

# Income tax collection and non-compliance in Ghana

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## Abstract

Ghana's tax collection is very low compared with other lower middle-income countries. The revenue from income tax is particularly low, lower than the average of low-income countries. Non-compliance of tax payments is an urgent issue in Ghana, as the government has been suffering from a widening fiscal deficit and a rising debt burden. This paper combines data from household surveys, the business census, and administrative income tax data, and examines the scale of non-compliance and potential revenue gains from the enforcement of tax collection in Ghana.

Business census data suggests the actual number of formal sector workers is higher than the number of formal sector workers reported both in the household survey and the administrative income tax data in Ghana. The income tax files do not include the individuals who work for formal sector firms which failed to file PAYE (Pay As You Earn), whereas the household data suffers from under-sampling and under-reporting of high-wage income earners. By combining the household survey data and the administrative income tax data, and adjusting the number of formal sector workers using the business census, we reconstruct the distribution of wage earners in the formal sector who are subject to income tax, and estimate potential income tax revenue gain from the enforcement of tax collection. We find the income tax revenue could have been higher by 582 million Cedi (equivalent to 0.5 percent of the GDP) if everyone who filed income tax in 2014 had paid the full amounts of income tax due. If all formal sector firms and organizations, regardless of whether they actually filed income tax or not in 2016 paid the full amounts of PAYE for all their employees, the income tax revenue could have been higher by 1.2 billion Cedi (equivalent to 1.4 percent of GDP). In 2016, we observe a further reduction of income tax revenue. The total income tax revenue could have been higher by 3.6 billion Cedi (2.2 percent of GDP) if all formal sector firms and organizations, regardless of whether they actually filed income tax or not in 2016, paid the full amounts of PAYE for all their employees.

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<sup>1</sup> We are grateful to Ghana Revenue Authority (GRA) for allowing us to use administrative income tax data, and to Ghana Statistical Service (GSS) for allowing us access to the GLSS 6 household survey data, the 2015 Labour Force Survey (LFS) data, and the 2014 Integrated Business Establishment Survey (IBES) data. We would also like to thank staff at GSS and GRA for valuable discussion.

## 1. Introduction

This paper combines data from household surveys, the business census, and administrative income tax data, and examines the scale of income tax non-compliance in 2014 and 2016, and the potential revenue gains from income tax compliance in Ghana.

Developing countries often collect too little tax. Ghana is not an exception. Table 1 shows that Ghana's tax collection, as a percentage of the GDP, is very low compared with other lower middle-income countries. Income tax revenue is particularly low, lower than the average of low-income countries. Tax compliance is an urgent issue in Ghana, as the government has been suffering from a widening fiscal deficit and a rising debt burden.

Besley and Persson (2014) attribute low tax collection in developing countries to their inadequate administrative capacity, the presence of a large informal sector, weak checks and balances, and the lack of social norms for tax compliance. They discuss how collecting income taxes is harder than collecting other taxes, such as trade taxes, because income tax collection requires a much more elaborate system of monitoring, enforcement, and compliance. Ahmed and Rider (2013) demonstrate that the evasion of income tax is estimated to be around 60 percent of potential revenues in Pakistan, which is much higher than the estimated evasion of indirect taxes.

Like in many other countries, the vast majority of income taxes are paid as PAYE (Pay As You Earn) in Ghana. In order to encourage firms to file income taxes for their employees, the government of Ghana raised the minimum taxable income from 1,584 Cedi to 2,592 Cedi, and shifted the income tax bands upward, as shown in Table 2. Under the new tax act, wage earners who make below 2,592 Cedi per year do not have to pay income tax. Until 2015, the maximum tax rate of 25 percent was only applied to people who earned more than 38,881 Cedi a year, while the maximum tax rate of 25 percent was applied to people who earned at least 31,681 Cedi. The tax rate change was applied from 2016. Experiences from other countries suggest the reduction in tax rates may reduce tax evasion. Fisman and Wei (2004) show that a one percentage point decrease in the tax rate is associated with a three percent reduction in corporate tax evasion in China.

Alvaredo and Gasparini (2013) demonstrate that only a few developing countries have made income tax data available, and incomes reported to the tax authorities are considerably higher than those reported in household surveys. Alvaredo and Piketty (2010, 2014) point out that top income individuals are usually not covered in household surveys, but are included in the administrative income tax data. Alvaredo and Londoño (2013) compare the Colombian household survey with administrative tax micro-data between 2007 and 2010 and find that household surveys poorly capture income at the top of the distribution.

For Ghana, we have access to both household data and administrative income tax data aggregated by income brackets in addition to the business census. The business census (IBES) was conducted in 2014, and covers all economic establishments in Ghana. IBES data suggests the actual number of formal sector workers is higher than the number of

formal sector workers reported in the administrative tax data. The administrative tax data does not include individuals who work for formal sector firms which fail to file PAYE. We use the algorithm developed by Fournier (2015) and Blanchet, Fournier and Piketty (2017) and combine the household survey data and the income tax files, adjusting the number of formal sector workers using the business census to reconstruct a nationally representative distribution of wage earners in the formal sector who are subject to income tax. We then estimate potential income tax revenue and the scale of tax evasion in 2014 and 2016. We find the income tax revenue could have been higher by 582 million Cedi (equivalent to 0.5 percent of the GDP) if everyone who filed income tax in 2014 had paid the full amounts of income tax due. Tax evasion is predominantly observed in the public sector. If all formal sector firms and organizations, regardless of whether they actually filed income tax or not in 2016, paid the full amounts of PAYE for all their employees, the income tax revenue could have been higher by 1.2 billion Cedi (equivalent to 1.4 percent of the GDP). In 2016, we observe a further reduction of income tax revenue. The total income tax revenue could have been higher by 3.6 billion Cedi (2.2 percent of the GDP) if all formal sector firms and organizations, regardless of whether they actually filed income tax or not in 2016, paid the full amounts of PAYE for all their employees.

Our simulation results indicate improving tax compliances among the registered formal sector firms and organizations can improve tax revenue dramatically. The government needs to improve its incentive mechanisms among taxpayers as well as among tax collectors. The concern on tax compliances is as important, or even more important in developing countries than it is in developed countries as they have been struggling to increase the tax revenues.

Hallsworth (2014) reviews recent impact evaluations in tax compliances in developed countries. He separates interventions into two approaches: a deterrence and a non-deterrence approach. The deterrence approach includes the use of audits and the introduction of fines. The non-deterrence approach includes various interventions such as the use of norms and fairness.

Overall, most deterrence interventions that increased the perceived enforcement or perceived severity of the enforcement increased tax compliance (for example, Kleven et al. (2011) and Harju et al. (2013)). The typical treatments under the deterrence approach include sending a letter to randomly selected taxpayers along with their bills, and inform them about the possibility of them being audited. Kahn, et al. (2001) demonstrate that an increase in fines improves tax enforcement in Brazil.

On the other hand, interventions using non-deterrence have mixed results in tax compliance (for example, Del Carpio (2013); Wenzel and Taylor (2004); Ariel (2012)). Del Carpio (2013) studies the effect of norms on tax compliance by giving tax payers the information on average compliance rates, and find positive effects of the interventions. Blumenthal, Christian and Slemrod (2001) evaluate the effect of a letter that uses normative appeals to taxpayers. They find no behavioral change in tax compliance. Ariel (2012) finds sending letters that use moral persuasion increases the tax deductions among corporations, which reduces the tax revenues of the government.

Although there are a number of studies on tax compliances in developed countries as discussed above, empirical evidence is limited in developing countries. In addition, developing countries face additional challenges such as weak institutions, corruption, and informal economy. This study shows weak institutions cause tax evasion not only in the private sector, but also in the public sector.

It is important to evaluate whether a particular intervention that works in developed countries also works in developing countries, and also in the public sector. Even if prior studies suggest that the deterrence approach increases tax compliance in developed countries, it should be noted that conducting such interventions is costly and providing the right incentives to tax officials to put their efforts to monitor can be challenging in developing countries (Ahmed et al. (2012)). The deterrence approach seems to work well where there is rigid law enforcement. In countries with weak institutions, such approach might not be effective. More empirical evidences are needed from developing countries before we can make solid policy recommendations for developing countries.

The availability of administrative income tax data is limited in developing countries, which makes it extremely difficult to understand the nature of tax evasion in developing countries. The availability of administrative income tax data together with rich household and business census data makes Ghana a great example to study tax compliances.

The paper is organized as follows: Section 2 describes data and the empirical strategy. Section 3 shows the results, and Section 4 provides policy recommendations and conclusions.

## **2. Data and methodology**

### **2.1 Data**

We use four types of data in this paper, namely, administrative income tax data, household survey data (2012/13 GLSS 6), business census data (2014 IBES), and the 2015 Labour Force Survey (LFS) data.

In the private sector, firms list all the workers and their wage incomes. They also report how much they withhold from each worker. In the public sector, the Controller & Accountant Generals Department sends one check for all public sector workers. Thus, GRA cannot determine how much each public sector worker earns, and how much income tax is withheld from each public sector worker. GRA conducts headcounts of all workers, both in the private and public sectors, every two years. We use the information from the headcounts to determine the number of workers.

