

Analysis of the correlation between ICT and Tax Revenue in Indonesia

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Abstract

This research aims to analyze the impact of ICT utilization in tax collection at the national, provincial and district/city levels. This research focuses on how far the impact of ICT utilization in increasing tax revenue. Based on that, this research recognizes three econometric models, namely central, provincial and district/city tax revenue models which analyzed through Fixed Effect Model (FEM) and Random Effect Model (REM) then selected by Hausman test. The results indicate that on average, an increase in SMEs using ICT with IP-ICT level 5, will increase the central tax ratio, then an increase in motorized vehicles whose owners use ICT with IP-ICT level 5, will increase the provincial tax ratio, an increase in Gross Regional Domestic Product of the hotel and/or restaurant sector whose owners/managers use the ICT with IP-ICT level 5, will increase district/city tax ratio. The implication of this research, Central Government needs to socialize the use of ICT-based tax applications, Provincial Government should coordinate with local police in disseminating the use of online tax applications for motor vehicle tax, District/City Governments periodically socialize the obligation to use the tapping box or online cash register machine.

Keywords: ICT utilization; IP-ICT; Tax revenue; Tax Ratio

Introduction

Taxes are the backbone of finance sustainable development for the Indonesia due to its dominates role to the State Revenue and Expenditure Budget (APBN) that reaches more than 70% every year. Thus, the government as a state administrator must continue to strive in optimizing tax revenues. The amount of tax revenue that can be collected by a country depends on socio-economic conditions, demographics and institutions, so tax revenues result will be different for each

country. One thing to measure the performance of the tax revenue is the tax ratio. Several terms that are often used in the research, such as tax revenue, tax ratio and tax capacity are terms with the same proxy, namely the percentage of tax realization to Gross Domestic Product (GDP).

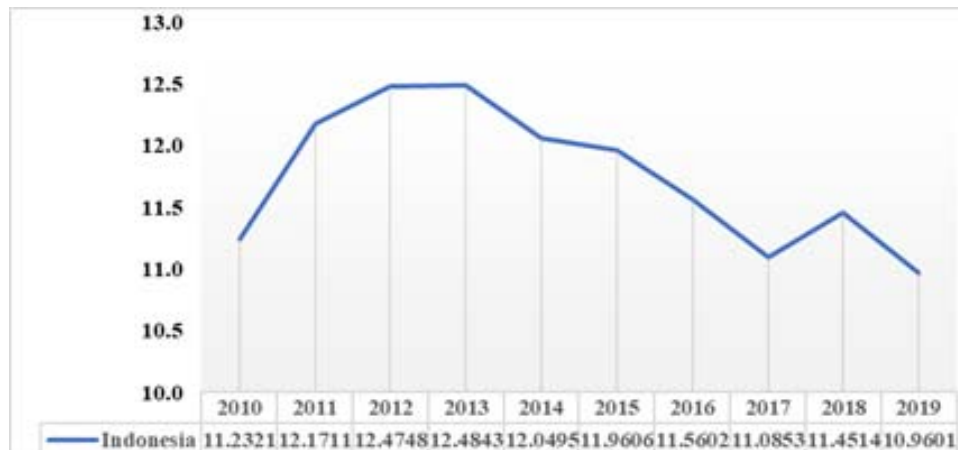
According to the International Monetary Fund (IMF), Indonesia's tax ratio still low compared to other developing countries, which should reach 15%. The IMF Mission Chief for

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Sources: International Monetary Fund (2020)

Figure 1. Indonesia's Tax Ratio 2010-2019

Indonesia, Luis E. Breuer measures that Indonesia still has room to increase the tax ratio by 15% of GDP (Fauzia & Djumena, 2018). Based on their statement, Indonesia has a population growth of 1.3 percent per year since 2000 to 2016, so that the projected population of Indonesia in 2030 will reach 296 million people. This trend shows an increase in the productive ages of 15-64 years by 1.6 percent every year therefore Indonesia would turn into economic potential if it managed properly. However, it will occurs conversely once it does not managed properly then it will jeopardized the state financing.

Seeing the huge parts of taxes as a source of funds for development in Indonesia and yet the tax ratio still touch the low level, so that the quantitative research on taxation is necessary to conduct in order to examine which factors behind of it and identify the strategy of a country or region in order to increase tax revenues which later will be use to financing the public spending (Rodríguez, 2018).

