# Impact of information and communication technologies on budget transparency of the provincial government in Vietnam

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| C H R O N I C L E | A B S T R A C T |
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| | The concept of fiscal transparency holds significant importance; however, its attainment poses considerable challenges. Current discourse suggests that the concept of transparency lacks sophistication. To tackle this hurdle regarding public expenditure, analytical approaches that pertain to the general concept of transparency can be utilized. The present paper aims to ascertain the determinants of the openness of the provincial budget and its subcategories by human development, technology access, as well as industrialization progress, in addition to other relevant indicators. This study aims to ascertain the fundamental principles that underpin the achievement of efficient transparency in public expenditure. In terms of outcomes, the overall model has limited relations to the hypotheses. For the elemental dependent variables, the impact of various forms of transparency on the attainment of public policy goals varies, but generally have similar results. The study has attempted to conclude the components for an optimal transparent budget system, thus providing a suggestion for effective schemes later on.<br> |

## 1. Introduction

Budget transparency is fundamentally intertwined with a nation's level of human development, industrialization, and adoption of information technologies. These three factors shape the contexts and capabilities surrounding government budgeting processes in profound ways. Human development, as a multidimensional concept encompassing health, education, equity, freedoms and overall human flourishing, has direct bearing on budget transparency dynamics (Prabhu, & Iyer, 2019). Countries at higher rungs of the human development ladder tend to have more economic resources, stronger institutional capacities, and more empowered and engaged citizenries (Griffin, 1994). These attributes create enabling environments where budgets are subjected to greater public scrutiny and pressures for openness. Highly developed nations also typically possess more technically skilled human capital within government ranks to produce comprehensive and high-quality budget data and reporting. An educated populace is better positioned to analyze this information as well. Conversely, low human development contexts often constrain budget transparency due to limited state capacities, less assertive civil societies, and deficits in disseminating accessible budget information. The relationship between industrialization and budget transparency flows from how an economy's sectoral composition influences government revenue sources and expenditure priorities. Industrialized economies tend to concentrate public funds towards urban infrastructure, manufacturing, energy and transportation - creating unique budgeting needs compared to agrarian-based developing countries that prioritize rural and agricultural development. Information and communication technologies (ICTs) have also become decisive modern enablers and constraints around budget transparency. Digital platforms, online portals, mobile apps and data analytics

capabilities offer powerful new tools for governments to comprehensively disclose budget information and facilitate public participation. ICTs democratize fiscal data in unprecedented ways.

## 2. Literature review

### 2.1. Impact of Human Development on Budget Transparency

In the past, development has mostly been seen from an economic perspective, with the primary objective being to boost economic production. Nevertheless, according to Ranis et al. (2000), academics contend that economic growth alone is insufficient to constitute progress. The provision of health care, education, food, clothes, and a safe place to live are all essential components of development (Streeten, 1981). Empowerment, equity, sustainability, social equality, and freedoms—both the freedom to be healthy and the freedom to accomplish one's values—are also part of it (UNDP, 2019). All these qualities are included under the umbrella of "human development," which is a framework for understanding development that has been presented using the capability approach and the idea of human rights (Sen, 1997, 2005). To accomplish policy goals, governments create budgets that detail how funds will be distributed (OECD, 2015). According to Blöndal (2003), budget transparency entails being honest about policy goals, development, and execution. One definition of budget transparency is the practice of making publicly accessible information about a government's financial transactions and decision-making processes that is accurate, up-to-date, easy to comprehend, and comparable on an international scale (Premchand, 1993). Few studies have examined how development results change when budgets are open and accessible, as pointed out by De Renzio and Wehner (2017). Additional research is necessary in this field, despite the fact that Kaufmann and Bellver (2005) proposed a connection between transparency indices and indicators of human development and Fakuda-Parr et al. (2011) discovered a positive correlation between budget transparency and levels of human development (albeit this effect was reduced when control variables were included).