We have aggregated administrative income tax by the public and private formal sectors for 2011, 2012, 2014, and 2016. Figure 1 summarizes the income tax revenue by the public and private formal sectors for these years. Administrative income tax data contains

aggregated Pay As You Earn (PAYE) and personal income tax for given income brackets by the public and private formal sectors. The PAYE contributions are withholdings from the salaries of employees. Self-employed persons are required to pay personal income tax at graduated rates in four equal installments. Figure 1 shows that income tax revenue increased dramatically between 2011 and 2014, but slightly declined in 2016. The increase in income tax collection from 2011 to 2014 was observed predominantly in the private sector. The income tax revenue rose by 267 percent in the private sector during that period.

The Ghana Living Standards Survey Round Six (GLSS 6) was conducted from 18th October 2012 to 17th October 2013. The data covers a nationally representative sample of 16,772 households. Detailed information was collected on the demographic characteristics of households, education, health, employment, agricultural production, household enterprises, household expenditure, income, and other factors. We combine the GLSS 6 (2012/2013) and 2014 administrative income tax data to estimate the scale of tax evasion for 2014. Note the number of taxpayers was not updated by GRA between 2013 and 2014. Thus, the number of taxpayers we use for the 2014 income tax data was counted in 2013.

The 2015 Labour Force Survey (LFS) is a nationally representative sample of a household-based survey. Unlike GLSS 6, the 2015 LFS is focused on work-related questions. We combine wage data from the 2015 LFS and the administrative income tax data from 2016 to estimate the distribution of wage earners and income tax evasion in 2016.

In developed countries, administrative income tax data is suitable for studying the distributions of income, as only a few individuals fail to file income tax. However, in developing countries, administrative income tax data suffers from a considerable number of missing wage workers and under-reporting of wages. Household survey data is also affected by under-sampling of wage earners, especially the top income individuals. This creates an extra challenge to capture the distributions of wage earners and potential taxpayers, and to estimate tax evasion and potential increases in government revenue from the enforcement of tax compliance.

We complement the household survey data and administrative income tax information with the business census, which covers all firms and organizations in Ghana. The 2014 Integrated Business Establishment Survey (IBES) is a business census that covers all establishments (firms and organization) undertaking economic activities in Ghana. IBES also covers firms and organizations without employees (i.e., self-employed individuals).

From the IBES, we know the exact number of firms and the number of employees for each firm in each district and each industry. We also have information on whether each firm is registered with the Ghana Revenue Authority (GRA). Table A.1 in the Appendix summarizes the number of firms and organizations in each region, the percentage of firms and organizations registered with GRA, the total number of wage workers, and the number of wage workers who are working for the firms and organizations registered with GRA. There is a large difference in the percentage of firms and organizations registered with GRA across regions. Both the numbers of employers and firms are the largest in Greater Accra. Moreover, the percentage of firms which are registered with GRA is also higher in

Greater Accra than in other areas. Poor regions with smaller numbers of employers, namely Volta, Northern, Upper East and Upper West, have the lowest percentages of firms registered with GRA. Similarly, the percentage of workers who are working for the firms registered with GRA is the highest in Greater Accra (76.5 percent). In Volta, Northern, Upper East and Upper West, the proportion of workers who are working for the firms registered with GRA is below 40 percent.

Table 3 compares the number of workers across datasets.<sup>2</sup> The number of private sector workers who filed income tax was 1.145 million in 2014, while the IBES data suggests there are 1.417 million people who were working for the firms registered with GRA in November 2013. It implies there are about 272 thousand formal private sector workers who are registered with GRA through their employers but their income tax was not filed.

For GLSS 6 and LFS, the number of workers was estimated using household weights. The estimated number of wage earners is 1.506 million in GLSS 6, which is slightly larger than the number of formal private sector workers in IBES.

IBES reports that about 1 million private-sector employees work for firms which are not registered with GRA. It is smaller than the estimated number of informal private sector workers in GLSS 6 (1.168 million). This may be because IBES does not cover all the informal private sector firms, such as self-employed individuals.

The administrative income tax data contains only around 310 thousand private formal sector workers in 2016, which is much smaller than the number of private sector workers who filed income tax in 2014 (1.145 million). GRA staff explains that the number of firms that filed income tax declined significantly in 2016. When the headcounts of employees were conducted from October to November 2016, the government failed to supply sufficient electricity. It forced many firms to temporarily shut down their businesses. The estimated number of private formal sector workers is only around 398 thousand in the 2015 LFS data as well. This suggests there was a large reduction in the number of private formal sector employment in 2015 and 2016.

Figure 2 compares the number of income taxpayers reported in the administrative income tax data in 2014, and the estimated number of wage earners in the formal sector in GLSS 6 by income brackets. We use household weights and wage information for each individual worker to estimate the number of formal sector workers for each income bracket in GLSS 6. The estimated number of wage earners in GLSS 6 is much larger than the income tax payers in lower gross income brackets (annual gross income below 7,800 Cedi) in both the public and private sectors. This is probably because people earning less than 7,800 Cedi of gross income are not paying income taxes, thus, GRA has no information about these individuals.

In contrast, the estimated number of wage earners in GLSS 6 is smaller than the income

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<sup>2</sup> The number of public sector employees in the administrative income is updated only every few years. In the administrative income data set, the number of employees in the public sector were the same in 2013 and 2014. This suggests the headcounts of public sector employees were conducted sometime in 2013.

tax payers in higher gross income brackets (annual gross income of above 7,800 Cedi) in both the public and private sectors. It implies GLSS 6 under-sampled wealthy individuals in the formal sector. This also indicates the Gini coefficient calculated using GLSS 6 may be underestimated, as GLSS 6 misses a large portion of the top income individuals.

Figure 3 compares the number of income tax payers in the administrative income tax data in 2016 and the estimated wage earners in the formal sector in the 2015 LFS data. We use household weights and wage information from each individual worker to estimate the number of formal sector workers for each income bracket for the LFS. In the public sector, the estimated number of wage earners in the LFS data is larger than the income tax payers in lower brackets of annual gross income below 12,000 Cedi. In the private formal sector, the estimated number of wage earners in the LFS data is larger than the income tax payers for annual gross income below 24,000 Cedi. This suggests that a considerable percentage of low income wage earners are not paying income tax, thus they are missing in the administrative income tax data. In contrast, the estimated number of wage earners in the LFS data is smaller than the actual income tax payers for higher gross income brackets in both the public and private sectors. It suggests LFS also under-sampled wealthy wage earners in the formal sector, however, the gap of the number of wage earners is much smaller for the LFS and 2016 administrative income tax data. It is partly due to a large portion of wage earners missing in the 2016 administrative income tax data.

## 2.2 Methodology

By combining the household survey data and the income tax files, and adjusting the number of formal sector workers using the business census, we reconstruct a nationally representative distribution of wage earners in the formal sector who are subject to income tax. Below, we explain step-by-step how we reconstruct the distribution. In the first step, we use administrative income tax data and household and labour force survey data, and generate continuous generalized Pareto curves. In the second step, we estimate the total number of potential income tax payers for each income bracket by applying the number of formal sector workers from the business census to the distribution of formal sector employees, which we derive in the first step. The resulting distribution of formal sector workers include those who did not file income tax and are outside of the administrative income tax data.

### **First step**

We use the algorithm developed by Fournier (2015) and Blanchet, Fournier and Piketty (2017), and attain continuous distributions of formal sector wage earners by approximating generalized Pareto curves for the public and private formal sectors separately.

The continuous distributions of wage income are defined as the curve of the inverted Pareto coefficients  $b(p)$ , where  $p$  is the percentile rank and  $b(p)$  is the ratio between the average income above the percentile  $p$  and the  $p$ -th quantile  $Q(p)$ .

$$b(p) = E[X|X > Q(p)]/Q(p)$$

Suppose  $b(p)=2$  for the top 2 percent of income and the income of the top 1 percent exceeds 1 million dollars, then the average income above 2 million dollars is 4 million dollars.

Figure 4 summarizes the simulated  $b(p)$  for the public and private sectors in 2014 and 2016, respectively. We use the mean income for each bracket from GLSS 6 and LFS since the mean income for each income bracket is not available in the administrative data. Substituting the mean income from GLSS 6 and LFS is likely to underestimate the distribution of wage income.<sup>3</sup>

Figure 3 demonstrates that the inverted Pareto coefficients are higher in the private sector than in the public sector. It implies there is a higher income disparity in the private sector than in the public sector, especially in 2016. In 2016, many workers at the lowest income bracket did not file income tax. Figures 5 and 6 show the estimated continuous distributions of formal sector workers in the public and private sectors, as well as the distribution of total workers from the simulation. They are continuous versions of the distribution of taxpayers. To compare the simulated distributions of workers from the administrative income tax data with GLSS 6 and LFS, we plotted them together in Figures 5 and 6. The blue bars represent the simulated distributions of workers from the administrative income tax data (generalized Pareto curves), and the red bars represent the distributions of formal sector workers in GLSS 6 and LFS, respectively. Figure 5 clearly shows that the simulated distribution of income tax payers in both the public and private formal sectors contains more high-income individuals, compared with the distribution of formal sector workers from GLSS 6. Figure 6 also shows that the simulated distribution of income tax payers contains more high-income individuals, especially in the private formal sector, compared with the distribution of formal sector workers from LFS. However, the difference is smaller between LFS and the administrative income tax data than GLSS 6 and the administrative income tax data. It may be due to a significant number of missing taxpayers in the 2016 administrative income tax data. Table 4 summarized the mean income of wage earners between GLSS 6, LFS and simulated tax administrative data. Both in the public and formal private sectors, the mean wage is significantly higher in the administrative income tax data than GLSS 6 and LFS.