Several studies related to the factors which influence tax revenue have been conducted, such as, by Dioda (2012) *Le et al.*, (2012) Piancastelli (2001), Piancastelli & Thirlwall (2021), Gupta (2007). The results from these research quoted that economic factors, demographic and social factors, along with institutional factors have impacts

to the tax revenues in a country. In addition, the condition or construction of roads in an area also can affect the tax revenues, for examples the railroad in Kyushu, Japan (Yoshino & Abidhadjaev, 2016), the availability and quality of road infrastructure in Indonesia (Andriany & Qibthhiyyah, 2018), and the provision of roads for Noi-Lao Cai and Ha Noi-Thai Nguyen expressways in the North Midland and mountains of Vietnam (Yoshino & Hoa, 2020).

In line with growth of Information and Communication Technology (ICT), ICT is considered as one of the factors that affect tax revenue in a region or country. The amount of the use of ICT in the tax administration system creates an assumption that the use of ICT is a factor which affect the tax revenues, but these factors have not been included in the recent study above. The OECD (2017) stated that the development of ICT in the last few decades has provided many opportunities to increase tax revenues, efficiency, quality of services intended for taxpayers, reduce the burden of compliance for taxpayers, the burden of government administration and improve law enforcement.

Currently the use of ICT for tax administration in Indonesia can be seen from the various ICT-based or internet

(online) tax applications that have been implemented. The examples of ICT or internet-based tax applications in Indonesia are e-Filing, e-Registration, e-Faktur, e-Billing, e-Bupot, e-SPT, e-Samsat, e-PBB, e-BPHTB, tapping box machines, online cash register machines and others. The use of ICT or internet-based tax applications consider as an important for the Indonesia because it has an archipelagic geographical condition, so with an online system, the tax administration process becomes easier and faster. For example, paying and reporting taxes are getting faster and easier with internet access, as well as reducing the physical presence of the taxpayer to the tax office. The realization of ICT-based tax applications is expected to increase the efficiency and reduce taxpayer compliance costs so as to increase tax revenue.

In a regional or province there is a tax base that contributes to tax revenues. Based on the contribution of the tax base to tax revenues, data availability and the authority to access the data, the tax base used in this research are the number of SMEs as the central tax base, the number of motorized vehicles as the provincial tax base and the total GRDP of hotels and restaurants as the District/city tax base.

The use of ICT-based tax applications on each tax base are closely related to the conditions in the use of ICT or internet by the community in that area. The condition of high ICT utilization in the community are expected to support the optimal use of ICT-based tax applications, so as to support tax collection efforts in that area. According to the definition above, this research will estimate the correlation between the use of ICT by taxpayers through ICT-based tax applications on central tax revenues, provincial tax revenues and district/city tax revenues.

This research will contribute to the literature related to the use of ICT by taxpayers on tax revenues, particularly in Indonesia, because there has been no similar research for provinces in Indonesia.

Agustina dan Pramana (2019) conducted research related to the affect of the use of ICT (with IP-ICT proxy) on economic growth, but research that related to the correlation of the use of ICT (with IP-ICT proxy interacted with the tax base) on tax revenue at the provincial level in Indonesia has never done. This research also can provide an information and empirical evidence of the linkage between the use of ICTs and tax revenues in Indonesia and by means to determine the strategies by the Government in order to increase tax revenues.

This research was adopts the theory of production with technological advances. Adejumo *et al.* (2020) mentioned that the use of technology in production input factors can increase its production output compared to the one who did not use technology. Philosophically, based on production theory, when there is similar number of tax bases, but these tax base uses ICT through ICT-based tax applications, so that it can generate higher tax revenues than if the one who did not applied the ICT. Because the use of ICT in taxation can increase the efficiency and reduce tax compliance costs.

The gap level in the use of ICT in each province in Indonesia creates the gap on tax revenue of each province as well, so it is necessary to conduct research related to the correlation between the use of ICT on tax revenues at the provincial level in Indonesia. The author has adopts the concept from the research of Brun *et al.* (2020), Hanrahan (2021), Koyuncu & Ünver (2017) for its provincial-level research in Indonesia. Through the tax decentralization system which causes differences in tax collection authority, this research is divided into 3 models, namely the central tax revenue model, the provincial tax revenue model, and the district/city tax revenue model.

This research explains the relation between the use of ICT by the community through central tax base (SMEs), the

provincial tax base (motor vehicle owners) and the district/city tax base (hotel and/or restaurant owners) towards the central tax revenues, provincial tax revenues, and district/city tax revenues. The use of ICT proxied through IP-ICT then connected with the central tax base, provincial tax base and district/city tax base so that it is suspected to have a positive correlation to the central tax revenues, provincial tax revenues and district/city tax revenues.