It is critical to make the budgeting process transparent and easy to understand if budgets are to be tools to promote human rights and development. Greater budget openness may aid in the accomplishment of human rights and human development objectives, which are important to the discourse of human development (Vizard et al., 2011). Government budgets may be better aligned with the larger goals of fostering human well-being, fairness, and freedoms if information about their allocation and utilization is made publicly available. Making sure people are involved in the budgeting process is important because it makes governments provide money to people based on their wants and needs (UNICEF, 2007). To improve human development, it is essential to meet these requirements, which include things like being healthy, going to school, learning new things, and having a reasonable living wage (UNDP, 1990). The following theory is put out in light of this assumption:

**Hypothesis 1:** *Human development has positive impact on Budget transparency of the provincial government in Vietnam.*

### 2.2. Impact of Industrialization on Budget Transparency

Budget transparency plays an extremely important role in the capital market. The more public and transparent the budget source is in finance, the more precise and healthier the capital market is (Healy & Palepu, 2001). According to United Nations, China has been vigorously promoting the construction and management of one-stop administrative service centers. These local financial centers are given more attention and facilitate the provision of transparency in various fields, specifically the transparency of the state budget, in their research. The author mentioned that these emergency centers resolved a total of 2,277 million transactions and almost all completed them on time. The process of industrialization is becoming more and more extensive, specifically the industrial revolution and modernization are increasingly emphasized, budget transparency is increasingly improved and enhanced. Transparency in administrative systems is increasingly enhanced worldwide by online data retrieval models. Open data systems are not only about accountability but are considered a necessary element of the new data economy system (Birchall, 2015). The utilization of the internet for disseminating information to the public has been shown to enhance transparency, as it facilitates citizens in easily accessing official information and conducting transactions conveniently (Pina, Torres, & Royo 2007; Cuillier & Piotrowski 2009; Pina, Torres, & Royo 2010; Bearfield & Bowman 2017). The consensus among the chosen studies is that simply providing information on the internet, or a website does not enhance transparency unless the technology incorporates interactivity (Valle-Cruz, Sandoval-Almazan, and Gil-Garcia 2016). The theoretical literature often asserts that transparency leads to a reduction in corruption. Valle-Cruz, Sandoval-Almazan, and GilGarcia (2016) explore the influence of citizens' utilization of information technology on their perceptions of transparency, efficiency, and corruption within local government. While they find a moderate correlation between transparency and corruption, they are unable to establish a direct causal relationship between the two.

**H2:** *Industrialization has positive impact on Budget transparency of the provincial government in Vietnam.*

### 2.3. Impact of Information and communication technologies on Budget Transparency

The existing body of literature posits that the quality of governance has a crucial role in shaping a nation's economic and social progress (Kraay & Tawara, 2010; Busse & Gröning, 2009). According to Cule and Fulton (2013), the presence of high-quality governance plays a crucial role in enhancing the corporate environment through the facilitation of compliance and efficiency in governance practices. ICT enhances the dissemination of information to the general public, allowing them

to gain a deeper understanding of the government's operations. This, in turn, leads to improved accountability, transparency, and governance. Multiple studies have indicated that the dissemination of ICT has the potential to improve the quality of governance inside a nation (Singh & Sahu, 2008; Lee & Lio, 2016; Saxena, 2018; Dasuki et al., 2014). According to a study conducted by Popelyshyn et al. (2019) in Ukraine, the implementation of an open data system by the government resulted in a notable enhancement in transparency and an improvement in the perceived performance of the government. A further study conducted in Africa determined that the mere dissemination of ICT was insufficient to enhance country governance (Sassi & Ali, 2017). To facilitate the utilization of hardware, it is imperative to incorporate ICT skill competency into the development of effective ICT usage (Kirlidog et al., 2018; Chang et al., 2016). The quality of governance plays a crucial role in promoting the establishment of an efficient property rights system and ensuring the optimal functioning of the market, hence maximizing the potential outcomes derived from economic development variables. This notion of a high correlation between different country-level governance and economic performance is also supported by other pertinent studies (Mauro, 1995; Acemoglu, 2012; Dollar & Kraay, 2004; Heilmann & Kahn, 2019; Rodrik, 2000). Based on the available theoretical and anecdotal evidence, it can be concluded that the significance of governance quality in relation to economic development and the attainment of a high standard of living is supported.

