms that shift the fiscal supervision of local governments from politically or locally aligned supervisors to more independent authorities.

Turley, Raffer and McNena point out that differences across countries must be carefully considered when designing appropriate local tax rules. The choice of rule or set of rules depends on the country's circumstances, economic structure and initial conditions, the wider intergovernmental fiscal framework, and the priority given to various policy objectives.

In the second part of the book, titled *Bailouts and Insolvency*, the authors take a closer look at the bailout practices that have been used at the local level in Europe. This part not only discusses insolvency regimes as alternatives to municipal bailouts, but also shows how they are currently operating in Hungary, Italy, Switzerland, and the United States. It appears that fiscal decentralization carries the risk that subnational governments will act in the belief that a higher level of government will bail them out if they get into trouble. Fiscally responsible behaviour by subnational governments seems to depend on a balanced mix of policy measures, in particular the provision of sufficient financial resources, adequate fiscal supervision, early intervention mechanisms, and sufficiently unattractive bailout rules. It seems that local fiscal autonomy must be limited to some extent to prevent local profligacy. It is interesting to note that in Germany, despite the existence of strict budgetary frameworks and fiscal equalisation systems, local budget crises have been a phenomenon for decades. As an institutional response, most German states have introduced bailout packages to restructure municipal finances. Person and Geissler evaluated the impact of local government bailouts on fiscal performance and came up with a structure of bailouts referring to institutional design, timing, and scope. However, the authors noted that "fiscal supervision changed state-local relationships and constrained local democracy in several ways. It remains an open question whether local governments are willing to accept fiscal and political constraints on a permanent basis, even in times of poor economic conditions".

In the third part of the book, titled *Local Public Finance in Times of Crisis*, the authors address the issue of global crises and their impact on local governments, taking a closer look at the practices used in Europe after the 2008 crisis. They compare the responses of local governments in Greece, Germany, Italy, and the United Kingdom. Taken together, these five chapters show that central governments need to adopt different strategies to deal actively with the local financial crisis. They highlight the importance of local governments' financial resilience. Drawing on large-scale surveys and comparative case studies, they describe how the institutional context affects local governments' ability to anticipate, absorb, and respond to financial shocks. Fiscal regulations can force local governments to build anticipatory capacity. However, fiscal frameworks and major policies such as austerity measures can also weaken local government capacity. Wortmann and Geissler have studied the direct and indirect effects of the 2008 crisis on twenty one European countries. They argue that the strengthening of local public finance regulation was a direct result of this crisis and the related changes in EU legislation. However, even though local finances have recovered or at least stabilized in most countries, local levels find themselves having less local autonomy.

The shortcomings of this book are indicated by the impression that chapters would "work" better in journals than in a book; often the same ideas and recommendations are repeated. Also, some of the chapters are written in a very academic manner and are difficult to understand if one is not familiar with the topic. All three editors are experts in the field of local public finance and are co-authors of some

of the chapters in the book. The book lacks a list of abbreviations and an index of terms. These additions are particularly important in the area of increasingly complex public sector regulation and the use of a number of abbreviations in this context. In this sense, the breakdown of meta-language in public finance is certainly a useful addition for readers, especially those who are not part of the already professional public.

The book is somewhat challenging for readers. It is not intended for quick reading as it fully discusses a variety of topics in detail. Some parts might even need re-reading. In the context of the terminology used and the writing style, a professional terminology is used that makes it difficult for non-professional readers. Therefore, a list of abbreviations and an index of terms would be helpful.

In conclusion, the book *Local Public Finance – An International Comparative Regulatory Perspective* contains a number of interesting cases on local public finance in EU countries, giving the reader a complete overview of the problems and solutions of the local public finance system. Moreover, it can be used as complementary reading in postgraduate courses in local public finance systems and can also be very useful for researchers working in this field. Accordingly, it could become essential reading for researchers, students, and all other professional publics interested in local public finance topics.

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