Several research that have done relates to the use of ICT (through the application of electronic taxation), and the results always stated that it has a positive impact on tax compliance and revenue of a country, including the use of the online tax system in Kenya (Wasao, 2014), the use of electronic sales registration machines (ESRM) (Ali *et al.*, 2017) and utilization of electronic sales registration machine (Mascagni *et al.*, 2021) in Ethiopia, the use of electronic tax system in the Republic of Turkey (Allahverdi *et al.*, 2017) and the use of electronic taxation system in Uganda (Night & Bananuka, 2020). In Zambia, electronic tax services for Small and Medium Enterprises (SMEs) has increase its tax revenue and tax compliance (Mukuwa & Phiri, 2019), tax revenues from large taxpayers in Tanzania also increase due to the use of the e-tax system (Masunga *et al.*, 2020). In addition, the electronic tax system in Nigeria were significantly reduce tax evasion (Otekunrin *et al.*, 2021).

However, these research has limited to micro studies to see the impact of implementing an electronic taxation system or application in a country and certainly the results will be differs between countries so the it cannot be generalized or measured across countries. The literature which analyzed the affect of the use of ICT on tax revenues still very limited.

Several research has been done relates to the use of ICT on tax revenues which measured across regions or across countries, such as: Koyuncu & Ünver (2017), the results of their research shows that the use

of ICT increases tax revenues throughout the country, then Brun *et al.* (2020) indicates that the influence of ICT readiness had a positive but not significant impact on tax revenue, then Adegboye *et al.* (2022) revealed that the influence of ICT on the tax ratio is very positive, but has a threshold and after crossing the threshold, the impact will be negative. The results of Hanrahan (2021) actually defined that digitalization can have a negative impact on tax revenues in developed countries with high ICT utilization conditions.

According to this explanation, the Initial hypothesis for this research could be drawn as follows:

- H₁: The use of ICT by community through the SME tax base is positively related to central tax revenue.
- H₂: The use of ICT by the community through the motor vehicle owner's tax base is positively related to provincial tax revenues.
- H₃: The use of ICT by the community through the hotel and/or restaurant owners tax base is positively related to district/city tax revenues.

Method

This research used 165 observations consisting of 33 provinces for 5 years, during 2015-2019. This research used qualitative method which processed by econometric techniques through panel data regression in order to analyze data such as fixed effects model and random effects model that selected based on chaw test, hausman test and lagrange multiplier test. The hypothesis examination towards these tax revenue model was estimated through Fixed effects model while for the provincial and district/city level of tax revenue models will be estimated by random effects model. This research currently used the data from BPS, the Directorate General of Fiscal Balance (DJPK) and the Directorate General of Taxes (DGT).

Table 1. Variable and Measurement

Variable Name	Definition
Dependent Variable	
rev_pajak_pusat	Central tax revenue to GRDP
rev_pajak_provinsi	Provincial tax revenues to GRDP
rev_pajak_kabkot	District/city tax revenues to GRDP
Independent Variabel	
UKM	Number of SMEs per province
KEND	Number of motorized vehicles per province
HOTEL_RESTO	Total GRDP of the hotel and restaurant sector per province
IPTIK*UKM	Interaction of IP-ICT with the number of SMEs
IPTIK*KEND	Interaction of IP-ICT with the number of vehicles
IPTIK*HOTEL_RESTO	Interaction of IP-ICT with Hotel and Restaurant GRDP
Control Variable	
PDRBC	Nominal GRDP per capita for each province (rupiah)
TPAK	Labor force participation rate per province (ratio)
DENSITY	Population density per province (population/km2)
SHARE_AGRI	Agricultural sector income to GRDP (ratio)
JALAN_SEMUA	The provision of road infrastructure to expand the province (km)
JALAN_BAGUS	The provision of good quality road infrastructure per provincial area (km)

Sources: Processed by the author (2022)

The research was conducted at the provincial level, so all of the research data was provincial level data or have been aggregated to the provincial level. The dependent variable of this research in the form of central tax revenue is the final income tax revenue data for SMEs and non-employee Personal income tax per Tax Service Office (KPP) which is aggregated to the provincial level per GRDP, provincial tax revenue data is provincial tax revenue per GRDP and District/City tax revenue data. The District/City tax revenue which is

aggregated to the provincial level per GRDP. After done with this step, then these data were examined for normality test, regression technique selection test and classical assumption test (for FEM models), while for REM models only that's multicollinearity tests were performed.