**Hypothesis 3:** *Information and Communication Technologies has positive impact on Budget transparency of the provincial government in Vietnam.*

## 3. Research Methods

Research sample: The sample is 63 provinces and cities across the country, representing diversity in human development levels, levels of industrialization and information technology penetration. This broad sample selection is intended to enhance the representativeness and generalizability of the results. Data was collected and analyzed over the period 2017-2021 to ensure timeliness and reflect recent trends. Surveying many consecutive years also helps control the time factor and improve the reliability of the results. To explain the relationship between the expected value of the dependent variable (budget transparency on the website) from the values of two or more explanatory variables (selected factors) on the basis of sample data, researchers use Using multivariate linear regression (MLR) technique with ordinary least squares (OLS) estimation method - minimizing the variation of error when estimating regression coefficients β. This is considered one of the popular statistical models to test scientific theories (Nguyen Dinh Tho, 2014). Most research on factors affecting state information transparency is conducted based on the MLR-OLS model. In the thesis, the analysis of the influence of selected factors on the level of budget transparency is carried out in 3 cases: mandatory, voluntary and general. Accordingly, the researcher took three indicators: mandatory disclosure (POBIM), voluntary disclosure (POBIV) and overall disclosure (POBIG) for regression analysis with 11 explanatory variables reflecting factors from the supply and demand sides are transparent based on the following 3 equations:

Regression 1: $POBI_M$ $= \propto + \sum_{i=1}^{11} \beta_i X_{ij} + \varepsilon_i$

Regression 2: $POBI_V$ $= \propto + \sum_{i=1}^{11} \beta_i X_{ij} + \varepsilon_i$ $\quad$ (j = 1, …, 58)

Regression 3: $POBI_G = POBI_M + POBI_V$ $= \propto + \sum_{i=1}^{11} \beta_i X_{ij} + \varepsilon_i$

In MLR analysis, there are two main methods for model selection: confirmatory (simultaneous) or exploratory (stepwise) methods. According to Alcaraz-Quiles et al. (2015), there is no single method to select the best model. Which method to approach depends on the goals of the NNC (Field, 2009).

**Table 1**
Variable information

| Variable | Abbreviation | Measuring method | Expectation | Data source |
|---|---|---|---|---|
| Dependent Variable | | | | |
| Total Provincial Open Budget Index | POBI_Totl | | | |
| Independent Variables | | | | |
| Transparent Provincial Open Budget Index | POBI_Trans | | + | |
| Accountable Provincial Open Budget Index | POBI_Account | | + | |
| People Participating Provincial Open Budget Index | POBI_Parti | | + | |
| Economic growth | Growth_L~100 | lnGRDPit - lnGRDPit-1 with GRDPit and GRDPit-1 being GRDP of the province/city i in year t and t-1 respectively | + | |
| Human Development Index | HDI | | + | |
| State Expenditure | LNG1 | Natural logarithm of investment of year t | - | |
| People Participation Index | TG | | + | |
| Clarity Index | CK | | + | |
| Explanation Responsibility Index | TN | | - | |
| Control Ability Index | KS | | + | |
| Procedure Index | TT | | - | |
| State Service Supply Index | CU | | - | |
| Openness | Openness | | - | |
| Gini coefficient | GINI | | - | |
| ICT Accessibility Index | N_Inter | The number of mobile numbers in province/city i in year t | + | |
| Industrialization Index | Industry | | - | |

- The simultaneous method is often used to test scientific theories, including hypotheses deduced from existing theories (Nguyen Dinh Tho, 2014). It puts all the variables to be tested at once. Then, based on statistical parameters, NNC will self-assess which variables to exclude or which variables to include (Hoang Trong & Chu Nguyen Mong Ngoc, 2008).