## Second step

In the second step, we estimate the total number of potential income tax payers in the private sector for each income bracket by applying the number of private formal sector workers from the business census to the distribution of formal sector employees, which we derive in the first step. The resulting distribution of private formal sector workers include those who did not file income tax and thus are outside of the administrative income tax data.

Czajka (2016) also applies Fournier's estimation method to tax administrative data, combines it with household survey data, and re-estimates the Gini coefficient for Cote d'Ivoire. Czajka assumes that the tax administrative data in Cote d'Ivoire completely covers

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<sup>3</sup> GRA is going to provide us with the mean income for each income bracket. Once we receive the data, we will replace the mean income from the administrative data with the ones we are currently using.

all formal sector workers in the economy. From the analysis in Section 2, we are aware that it is not the case in Ghana. The tax administrative data suffers from missing individuals who failed to file income tax. For that reason, we adjust the number of the private formal sector workers using the business census.

We assume that the proportion of missing private sector workers in each income bracket is identical across income brackets. We understand this is a strong assumption, as the simulation results heavily depend on the assumption of the distribution of missing tax payers. We will discuss alternative assumptions we can make in the conclusion section.

### 3. Results

Let us first compare the actual tax revenues with potential tax revenues under the assumption that all wage earners within each income bracket earn the minimum (or maximum) income of that bracket. Theoretically, we expect the actual tax revenue to be between the two estimated revenues.

Figure 7 shows the actual tax revenue and the estimated tax revenues at minimum and maximum levels of income for each income bracket for 2014. In the public sector, there are four income brackets in which actual tax revenues are smaller than the estimated tax revenues under the assumption that every wage earner in the bracket earned the minimum wage of the corresponding bracket. The income brackets cover gross income from 4201 to 30,000 Cedi. This implies income tax was not fully paid by taxpayers in these income brackets. Consequently, the total tax revenue in the public sector was only 461 million Cedi, which is much lower than the estimated total tax revenue under the assumption that people made the minimum income in their respective income brackets (743 million Cedi).

In the private sector, we do not find significant underpayments of income tax in 2014. On the contrary, people in the income bracket of 30,001 to 42,000 slightly overpaid income tax, as the actual tax revenue for that bracket is slightly higher than the estimated tax revenue under the assumption that people made maximum income within the brackets. In other income brackets, the actual tax revenues are between the two estimated tax revenues.

The last graph in Figure 7 summarizes the total tax revenue and its comparison with the estimated tax revenues at minimum and maximum levels of income for each income bracket. Between the income brackets of 4201 to 18,000 Cedi, we observe underpayments of income tax, while we observe an overpayment of income tax for the income bracket of 30,001 to 42,000 Cedi. This reflects the patterns of underpayment of income tax in the public sector and overpayment of the private sector for these income brackets.

Figure 8 shows the actual tax revenue and the estimated tax revenue at minimum and maximum levels of income for each income bracket for 2016. It is clear from the first graph on the public sector that the underpayment of income tax in the public sector disappeared in 2016. Moreover, we observe overpayments of income tax in the private sector. Thus, it seems that the large tax evasion we observe in 2014 disappeared in 2016. However, as

shown in Table 3, the number of private formal sector workers reduced from over 1 million to about 398 thousand between 2014 and 2016.

Below, we conduct simulations separately as the public sector and private sector requires different assumptions.

### **Public sector**

With the estimated continuous distribution of wage income earners, we estimate the expected tax revenue for each income bracket, under the assumption that there was no underpayment of income tax among the formal sector workers who filed income tax. Figure 9 shows the estimation results for the public sector. It indicates in 2014, the total income tax revenue would have been higher by 742 million Cedi (equivalent to 0.65 percent of GDP) if income tax was paid for all public sector workers in 2014. The non-compliance of tax payments is particularly high in the highest income bracket. The estimated tax evasion in the highest income bracket alone is 266 million Cedi, which is equivalent to 0.23 percent of the GDP in 2014. The research staff at GRA explains that the payments of income tax come as aggregated amounts from government offices, and no information on the individuals who contributed to the income tax payments is provided. Therefore, GRA cannot tell who contributed to the income tax and how much each individual contributed. In addition, it is reported that the government has recently removed 50,000 ‘ghost names’ from its payroll.<sup>4</sup> It seems that tax evasion in the public sector results from the lack of transparency and the existence of ghost workers in the public sector.

In contrast to 2014, tax evasion in the public sector largely disappeared in 2016. The income tax evasion in the public sector was only 181 million Cedi in 2016. We are not sure why tax evasion vanished in the public sector in 2016. GRA research staff explains that the accounting system was simplified in 2016, and the income tax was sent to a single account, instead of multiple accounts. It may have reduced no-payments or under-payments of PAYE to GRA, as it made it harder for governmental organizations to evade.

### **Private sector**

For the private sector, we conduct three simulations. In Simulation I, we estimate the expected tax revenue, under the assumption that there was no underpayment of income tax among the formal sector workers who filed income tax for both 2014 and 2016. In Simulation II, we assume that IBES’s number of wage earners is correct, and estimate the expected tax revenue for both 2014 and 2016. In Simulation III, we estimate the expected tax revenue for 2016, under the assumption that the number of wage earners in the formal private sector remained the same as it was in 2014.

The results of the simulations are shown in Figure 10. Simulation I results demonstrate that the private sector workers slightly overpaid tax both in 2014 and 2016. It may be because

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<sup>4</sup> Source: <https://www.ghanabusinessnews.com/2017/04/14/ghana-government-removes-50000-ghost-names-from-payroll-imf/>

many private sector firms and organizations filed PAYE for the actual wage at the time of filing, while GRA's wage information is updated only every two years. If individual workers' wages increased since the last headcounts, it is likely that the firms pay more than what GRA expects.

The second simulation (Simulation II) examines the nonpayment of income tax among employees who work for the firms and organizations which are registered with GRA, but did not file income tax. The results suggest the total income tax revenue could have been higher by 432 million Cedi and 3.429 billion Cedi in 2014 and 2016, respectively. They are equivalent to 0.4 and 2.1 percent of the GDP, respectively. This indicates that either the nonpayment of income tax dramatically increased, or there was a massive reduction in the formal private sector employment in 2016.

The third simulation (Simulation III) assumes that the number of taxpayers remained the same between 2014 and 2016. The simulation yields a significant increase in the potential income tax revenue. The total income tax revenue could have been higher by 2.381 billion Cedi if all formal sector workers who paid income tax in 2014 paid income tax in full amounts in 2016. It is equivalent to 1.4 percent of the GDP in 2016.

#### **4. Conclusion and policy recommendations**

This paper examines the scale of tax evasion and potential revenue gains from the enforcement of tax compliance in Ghana.

By combining the household survey data and the administrative income tax data, and adjusting the number of formal sector workers using the business census, we reconstruct a nationally representative distribution of wage earners in the formal sector, and estimate the potential income tax revenue gain from the enforcement of tax compliance for 2014 and 2016. We find the income tax revenue could have been higher by 582 million Cedi (equivalent to 0.5 percent of the GDP) if everyone who filed income tax in 2014 had paid the full amounts of income tax due. If all formal sector firms and organizations, regardless of whether they actually filed income tax or not in 2016, paid the full amounts of PAYE for all their employees, the income tax revenue could have been higher by 1.2 billion Cedi (equivalent to 1.4 percent of the GDP). In 2016, we observe a further reduction of income tax revenue. The total income tax revenue could have been higher by 3.6 billion Cedi (2.2 percent of GDP) if all formal sector firms and organizations, regardless of whether they actually filed income tax or not in 2016, paid the full amounts of PAYE for all their employees.

In contrast to 2014, tax evasion in the public sector largely disappeared in 2016. We speculate that the tax compliance improved in the public sector because the income tax collection system was simplified, making it harder for governmental organizations to evade. In contrast, the number of private formal sector workers who filed income tax significantly reduced between 2014 and 2016. Our simulation results indicate that if the same number of people filed income tax in 2016 as in 2014, and if they had fully paid the

tax, then the total income tax revenue could have been higher by 54 percent, which is equivalent to 1.0 percent of GDP.

This paper shows income tax compliances have significant impacts on tax revenue, however, the simulation results heavily depend on the assumption and the quality of the data. Further improvement of assumptions and data quality is desirable to estimate the scale of non-compliance more accurately. We used the mean income from household survey and labour force survey for simulations. Ideally, the mean income should be calculated from the administrative income tax data. Also, we assumed that the number of missing private sector workers are distributed proportionally across income brackets. It is possible that missing tax payers exist more in lower income brackets. If this is true, then the simulation results overestimate tax evasion. We need to conduct further simulations and test other assumptions.

Income tax compliance has a great redistributive effect as income tax is paid by only wage earners, who are often the richest segment of the society in developing countries. Investigating redistributive effects and income inequality is left for future research.