The empirical model of this research are recognized the use of ICT by the community through the tax base as a relevant determinant of tax revenue. Thus, the empirical model for analysis with panel data as follows:

$$\ln_{rev_pajak_pusat}_{it} = \beta_0 + \beta_1 \ln_{UKM}_{it} + \beta_2 (\ln_{IPTIK}_{it} * \ln_{UKM}_{it}) + \beta_3 \ln_{PDRBC}_{it} + \beta_4 \ln_{TPAK}_{it} + \beta_5 \ln_{JALAN_BAGUS}_{it} + \beta_6 \ln_{DUMMY_TAHUN}_{it} + u_{it} \quad (1)$$

$$\ln_{rev_pajak_provinsi}_{it} = \beta_0 + \beta_1 \ln_{KEND}_{it} + \beta_2 (\ln_{IPTIK}_{it} * \ln_{KEND}_{it}) + \beta_3 \ln_{PDRBC}_{it} + \beta_4 \ln_{JALAN_SEMUA}_{it} + \beta_5 \ln_{DENSITY}_{it} + \beta_6 \ln_{DUMMY_TAHUN}_{it} + u_{it} \quad (2)$$

$$\ln_{rev_pajak_kabkot}_{it} = \beta_0 + \beta_1 \ln_{HOTEL_RESTO}_{it} + \beta_2 (\ln_{IPTIK}_{it} * \ln_{HOTEL_RESTO}_{it}) + \beta_3 \ln_{PDRBC}_{it} + \beta_4 \ln_{JALAN_BAGUS}_{it} + \beta_5 \ln_{DENSITY}_{it} + \beta_6 \ln_{SHARE_AGRI}_{it} + \beta_7 \ln_{DUMMY_TAHUN}_{it} + u_{it} \quad (3)$$

Result

The descriptive statistical test results from this research were indicates that; The ratio of central tax between provinces may varies between 0.53 percent to 9.81 percent with an average of 2.88 percent, in other words that there is still have a large gaps in terms of central tax revenue between regions. Meanwhile, in the ratio of provincial taxes and district/city taxes, the gaps seems not too big. In the provinces, the minimum tax ratio is 0.35 percent and the maximum tax ratio is 1.64 percent, while in districts/cities, the minimum tax ratio is 0.11 percent and the maximum tax ratio is 2.48 percent.

The IP-ICT independent variable which will be interacted with the central tax base, provincial tax base and district/city tax base and become the main independent variable has a minimum value of 2.13 and a maximum value of 6.90 with an average of 4.58, so it can be said that there is still have

a gaps in the ICT development index of each province in Indonesia.

The estimation results (table 2) from the central tax revenue model indicates that on the average a 1 percent increase in the central tax base (number of SMEs) will increase the central tax ratio by 0.1508816 percent with significance level of 5 percent, *ceteris paribus*. Then if these SMEs use the ICT, the average of the increase in the central tax ratio will increases by 0.127847 percent, *ceteris paribus*. Thus, on average the increase of 1 percent of the central tax base (the number of SMEs) whose using the ICT will increase the central tax ratio by 0.2787286 percent with significance level of 1 percent, *ceteris paribus*.

The estimation results (table 3) from the provincial tax revenue model indicates that on the average a 1 percent increase in the provincial tax base (total of Vehicles) will increase the provincial tax ratio by 0.2025171 percent with significance level of 1 percent, *ceteris paribus*. Then if the

Table 2. The Estimated Results of Central Tax Revenue

Dependent Variable: Central Tax Ratio	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Main Independent Variable						
Number of SMEs	0.284557*** 0.0305126	0.307648*** 0.0424564	0.2021199*** 0.0496147	0.1918066*** 0.0516863	0.1998843*** 0.0524136	0.1508816** 0.0563106
The use of ICT in the SME tax base		(-0.0058959) 0.007523	0.0816815*** 0.0158329	0.0843644*** 0.0160035	0.0795534*** 0.0169667	0.127847*** 0.0189107
Control Variable						
Income per capita			(-1.559172)*** 0.2064654	(-1.609904)*** 0.2103934	(-1.542968)*** 0.2294969	(-0.0476656) 0.2988121
Labor force participation rate				0.8116716 0.5027346	0.8140614 0.5205239	0.9684108* 0.4774926
Long road with good quality					0.1176167 0.0777257	0.1108776** 0.0512921
Time trend						(-0.1671019)*** 0.0217979
R-squared	0.1340	0.1278	0.1325	0.1336	0.1547	0.2603

*Significant at $\alpha = 10\%$, ** Significant at $\alpha = 5\%$, *** Significant at $\alpha = 1\%$