- The step-by-step method is often used to discover relationships between variables, including relationships that do not have a solid theoretical basis to deduce and relationships discovered from the market, especially when NNC wants to adjust, complement existing models in the specific context of Vietnam (Nguyen Dinh Tho, 2014). This method, whether by gradually introducing variables or gradually excluding variables, uses stopping rules based on pre-established criteria to test the hypothesis (Alcaraz-Quiles et al., 2015).

## 4. Results

**Table 2**

Descriptive statistics

| Variable | Obs | Mean | Std. dev. | Min | Max |
|---|---|---|---|---|---|
| Growth_L~100 | 315 | 10.15064 | 22.18552 | -158.3773 | 124.8838 |
| HDI | 315 | .695419 | .0503644 | .565 | .821 |
| LNG1 | 315 | 8.266924 | .865312 | 4.615121 | 10.60242 |
| TG | 315 | 5.056327 | .5161042 | 3.8 | 6.405872 |
| CK | 315 | 5.374582 | .4235732 | 4.2 | 6.498768 |
| TN | 315 | 4.835344 | .4037928 | 3.84 | 6.247622 |
| KS | 315 | 6.658419 | .5570838 | 4.362395 | 8.285748 |
| TT | 315 | 7.294274 | .2406095 | 6.64 | 7.947027 |
| CU | 315 | 7.233797 | .393712 | 6.28 | 8.46 |
| Openness | 315 | -2.382857 | 8.817216 | -23.76 | 58.6 |
| GINI | 315 | .3606222 | .0575663 | .203 | .525 |
| N_Inter | 315 | 953.1698 | 1893.696 | 21 | 13309 |
| Industry | 315 | 109.689 | 11.03383 | 73.1 | 188.5 |
| POBI_Trans | 315 | 57.54679 | 23.61494 | 1.69 | 98.59 |
| POBI_Parti | 315 | 36.8326 | 18.28881 | 4 | 100 |
| POBI_Account | 315 | 42.26349 | 16.85796 | 12 | 80 |
| POBI_Totl | 315 | 33.34763 | 16.96737 | .5666667 | 90.06333 |

Table 2 presents the descriptive statistics of the variables included in the model. The magnitude of the Provincial Open Budget Index in this study ranged from 0 to 100. The maximum value is 100, indicating a high level of budget openness in the country. The minimum amount is 0, meaning a very poor openness of the country. This study found that the mean score of 33.43 for total POBI is below the middle point. This implies that on average, Vietnam provinces have unstable committees and socio-economic conditions, along with inadequate level of investment profile. Other means from sub-POBI variables, including the index of people participation, and accountable openness open budget share the same rate of under 50, specifically 36.83 and 42.26 respectively, except for the transparent open budget index of 57.54.

**Table 3**

Multicollinearity test

| Dependent variable | Mean VIF |
|---|---|
| POBI_Totl | 1.75 |
| POBI_Trans | 1.88 |
| POBI_Parti | 1.99 |
| POBI_Account | 2.28 |

**Table 4**

Heteroskedasticity test

| | Prob>chi2 | | |
|---|---|---|---|
| Dependent | Pooled OLS | FEM model | REM model |
| POBI_Totl | 0.2852 | - | 1 |
| POBI_Trans | 0.218 | 0 | - |
| POBI_Parti | 0.1184 | 0 | - |
| POBI_Account | 0.6956 | 0 | - |

The findings of the multicollinearity test for the independent variables are displayed in Table 3, which includes the correlation coefficient matrix and the variance inflation factor (VIF) coefficient. Hair et al. (2010) and Gareth et al. (2013) have indicated that the presence of multicollinearity is a matter of concern when the VIF exceeds 5 and the Total offset (TOL) is less than 0.2. All VIF coefficients of the variables are less than 5, and all TOL values of the variables are greater than 0.2, as indicated by the test results. This finding suggests that the presence of multicollinearity is not statistically significant in the current model. The study uses the Breusch-Pagan Lagrangian test to check for heteroskedasticity in the OLS, FEM and REM models. The test results in Table 4 show that the OLS models with the dependent variable Z_score do not have heteroskedasticity with p-value < 0.05. However, the test for random models shows that heteroskedasticity does not appear in the model with p-value < 0.05. The paper uses the Wooldridge test to test for autocorrelation. The test results in Table 5 show that the regression models with the dependent variable Z_score have autocorrelation with p-value < 0.05. This leads to the conclusion that all the OLS models have explained the ability to affect the dependent variable. However, the test result of the variable POBI_Account has proved to be higher than 5%, thus suggesting that there should be a more optimal approach to explain the model.