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**Table 1: Comparison of tax revenue in 2012**

	Revenue as % GDP		
	VAT	Corporate Tax	Income Tax
Low income	5.04	2.24	3.30
Lower-middle	5.99	3.51	4.38
Upper-middle	6.20	3.40	4.86
High incoe	6.60	3.65	8.35
Total	6.09	3.33	5.53
Ghana	4.65	2.87	2.52

Source: USAID tax database

**Table 2: Annual income tax rates**

Until 2015

Income	Rate
0- 1,584	0
1,585-2,376	5
2,377-3,480	10
3,481-31,680	17.5
31,681 and above	25

From 2016

Income	Rate
0- 2,592	0
2,593-3,888	5
3,889-5,700	10
5,701-38,880	17.5
38,881 and above	25

**Table 3: Comparison of number of wage earners**

	Public	Private- Formal	Private- Inform	Unknown
2013/14 Income tax data	503,913	1,145,183	-	-
2013 IBES	-	1,417,368	1,009,632	-
2012/13 GLSS 6	617,972	1,505,667	1,168,824	2,766,436

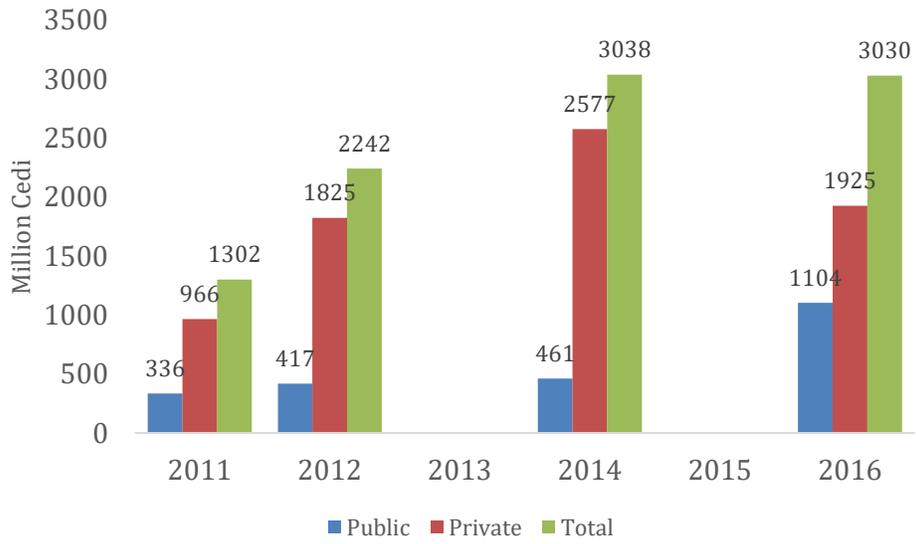
  

	Public	Private- Formal	Private- Inform	Unknown
2016 Income tax data	512,228	309,763	-	-
2013 IBES	-	1,417,368	1,009,632	-
2015 Labour Force Survey	585,838	397,987	678,367	195,739

**Table 4: Comparison of mean income between GLSS 6, LFS and simulated tax administrative data**

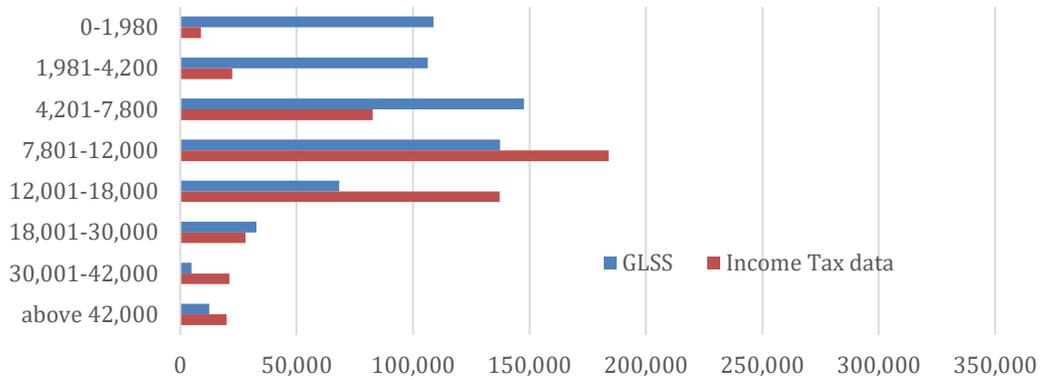
	GLSS/LFS	Simulation
GLSS 6 - Public	7.92 (0.23)	14.78*** (0.50)
GLSS 6 - Private	7.53 (0.30)	13.15*** (0.25)
GLSS 6 - Total	7.69 (0.19)	13.96*** (0.29)
LFS - Public	15.25 (0.44)	16.79** (0.49)
LFS - Private	12.37 (1.07)	18.60*** (1.77)
LFS - Total	14.19 (0.49)	16.62*** (0.61)