Sources: Processed by the author (2022)

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Table 3. Estimated Results of Provincial Tax Revenue

Dependent Variable: Provincial Tax Ratio	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Main Independent Variable						
Number of vehicles	0.0624046*	0.0800819*	0.0550814*	0.0432656	0.1995343***	0.2025171***
	0.0350296	0.042504	0.029199	0.0315387	0.0570338	0.0580037
The Use of ICT on the tax source from the number of vehicles		(-0.0027456)	0.0210561***	0.0199882***	0.0181941***	0.0113075
		0.0036725	0.0046609	0.0049206	0.0048165	0.0076772
Control Variable						
Income per capita			(-0.5008746)***	(-0.4726931)***	(-0.5346747)***	(-0.5425779)***
			0.0672826	0.0749446	0.0735196	0.0756474
Total of long road				0.0401838	0.0389787	0.0461432
				0.0498294	0.0471487	0.0484229
Population density					(-0.2149751)	(-0.2096602)
					0.0664227	0.0677209
Time trend						0.0120668
						0.0107302
R-squared	0.1102	0.1049	0.5734	0.5746	0.6725	0.6412

*Significant at $\alpha = 10\%$, ** Significant at $\alpha = 5\%$, *** Significant at $\alpha = 1\%$

Sources: Processed by the author (2022)

tax base (through motorized vehicle owners) use the ICT, then the average of the increase in the provincial tax ratio will increase by 0.0113075 percent, *ceteris paribus*. Thus, the increase in 1 percent of the provincial tax base (number of motorized vehicles) whose the owners use

ICT will increase the provincial tax ratio by 0.2138246 percent but not significantly, *ceteris paribus*.

The estimation results (table 4a & table 4b) from the district/city tax revenue model indicates that on the average a 1 percent increase in the district/city tax

Table 4a. The Estimated Result from District/City Tax Revenue

Dependent Variable: District/City Tax Ratio	Model 1	Model 2	Model 3	Model 4
Main Independent Variable				
GRDP of the hotel and restaurant sector	0.3597161***	0.1526801***	0.1747155***	0.1644186***
	0.0340434	0.0473568	0.0423532	0.0433228
The use of ICT in Hotel and Resto tax base		0.0124146***	0.0187437***	0.0180603***
		0.0020532	0.0027981	0.0028447
Control Variable				
Income per capita			(-0.3267159)***	(-0.2854088)***
			0.1020052	0.1070879
Long road with good condition				0.0479768
				0.0394152
R-squared	0.3090	0.3251	0.4946	0.5105

*Significant at $\alpha = 10\%$, ** Significant at $\alpha = 5\%$, *** Significant at $\alpha = 1\%$

Sources: Processed by the author (2022)

Table 4b. The Estimated Result from District/City Tax Revenue

Dependent Variable: District/City Tax Ratio	Model 5	Model 6	Model 7
Main Independent Variable			
GRDP of the hotel and restaurant sector	0.265239***	0.237385***	0.2538875***
	0.0614258	0.0576501	0.0545179
The use of ICT in Hotel and Resto tax base	0.0177952***	0.0213454***	0.0091039**
	0.0028168	0.0028351	0.0036885
Control Variable			
Income per capita	(-0.3797191)***	(-0.5880584)***	(-0.8216514)***
	0.1085939	0.1104911	0.1156681
Long road with good condition	0.0568842	0.0606098	0.0680918*
	0.0392716	0.0385044	0.036176
Density	(-0.2221834)**	(-0.2537675)***	(-0.2901947)***
	0.0990206	0.0844212	0.080326
Share agriculture		(-0.3181144)***	(-0.4325636)***
		0.1078217	0.1049449
Time trend			0.0547026***
			0.0114879
R-squared	0.6390	0.7547	0.8066

*Significant at $\alpha = 10\%$, ** Significant at $\alpha = 5\%$, *** Significant at $\alpha = 1\%$

Sources: Processed by the author (2022)

base/source (total GRDP of hotels and restaurants) will increase the district/city tax ratio by 0.2538875 percent with significance level of 1 percent, ceteris paribus. Then if the tax base (from hotel and/or restaurant

owners) whose use the ICT, then the average for the increase in the district/city tax ratio will increases by 0.0091039 percent, ceteris paribus. Thus, the average of an increase of 1 percent of the district/

Table 5. The Calculation of Estimated Results from ICT Utilization on Tax Revenue