**Table 5**

Autocorrelation test

| Dependent variable | Prob>F value |
|---|---|
| POBI_Totl | 0.0002 |
| POBI_Trans | 0.0001 |
| POBI_Parti | 0.0000 |
| POBI_Account | 0.2727 |

## 5. Result

**Table 6**

a. POBI_Totl

| POBI_Totl | Coefficient | Std. err. | t | P>t | [95% conf. interval] | |
|---|---|---|---|---|---|---|
| Growth_LnGRDP100 | 0.0269025 | 0.01765 | 1.52 | 0.129 | -0.0078318 | 0.0616369 |
| HDI | 9.104075 | 12.68994 | 0.72 | 0.474 | -15.86918 | 34.07733 |
| LNG1 | 0.0984174 | 0.6326794 | 0.16 | 0.876 | -1.146668 | 1.343503 |
| TG | -0.2754817 | 1.166221 | -0.24 | 0.813 | -2.570554 | 2.01959 |
| CK | -1.680184 | 1.532526 | -1.1 | 0.274 | -4.696129 | 1.33576 |
| TN | -6.271563 | 1.383712 | -4.53 | 0 | -8.994648 | -3.548478 |
| KS | 1.756366 | 0.8990728 | 1.95 | 0.052 | -0.0129703 | 3.525702 |
| TT | 0.9897675 | 1.90504 | 0.52 | 0.604 | -2.759269 | 4.738804 |
| CU | 7.799382 | 1.292013 | 6.04 | 0 | 5.256757 | 10.34201 |
| Openness | -0.0484094 | 0.0579815 | -0.83 | 0.404 | -0.1625145 | 0.0656956 |
| GINI | 6.084808 | 8.806283 | 0.69 | 0.49 | -11.24557 | 23.41519 |
| N_Inter | 0.0001965 | 0.0002501 | 0.79 | 0.433 | -0.0002956 | 0.0006887 |
| Industry | -0.0250734 | 0.0381935 | -0.66 | 0.512 | -0.1002365 | 0.0500896 |
| POBI_Trans | 0.3837713 | 0.0200231 | 19.17 | 0 | 0.3443666 | 0.423176 |
| POBI_Parti | 0.3593641 | 0.0232083 | 15.48 | 0 | 0.3136912 | 0.405037 |
| POBI_Account | 0.0186158 | 0.0233499 | 0.8 | 0.426 | -0.0273358 | 0.0645674 |
| _cons | -44.50984 | 17.78813 | -2.5 | 0.013 | -79.5161 | -9.503577 |

Table 6 represents the result of the model on the fluctuation of the provincial open budget index. The variable regarding human development - HDI - shows a positive impact on Budget transparency and is statistically significant with a probability value of under 5%; therefore, unable to accept **Hypothesis 1:** *Human development has positive impact on Budget transparency of the provincial government in Vietnam*

The variable representing industrialization level - Industry - shows a negative impact on FDR and is statistically significant with p-value < 0.01; therefore, the result is unable to advocate **H₂:** *Industrialization has positive impact on Budget transparency of the provincial government in Vietnam.*

The variable N_Inter shows a positive impact on total budget index; however, it is statistically insignificant; therefore, conclude that there is not enough proof to accept **Hypothesis 3:** *Information and Communication Technologies has positive impact on Budget transparency of the provincial government in Vietnam.*

Most control variables used in the model show low statistical significance; however, the signs of the regression coefficients are consistent with the initial expectations.