**Figure 1: Income tax revenue from public and private sectors**

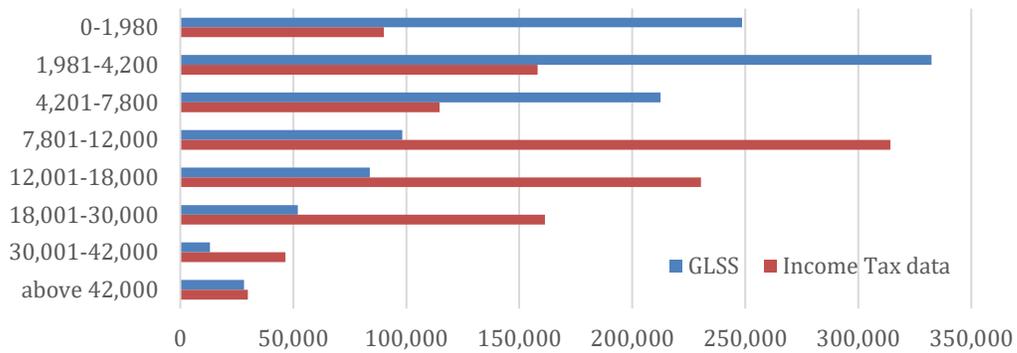


**Figure 2: Comparison of public sector and formal private sector workers in income tax data and GLSS 6 data**

Public

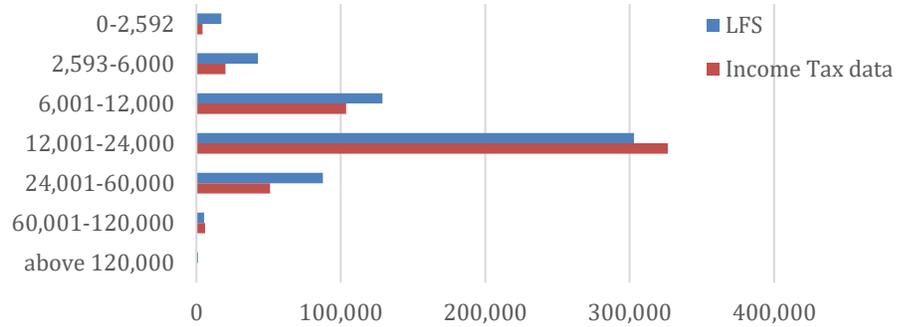


Private

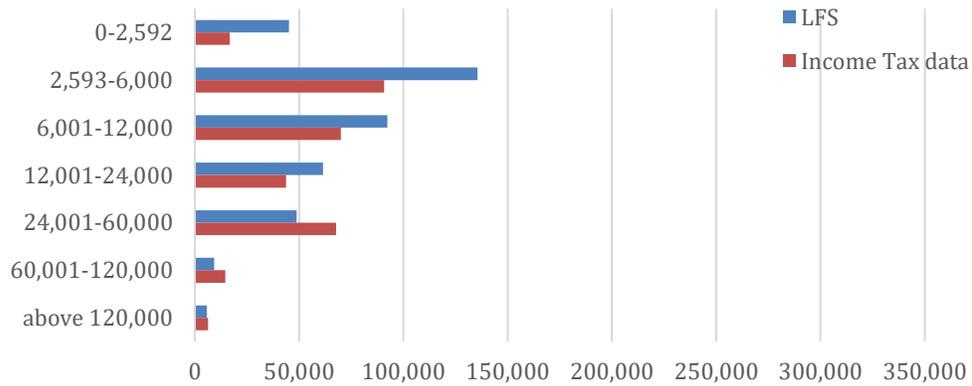


**Figure 3: Comparison of public sector and formal private sector workers in income tax and LFS data**

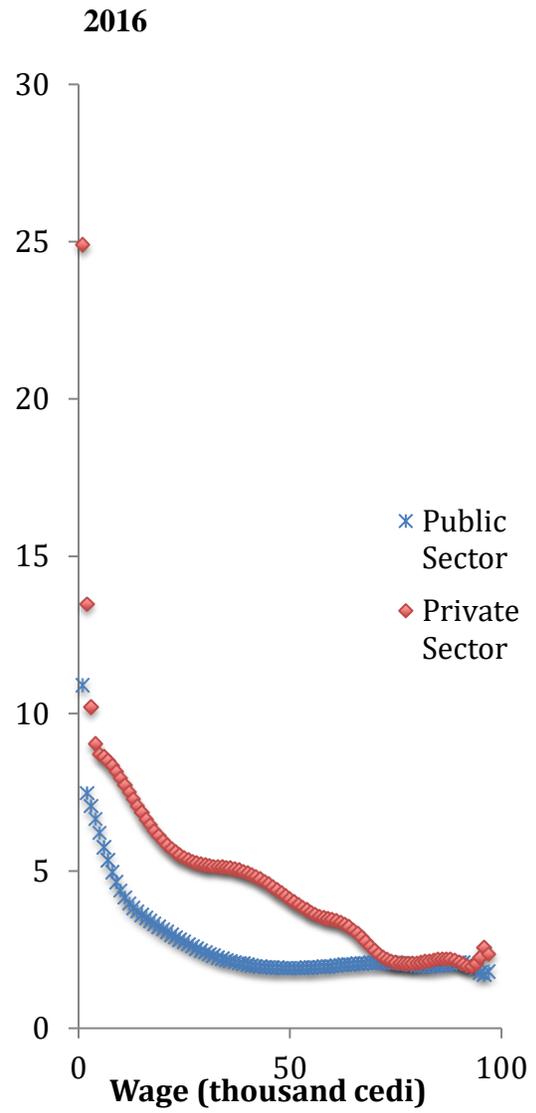
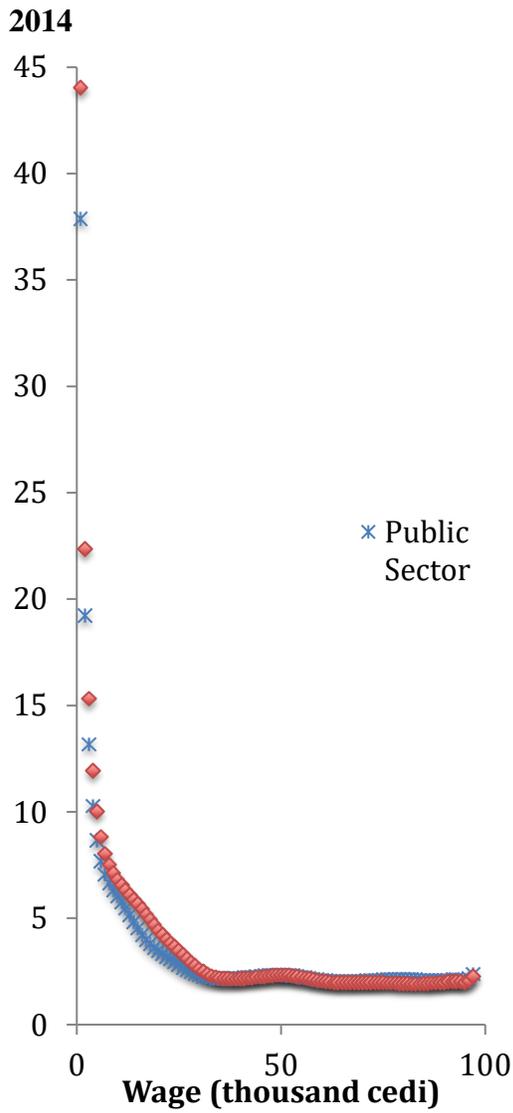
Public