Variable	Mean Value Variable	Regression Result Coefficient	X Increment (unit)	Y Increment (unit)
rev_pajak_pusat	2,8772			
rev_pajak_provinsi	0,8063			
rev_pajak_kabkot	0,4226			
UKM	126.335	0,150882	1.263	0,004341
int_IPTIK_UKM	599.547	0,127847	5.995	0,003678
				0,008020
KEND	3.082.815	0,202517	30.828	0,001633
int_IPTIK_KEND	14.900.000	0,011308	149.000	0,000091
				0,001724
HOTEL_RESTO	10.800.000.000.000	0,253888	108.000.000.000	0,001073
int_IPTIK_HOTEL_RESTO	54.900.000.000.000	0,009104	549.000.000.000	0,000038
				0,001112

*Significant at $\alpha = 10\%$, ** Significant at $\alpha = 5\%$, *** Significant at $\alpha = 1\%$

Sources: Processed by the author (2022)

city tax base (through hotel and restaurant owners) who are using the ICT will increase by 0.2629914 percent to the district/city tax ratio with significance level of 5 percent, *ceteris paribus*.

The conclusion from these calculation of estimated tax revenues for both the central government, provisional, district/city (table 5), on the average, an increase of 1,263 SMEs to the use of ICT through IP-ICT level 5, will increase the central tax ratio by 0.00802 percent, then on average, an increase of 30,828 motorized vehicles whose owners use the ICT through IP-ICT level 5, it will increase the provincial tax ratio by 0.001724 percent, and on average, an increase of 108 billion rupiahs of GRDP in the hotel and/or restaurant sector that the owners or the manager uses the ICT through IP-ICT level 5, then it will increase the district/city tax ratio by 0.001112 percent.

The results from this research were also confirmed that the use of ICT by central tax base, provincial tax base and district/city tax base are positively related to the central tax revenues, provincial and district/city tax revenues. However, these connection seems not significant for the provincial tax revenues. By these results, it can be concluded that H1 and H3 are accepted, while H2 is rejected.

Discussion

Estimated Results of Central Tax Revenue Regression

The use of ICT by tax base (Taxpayers) will contribute to central tax revenues, the transmission which is through the use of ICT-based tax applications by taxpayers. The use of ICT will increase the efficiency and reduce tax compliance costs, thereby increasing compliance and tax revenue at the same time. As stated by Marliana *et al.* (2017) whom define that the new e-filing tax application was introduced and socialized in the work area of KPP Pratama Tasikmalaya City in 2013. Then it stated the number of taxpayers who

reported taxes through e-filing in 2013 was 3,111 taxpayers, in 2014 there were 12,751 taxpayers and in 2015 as many as 36,225 taxpayers has done that. So in other word the number of individual taxpayers who use e-filing has increased every year, this can minimize costs and time so as to make it easier for taxpayers to submit their annual tax returns. The increase in taxpayer compliance will have an impact on tax revenues.

Another factor which positively and significantly related to the central tax ratio is LFPR and the length of roads which have good quality. TPAK can contribute as MSMEs and non-employee entrepreneurs or from the informal sector that will submit the MSME Final personal income and non-employee personal income, so that it will positively related to central tax revenue according to the proxy which used in this research. The Road infrastructure with has good quality can encourage the public activities because the distribution of goods and/or services will be better if the roads are in good condition. These results are in line with research from Andriany & Qibthhiyyah (2018), Yoshino & Abidhadjaev (2016), Yoshino & Hoa (2020).

The negative impact from income per capita towards tax ratio can occur due to the government's expansionary fiscal policy to reduce the tax burden in an efforts to encourage the economic growth (Arnold *et al.*, 2011; Bird *et al.*, 2008), for example the changes in the limit of Non-Taxable Income (PTKP) to Rp 54 million and also the MSME Final PPh scheme decreased from 1% to 0.5%, these thing will reduce the potential of income tax revenues in the short term (Fatimah, 2020).

Estimated Results of Provincial Tax Revenue Regression

In the province level, there is an online motor vehicle tax payment application which can make it easier for the public to pay their motor vehicle taxes,

namely e-Samsat, which is currently called the National Digital Samsat (SIGNAL). In 2021, there are 36,531 people who have downloaded the National Digital Samsat (SIGNAL) application or accessed across this application. From this number, there are 18,860 vehicles which have registered, while only 5,131 have successfully made payments with amount of Motor Vehicle Tax value Rp 6,927,823,956 (Jawapos, 2021). The number of this application users are recognize very low compared to the number of motorized vehicles in 2021, which as many as 143 million units. The use of ICT in provincial tax revenues are positive but only insignificant due to its mechanism which is still semi-online because it still requires those taxpayers to come to Samsat in order to exchange validation papers/sheets, which is still considered as complicated by the public.