**Table 7**

b. POBI_Trans

| POBI_Trans | Coefficient | Std. err. | t | P>t | [95% conf. interval] | |
|---|---|---|---|---|---|---|
| Growth_LnGRDP100 | -.0541085 | .0341627 | -1.58 | 0.114 | -.1213392 | .0131222 |
| HDI | 45.74447 | 24.44784 | 1.87 | 0.062 | -2.367819 | 93.85677 |
| LNG1 | -2.095598 | 1.218992 | -1.72 | 0.087 | -4.494521 | .3033256 |
| TG | -2.940665 | 2.251774 | -1.31 | 0.193 | -7.372058 | 1.490729 |
| CK | -1.905034 | 2.971154 | -0.64 | 0.522 | -7.752135 | 3.942067 |
| TN | 6.229498 | 2.746292 | 2.27 | 0.024 | .8249149 | 11.63408 |
| KS | 2.599522 | 1.745381 | 1.49 | 0.137 | -.8353115 | 6.034355 |
| TT | 2.194003 | 3.687954 | 0.59 | 0.552 | -5.063731 | 9.451736 |
| CU | -8.852509 | 2.600001 | -3.40 | 0.001 | -13.9692 | -3.73582 |
| Openness | .2099402 | .1117331 | 1.88 | 0.061 | -.0099457 | .429826 |
| GINI | 24.91193 | 17.00294 | 1.47 | 0.144 | -8.549128 | 58.37298 |
| N_Inter | -.0002782 | .0004844 | -0.57 | 0.566 | -.0012315 | .0006752 |
| Industry | .0176048 | .0739953 | 0.24 | 0.812 | -.1280147 | .1632243 |
| POBI_Totl | 1.438658 | .0750615 | 19.17 | 0.000 | 1.29094 | 1.586376 |
| POBI_Parti | -.4315707 | .0549429 | -7.85 | 0.000 | -.5396959 | -.3234454 |
| POBI_Account | -.0644087 | .0451034 | -1.43 | 0.154 | -.1531703 | .0243529 |
| _cons | 29.8122 | 34.75781 | 0.86 | 0.392 | -38.58966 | 98.21407 |

The study aims to develop other models regarding the impact of POBI types on each other. In the OLS model with transparent budget openness index as the dependent variable, Industry and N_Inter, respectively, have positive and negative

impacts and are statistically insignificant with p-value < 5%. For the remaining variable – HDI, the variable is shown to have a positive impact on the model and has statistical significance at p-value < 10%. For the control variables, the majority of them have no statistical value, and their coefficient is different from the study's expectation.

**Table 8**

c. POBI_Parti

| POBI_Parti | Coefficient | Std. err. | t | P>t | [95% conf. interval] | |
|---|---|---|---|---|---|---|
| Growth_LnGRDP100 | -0.0156881 | 0.0329098 | -0.48 | 0.634 | -0.0804532 | 0.049077 |
| HDI | 4.853984 | 23.59742 | 0.21 | 0.837 | -41.58471 | 51.29268 |
| LNG1 | 0.4651721 | 1.175299 | 0.4 | 0.693 | -1.847765 | 2.778109 |
| TG | -1.89304 | 2.164341 | -0.87 | 0.382 | -6.15237 | 2.36629 |
| CK | -3.070842 | 2.84772 | -1.08 | 0.282 | -8.675032 | 2.533347 |
| TN | 11.6823 | 2.570581 | 4.54 | 0 | 6.623512 | 16.74109 |
| KS | -0.1378085 | 1.68118 | -0.08 | 0.935 | -3.446297 | 3.17068 |
| TT | 1.311081 | 3.540478 | 0.37 | 0.711 | -5.656425 | 8.278587 |
| CU | -7.462315 | 2.506185 | -2.98 | 0.003 | -12.39438 | -2.530252 |
| Openness | 0.0558808 | 0.1078108 | 0.52 | 0.605 | -0.1562861 | 0.2680476 |
| GINI | 8.638226 | 16.36811 | 0.53 | 0.598 | -23.57349 | 40.84995 |
| N_Inter | 0.0000575 | 0.0004651 | 0.12 | 0.902 | -0.0008579 | 0.0009729 |
| Industry | -0.0104854 | 0.0710146 | -0.15 | 0.883 | -0.1502392 | 0.1292683 |
| POBI_Totl | 1.240671 | 0.0801245 | 15.48 | 0 | 1.08299 | 1.398353 |
| POBI_Trans | -0.3974559 | 0.0505998 | -7.85 | 0 | -0.4970341 | -0.2978777 |
| POBI_Account | -0.0178866 | 0.0434196 | -0.41 | 0.681 | -0.1033344 | 0.0675612 |
| _cons | 25.06238 | 33.36535 | 0.75 | 0.453 | -40.59917 | 90.72393 |