Private

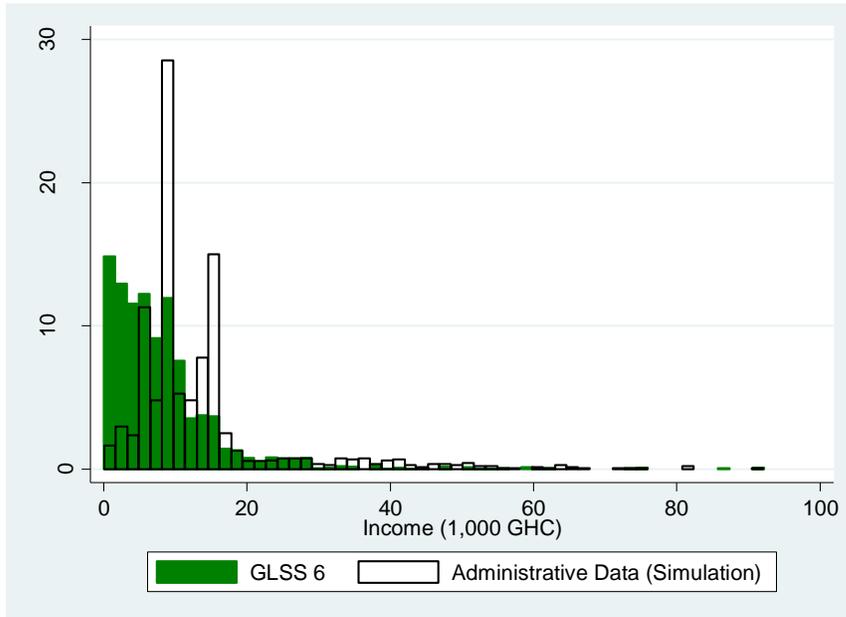


**Figure 4: Inverted Pareto coefficients**

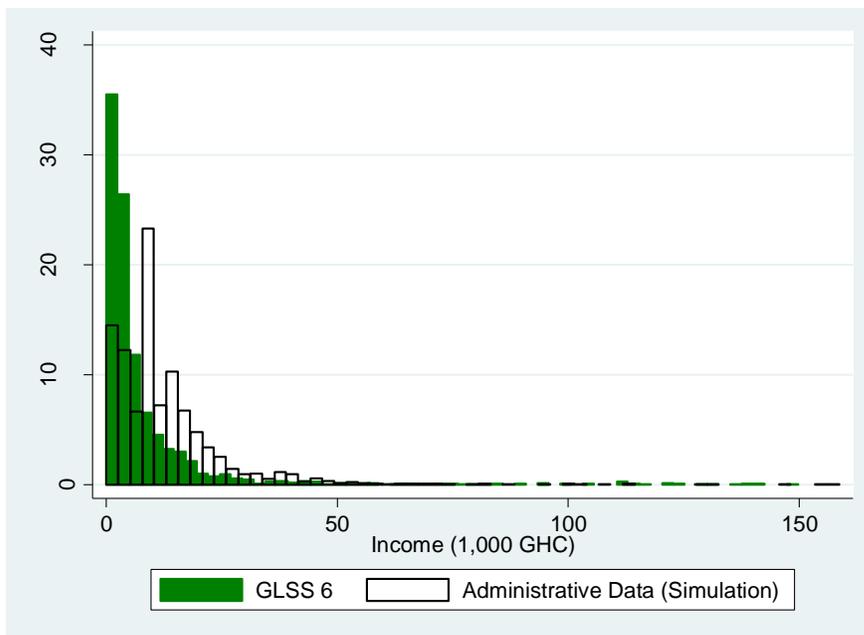


**Figure 5: Distributions of wage earners for 2014 simulations**

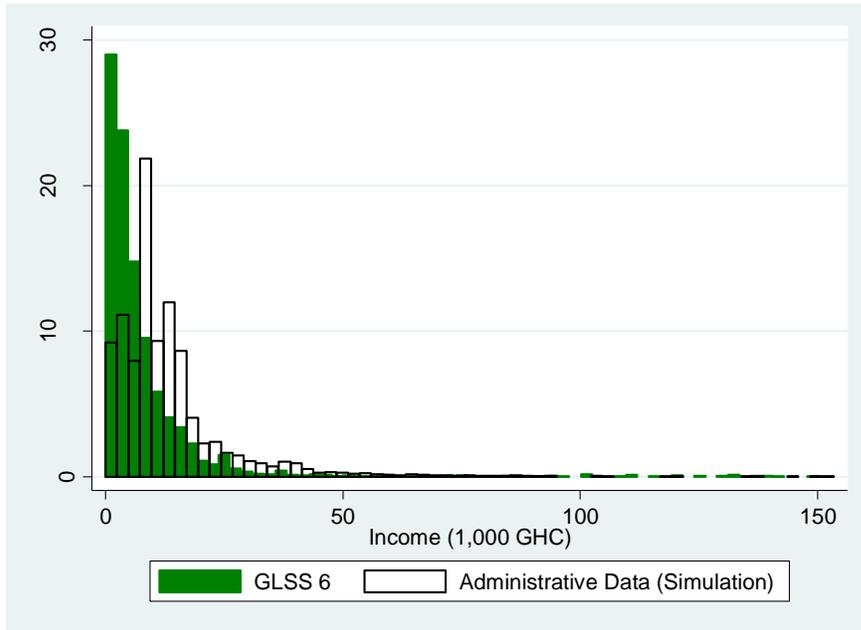
**Public**



**Private**

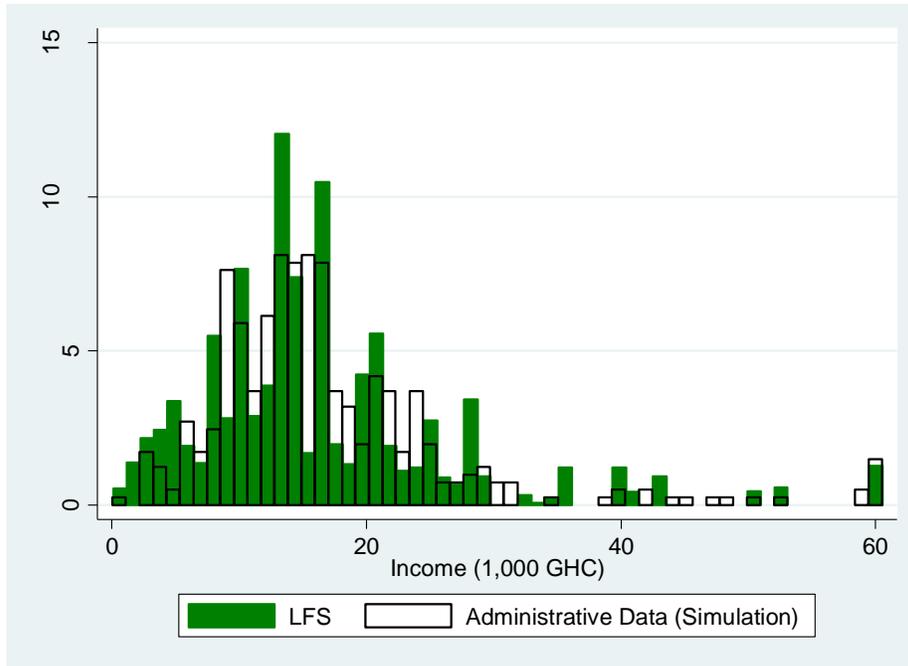


**Total**

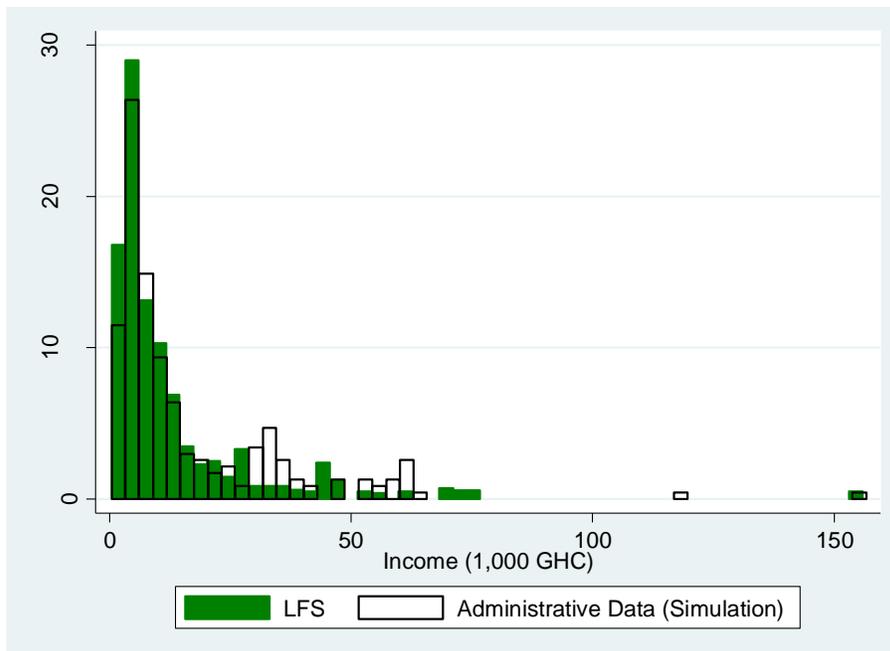


**Figure 6: Income distributions of wage earners for 2016 simulations**

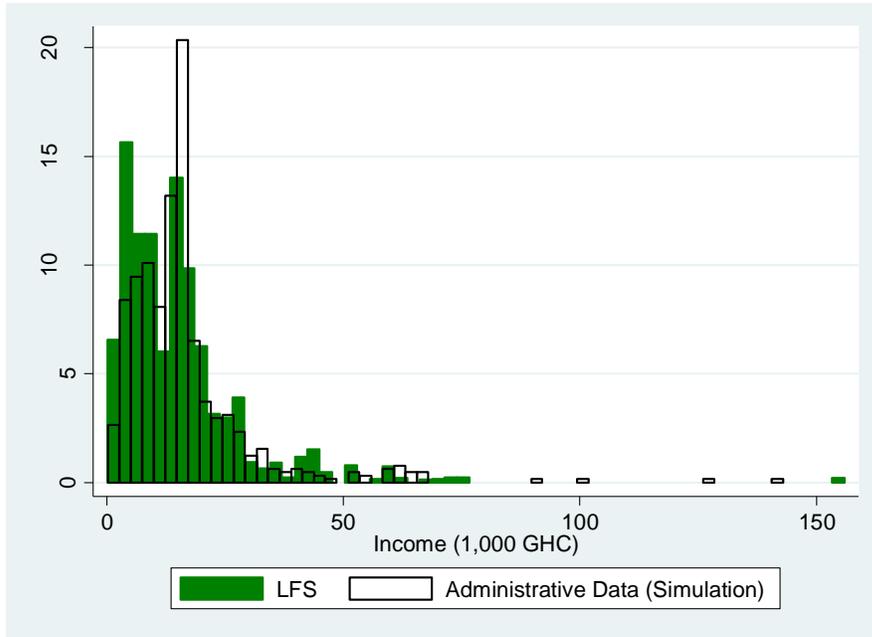
**Public**



**Private**

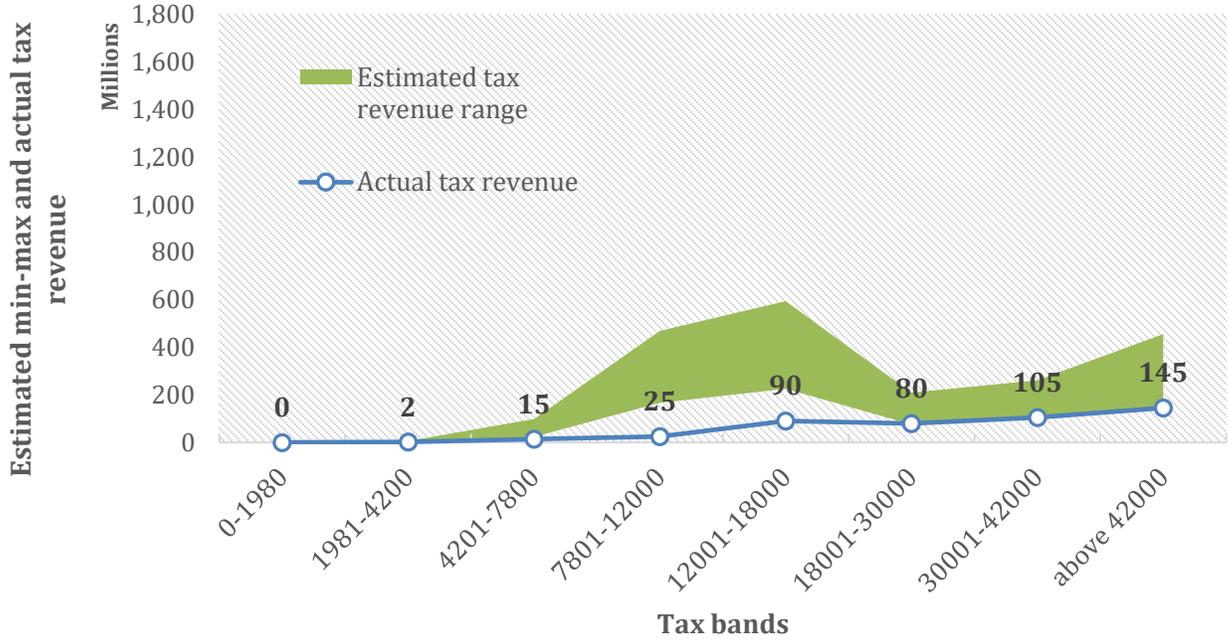


# Total

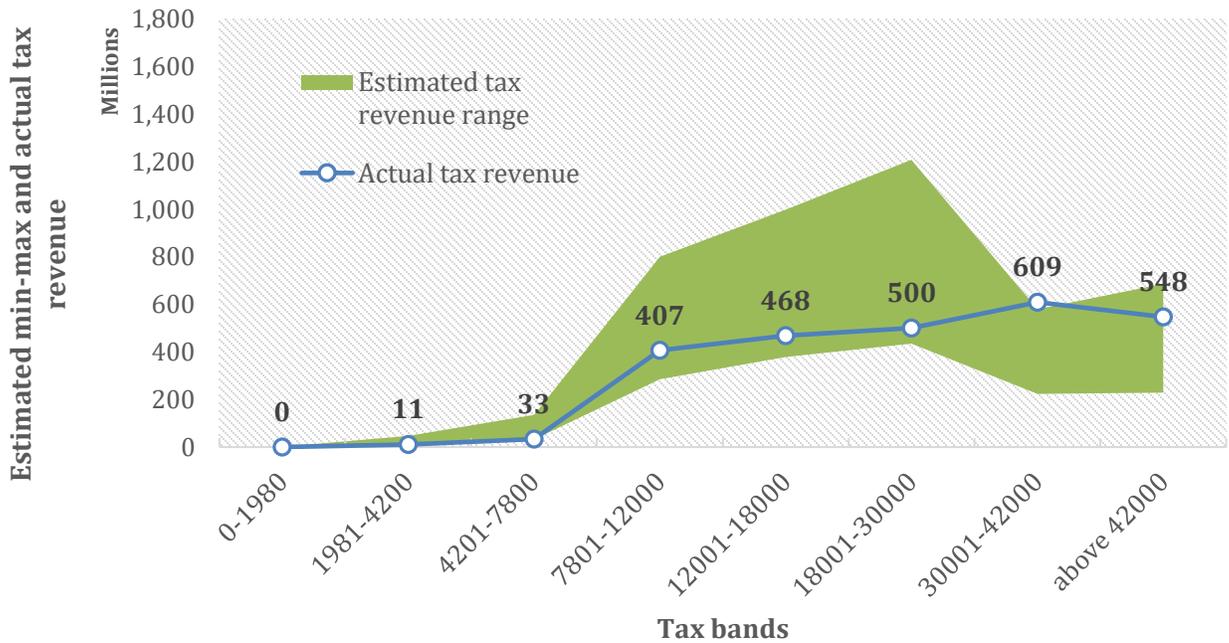


**Figure 7: Comparison of actual revenue and estimated revenues under the assumption of min and max income within brackets (2014)**