For example, the implementation of e-SAMSAT at the Bali province which has not shown any significant results for motor vehicle tax revenues. The main factor which inhibiting this process are due to the application that still not fully online, its socialization which is still very minimal and the community habit which still using formal and informal intermediary services that are more popular to these days. While in Medan Selatan, the lack of socialization related to the implementation and the use of Samsat Online application, make it this application has not been popular used by the public (Saragih et al., 2019).

Another factor which significantly related to the provincial tax ratio is income per capita. The negative impact from income per capita towards tax ratio can occur due to the government's expansionary fiscal policy to reduce the tax burden in order to encourage economic growth (Arnold *et al.*, 2011; Bird *et al.*, 2008), for example in provincial taxes there is elimination of sanctions for late payment on motor vehicle tax. In addition, the supervision and sanctions from the Regional Government have not been optimal for

taxpayers who evade the provincial taxes, for example fines for late payment of motor vehicle taxes did not cause a deterrent effect. The implementation of progressive tax rates tends to encourage those taxpayers to evade the taxes (Chen, 2012; Clotfelter, 1983; Estri & Djamaluddin, 2019; Gruber & Saez, 2002; Sillamaa & Veall, 2001; Skinner & Slemrod, 1985), for example, someone who owns several motorized vehicles but still registered it in the name of another person in order to avoid a progressive vehicle tax rate.

The provision of road infrastructure will foster the public interest in owning motorized vehicles, so that it will increase the number of motorized vehicles and that will also lift the provincial tax revenues. Furthermore, the negative impact from this high population density in an area is that it can lead to the growth of informal economy sector which is difficult to taxing and has limit to the tax base (Mkandawire, 2010). If the population density is high and not matched by the number of jobs, that will causing competition in finding work or income, then it will increase the number of unemployed, so that it will reduce the ability to pay taxes.

Estimated Results of District/City Tax Revenue Regression

In the district/city area, hotels and restaurants are one of the tax sources which contribute to district/city tax revenues. One of the uses of ICT in district/city taxation is the installation of tapping box tool in hotel and restaurant businesses. For example in the city of Batam, according to the Head of the Regional Retribution Tax Revenue Agency (BP2RD) of Batam City, Raja Azmansyah, the installation of tapping boxes has a significant role in increasing district/city local taxes. By the end of 2018, as many as 400 tapping boxes had provided support for multiplying the regional income, for example from the tourism sector, the

original regional income was Rp. 20 billion arose to Rp. 40 billion. Until 2021, the Batam City Government and Riau Islands Bank (BRK) are targeting the installation of 1,500 tapping boxes. The installation of tapping boxes at hotels and restaurants can make it easier for taxpayers to calculate taxes that need to be paid to the City/District Government, then it will increase the efficiency and reduce tax compliance costs, so as to increase taxpayer compliance which will have impact to tax revenue (Jawapos, 2019).

Other factors that are significantly related to the district/city tax ratio are income per capita, length of roads with good quality, population density, and income from the agricultural sector. The negative impact from income per capita on the tax ratio is because there is an expansionary fiscal policy of the government to reduce the tax burden in order to encourage economic growth (Arnold *et al.*, 2011; Bird *et al.*, 2008), for example the annihilation sanctions for late payments of Land and Building Tax (PBB) and the exemption of Land and Building taxes payments for certain criteria. In addition, the supervision, collection, and tax sanctions from the local government seems not been optimal for taxpayers who were tried to evade the taxes, such as collecting bird's nest taxes, restaurant tax arrears that have not been collected, such as several Bakso sony outlets which were finally shut down by the local government. Many hotel and restaurant businesses still did not want to install this tapping box machines with the aim to avoiding the taxes, so the sales reported to the tax office are smaller than with what they actually are. This happens because the greater the income of taxpayers, they will tends to avoid the taxes to minimize the cost of paying taxes (Chen, 2012; Gruber & Saez, 2002).

The availability of road infrastructure which are in good condition will increase the property value along the road so that it will affect the payment of Land and

Building Tax (Andriany & Qibthhiyyah, 2018) and also can foster the tourist interest to visit, thus it will affecting the hotel tax revenues, restaurant taxes, taxes entertainment and parking taxes.

The negative affect from high population density in an area causes the growth of informal economy sector which is difficult to taxing and short limit of the tax source (Mkandawire, 2010). The negative affects also come from the agricultural sector which is an informal sector and difficult to tax (Leuthold, 1991). The more income from the agricultural sector in an area, the less taxes that can be collected, for example Land and Building Tax on rice fields area.