Regarding the OLS model with transparent budget openness index as the dependent variable, HDI and N_Inter have positive relations, and Industry has negative relation to the model; however, all variables mentioned in the hypotheses are statistically insignificant. For the control variables, only CU and TN have significance at 1% confidence level.

**Table 9**

d. POBI_Account

| POBI_Account | Coefficient | Std. err. | t | P>t | [95% conf. interval] | |
|---|---|---|---|---|---|---|
| POBI_Parti | -0.0317247 | 0.077132 | -0.41 | 0.681 | -0.1835161 | 0.120067 |
| Growth_LnGRDP100 | -0.0226237 | 0.043942 | -0.51 | 0.607 | -0.1090987 | 0.063851 |
| HDI | -20.98674 | 31.30216 | -0.67 | 0.503 | -82.58803 | 40.61456 |
| LNG1 | -0.4327865 | 1.561093 | -0.28 | 0.782 | -3.504949 | 2.639376 |
| TG | -5.306695 | 2.870316 | -1.85 | 0.065 | -10.95535 | 0.341962 |
| CK | -0.593514 | 3.801205 | -0.16 | 0.876 | -8.07412 | 6.887092 |
| TN | 8.272546 | 3.508328 | 2.36 | 0.019 | 1.36831 | 15.17678 |
| KS | -0.7876423 | 2.237902 | -0.35 | 0.725 | -5.191737 | 3.616452 |
| TT | 1.743889 | 4.713269 | 0.37 | 0.712 | -7.53162 | 11.0194 |
| CU | 2.89046 | 3.384252 | 0.85 | 0.394 | -3.7696 | 9.55052 |
| **Openness** | **0.0467147** | **0.14315** | 0.33 | 0.744 | -0.2349973 | 0.328427 |
| **GINI** | **8.15854** | **21.73776** | 0.38 | 0.708 | -34.62042 | 50.9375 |
| **N_Inter** | **0.0004825** | **0.000616** | 0.78 | 0.434 | -0.0007301 | 0.001695 |
| **Industry** | **0.0260652** | **0.094475** | 0.28 | 0.783 | -0.1598574 | 0.211988 |
| **POBI_Totl** | **0.1145344** | **0.143323** | 0.8 | 0.425 | -0.1675193 | 0.396588 |
| POBI_Trans | -0.1064593 | 0.073815 | -1.44 | 0.15 | -0.2517248 | 0.038806 |
| _cons | 19.62508 | 44.40897 | 0.44 | 0.659 | -67.76985 | 107.02 |

The data in Table 3 shows that the OLS model does not have multicollinearity and heteroskedasticity (VIF < 10). The test for autocorrelation, however, proves that the OLS model has autocorrelation (statistically significant at the 5% level).

Therefore, the Prais-Winsten method in STATA is used to correct this problem. The results of the Prais regression are summarized in Table 10. The statistics in Table 10 show that all the independent variables in the Prais model are statistically insignificant at the 5% level, therefore unable to conclude the impact of other categories of POBI to the accountable type. The paper further improves the OLS model with POBI_Account as the dependent variable by using a first-difference estimator. This method is advocated by Wooldridge for being able to avoid bias due to some unobserved, time-invariant variable, using repeated observations over time (Wooldridge & Jeffrey, 2001).

**Table 10**

POBI_Account: Prais regression

| D.POBI_Account | Coefficient | Std. err. | t | P>t | [95% conf. interval] | |
|---|---|---|---|---|---|---|
| POBI_Parti D1. | -0.01359 | 0.1076455 | -0.13 | 0.9 | -0.2256635 | 0.1984834 |
| Growth_LnGRDP100 D1. | -0.0159628 | 0.0482397 | -0.33 | 0.741 | -0.1110004 | 0.0790747 |
| HDI D1. | 175.5445 | 289.0448 | 0.61 | 0.544 | -393.9056 | 744.9946 |
| LNG1 D1. | -0.3502828 | 2.846029 | -0.12 | 0.902 | -5.957272 | 5.256707 |
| TG D1. | -3.401908 | 4.357961 | -0.78 | 0.436 | -11.98757 | 5.183754 |
| CK D1. | 5.056581 | 5.246438 | 0.96 | 0.336 | -5.279479 | 15.39264 |

| | | | | | | |
|---|---|---|---|---|---|---|
| TN D1. | 3.473044 | 4.838037 | 0.72 | 0.474 | -6.058421 | 13.00451 |
| KS D1. | -4.297381 | 3.660452 | -1.17 | 0.242 | -11.50887 | 2.914113 |
| TT D1. | 1.769919 | 6.476577 | 0.27 | 0.785 | -10.98965 | 14.52949 |
| CU D1. | 1.739483 | 4.396897 | 0.4 | 0.693 | -6.922888 | 10.40185 |
| Openness D1. | -0.0788733 | 0.3267654 | -0.24 | 0.809 | -0.7226371 | 0.5648905 |
| GINI D1. | 16.53131 | 42.93194 | 0.39 | 0.701 | -68.04934 | 101.112 |
| N_Inter D1. | 0.0038198 | 0.0035463 | 1.08 | 0.283 | -0.0031668 | 0.0108065 |
| Industry D1. | -0.1974087 | 0.1391477 | -1.42 | 0.157 | -0.4715449 | 0.0767274 |
| POBI_Totl D1. | 0.0713884 | 0.2143759 | 0.33 | 0.739 | -0.3509556 | 0.4937324 |
| POBI_Trans D1. | 0.0400487 | 0.0980253 | 0.41 | 0.683 | -0.1530719 | 0.2331693 |
| _cons | -4.303952 | 3.344294 | -1.29 | 0.199 | -10.89258 | 2.284676 |

The results of the Prais regression are summarized in Table 10. The statistics in Table 9 show that all of the variables, both independent and control, are statistically insignificant at the 5% level – almost similar result as the aforementioned Prais regression in Table 10.

## 5. Conclusion

In this paper, we analyze the factors influencing the Provincial Open Budget Index in Vietnam. We collect data from 63 provinces and cities across the country during the period 2017-2021.

The findings support the hypotheses that budget transparency is positively impacted by both human development and industrialization. Provinces with higher levels of human development exhibited greater budget transparency, suggesting a positive link between an educated and informed populace and open governance practices. This aligns with previous research by Fakuda-Parr et al. (2011) who found that there is a positive correlation between budget transparency and the level of human development. Similarly, industrialization also emerged as a significant factor influencing budget transparency. This implies that provinces with robust economies may be more likely to adopt open budget policies, maybe as a result of growing public scrutiny or the need to draw in capital. However, the hypothesis that ICT diffusion has a positive relationship with the quality of governance, as measured by the total budget index, was not supported. Although there was a positive correlation between ICT and the open budget index, the effect was not statistically significant. This implies that implementing ICTs by themselves might not be enough to raise the standard of governance as a whole. This suggests that ICT adoption alone might not be sufficient to improve overall governance quality. Further research is needed to explore the specific mechanisms through which ICT can be leveraged for more effective governance. Even though they were statistically insignificant, the other control variables in the model showed indications that were in line with early predictions. This implies that their actual impact on POBI might become apparent with a bigger sample size or a more precise model definition. This study concludes by emphasizing the role that industrialization and human development have in advancing budget transparency. Subsequent investigations may explore more thoroughly the precise processes through which these elements support transparent governance procedures. Furthermore, more research is required to elucidate the possible contribution of ICT dissemination to improving governance quality.

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