Conclusion

The results of this research were confirmed that the use of ICT by the central tax base, the provincial tax base and the district/city tax base are positively related to central tax revenues, provincial tax revenues and district/city tax revenues, but this relations are not so significant to the provincial tax revenues. This can be explained because the mechanism for online motor vehicle tax application still recognize as semi-online, which is requires taxpayers to come to Samsat to exchange the validation papers/sheet, therefore it still considered complicated by the public.

In detail, it could be described that on the average when there is an increase in the number of SMEs as many as 1,263 SMEs that use ICT in the regions through (IP-ICT) index level 5, then central tax ratio (with the proxy of Final personal income of SMEs and non-employee personal income) will increase by 0.00802 percent. On provincial tax revenues, on the average, when there is an increase in the number of motorized vehicles by 30,828 whose owners use ICT through IP-ICT index level 5, then the provincial tax ratio will increase by 0.00172 percent. Finally, on district/city tax revenues, on average, when there is an increase in the amount of

GRDP in the hotel and restaurant sector by 108 billion rupiah whose the owners/managers use the ICT through IP-ICT level 5, then the district/city tax ratio will increase by 0.00111 percent. Thus, the use of ICT by those tax base will increase the central tax ratio, the provincial tax ratio and the district/city tax ratio.

There is still have research limitations, such as the correlation between the use of ICT by the tax base towards tax revenue at the provincial level which had a short-term estimate of 2015-2019. The IP-ICT proxy that used are the IP-ICT that is used by the public in general, not only SMEs, motor vehicle owners and hotel restaurant owners, so in this research the IP-ICT proxy which interacted with the tax base of SMEs, motor vehicles, and restaurant hotels to describe its transmission to the tax revenue. The IP-ICT values also cannot be separated into sub-indexes. As well as the limitations of the use of research variables (control variables), such as some central and regional tax bases that cannot be used in this research, for example the Land and Building Tax (PBB) base, parking tax base, cigarette tax base, edible bird nest tax base, those happen due to the unavailability of data and the authority to access data. This research also did not estimate the costs and benefits of using ICT on tax revenues.

According to the research results, there are several recommendations that can be conveyed related to the use of ICT which has a positive correlation to the central tax revenues and local tax revenues in Indonesia. It aims to increase the central tax revenues and local tax revenues. This recommendations are include: The Central Government in this case are the tax officers need regularly continue to socialize regarding the use of ICT-based tax applications to the taxpayers. Particularly for the new taxpayers, this education should be provided intensively in order to maximize the use of ICT-based or internet-based tax applications to facilitate the implementation of their tax obligations. In addition, we can

gradually add electronic tax payment methods via e-wallet so it will make it easier for taxpayers to pay taxes, for example through OVO, GoPay, Tokopedia, Dana, and others. The Provincial Government, need to coordinate with the local police in disseminating the use of online tax application for motor vehicle tax namely the SIGNAL application (National Digital Samsat) and persuasively encourage the public to take advantage of the online motor vehicle tax application so that people do not need to use motor vehicle tax management service providers which are free from extortion. District/City Governments, periodically continue to socialize relates to the obligation to use tapping boxes or online cash register machines and convey the sanctions that will be received by Taxpayers if they try to violate the rules (up to the revocation of business licenses). Then, the District/City Government can coordinate with BKPM to obtain a list of new hotel and/or restaurant as Taxpayers who already have a Business Identification Number therefore the education can be conduct on the use of ICT-based tax applications, either tapping boxes or online cash register machines or online tax systems on respective districts/cities in an efforts to facilitate the implementation of tax obligations

According to the research limitations which occurs in this study, the suggestions for further research with this theme are includes that this research can be conducted at a smaller regional level, for example at the district/city level, considering that currently were developed the IP-ICT for the district/city level. Beside that, the addition of the research period and type of taxes that used as the dependent variable also can be done. The greater the number of observations, that will reduce the bias of the research estimation results. If the district/city level IP-ICT is not Available yet, the proxy for the use of ICT probably can use the IP-

ICT components found at the provincial and district/city levels, for example the number of fixed telephone subscribers, the number of cellular telephone subscribers, international internet bandwidth per user, the percentage of individuals who use the internet, subscribers to fixed broadband internet and so on. Because the provincial level of IP-ICT combines the expertise, then it could be added with educational for control variables such as the average length of school, the secondary enrollment rate and the tertiary enrollment rate.

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