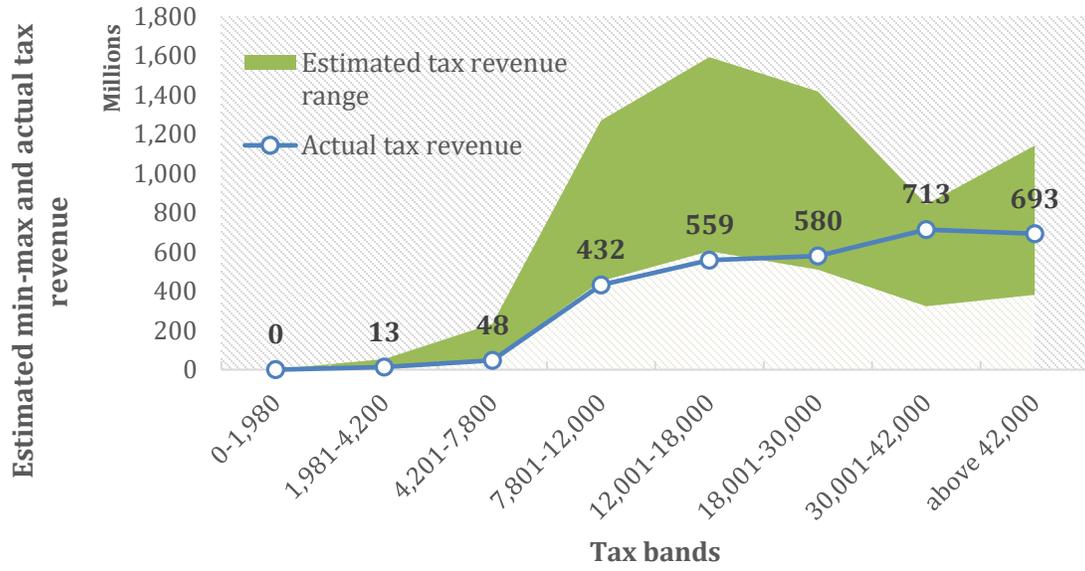
**Public**



**Private**

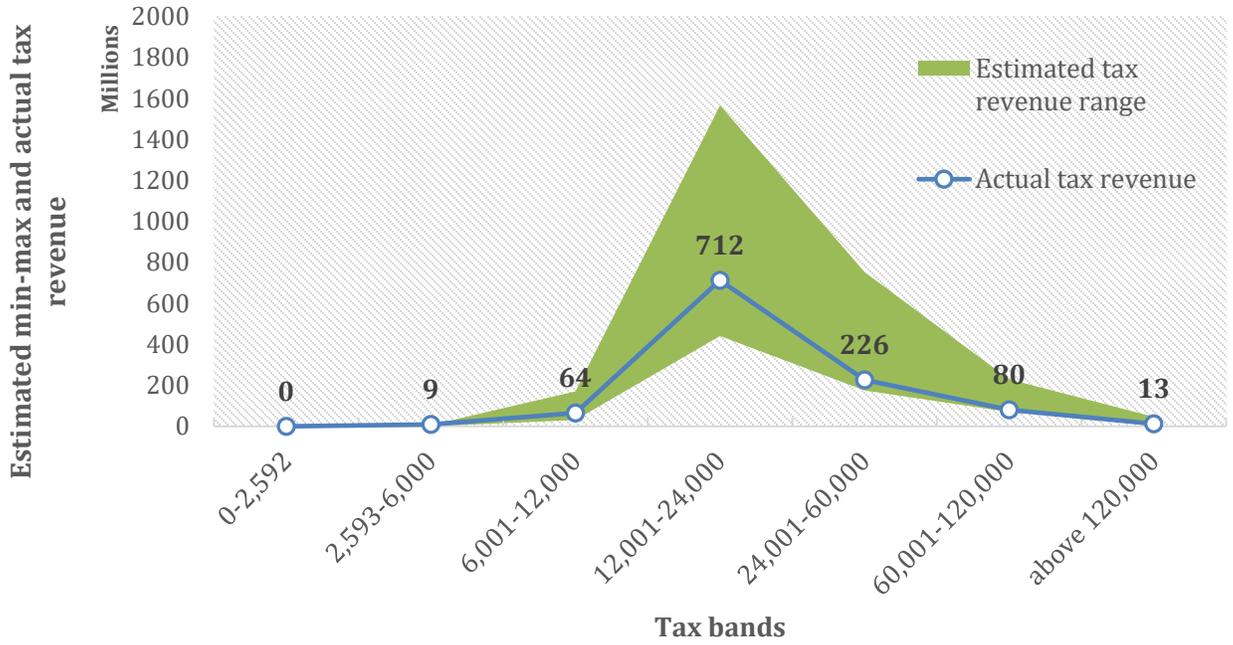


# Total

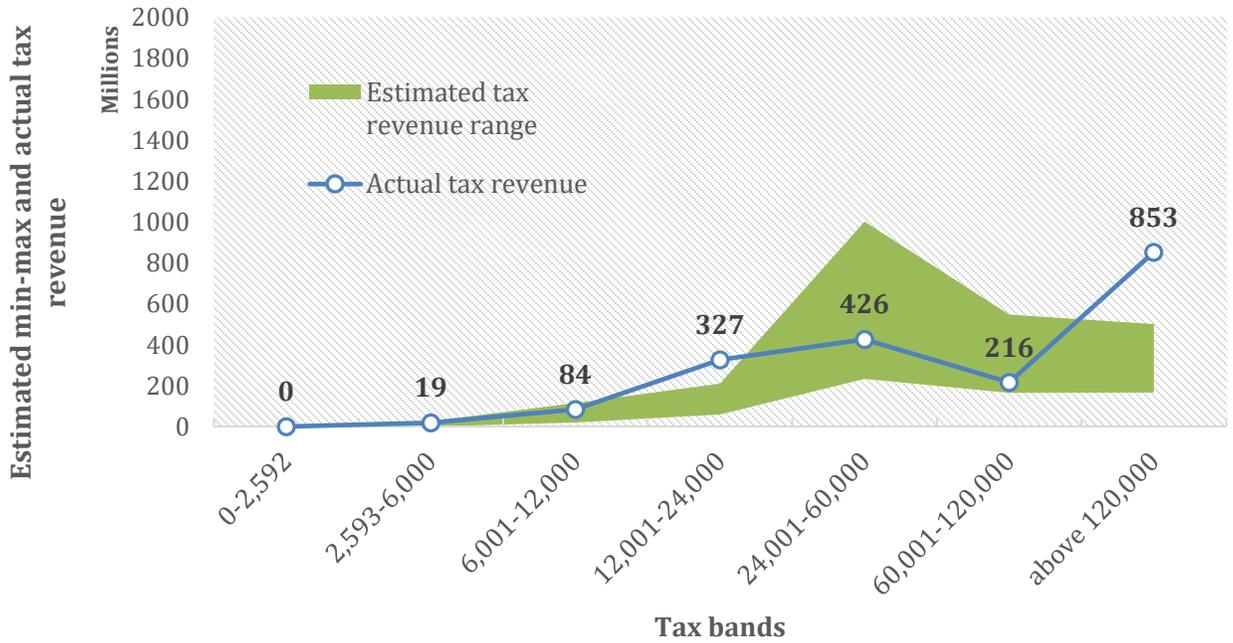


**Figure 8: Comparison of actual revenue and estimated revenues under the min and max income within brackets (2016)**

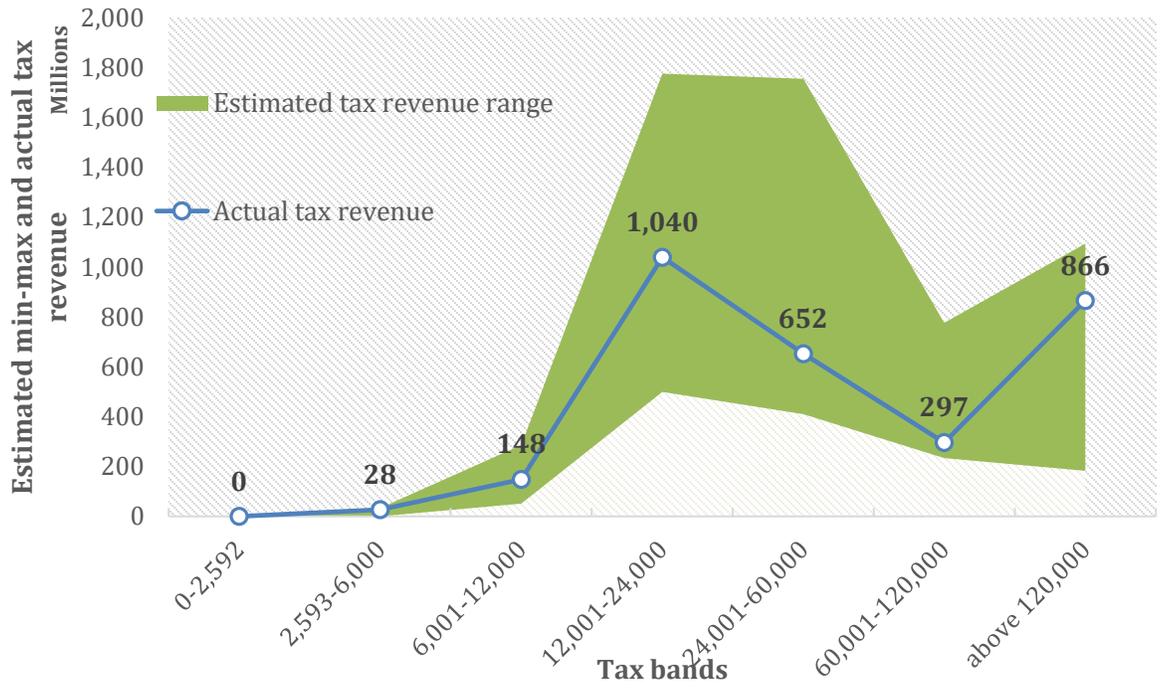
**Public**



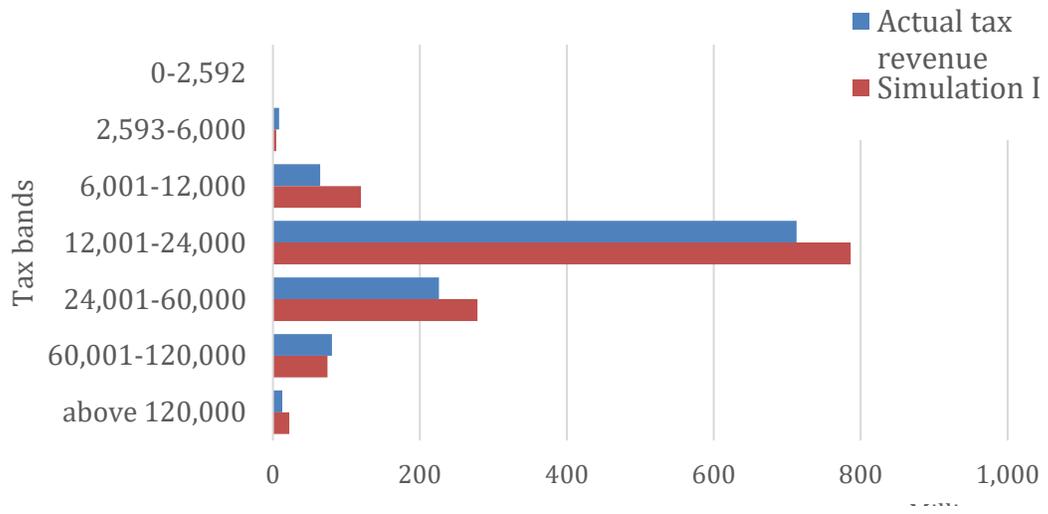
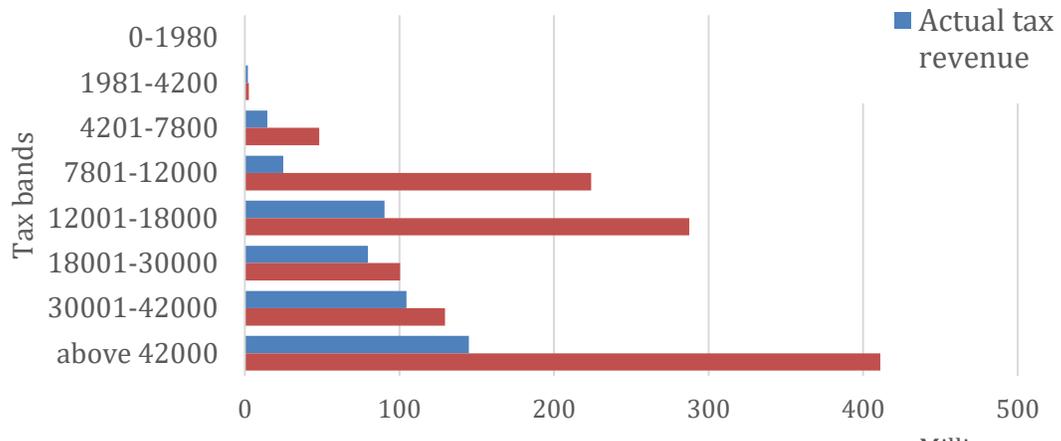
**Private**



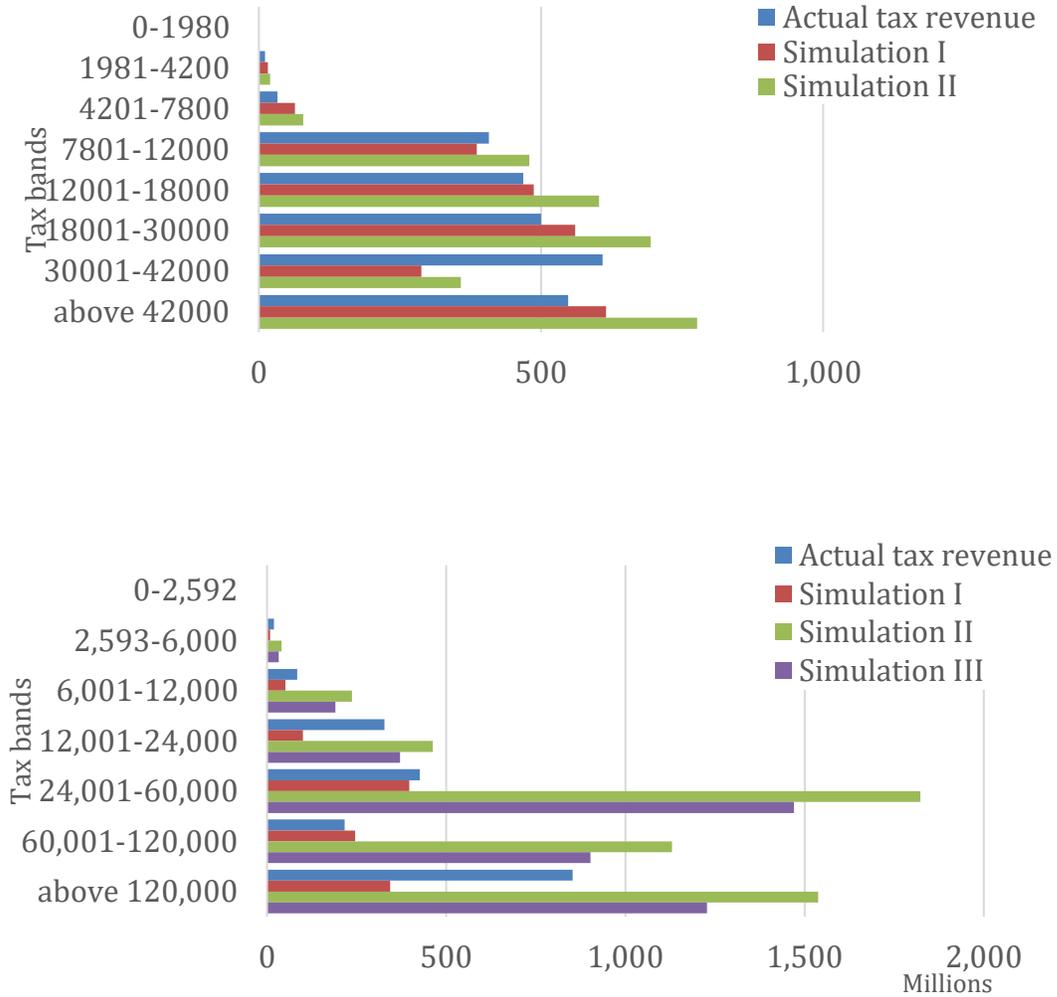
**Total**



**Figure 9: Comparison of actual revenue and estimated revenue for the public sector in 2014 and 2016 (million Cedi)**



**Figure 10: Comparison of actual revenue and estimated revenues for the formal private sector in 2014 and 2016 (million Cedi)**



## Appendix

**Table A.1: Number of establishments and permanent workers in the private sector by region in November 2013**

Region	Number of establishments	Of which: registered with GRA (%)	Number of employees (Thousand)	Of which: Working for firms registered with GRA (%)
Western	59,978	33.7	239.1	56.6%
Central	50,198	39.6	151.4	48.6%
G. Accra	175,111	42.7	1,067.2	76.5%
Volta	39,217	18.2	102.8	27.9%
Eastern	55,464	30.5	168.3	42.2%
Ashanti	119,492	31.4	363.7	47.3%
Brong Ahafo	46,370	34.1	140.5	46.3%
Northern	36,760	14.7	108.1	21.5%
Upper East	15,418	22.9	50.3	37.3%
Upper West	12,400	22.7	35.4	31.1%
Total	610,408	33.4	2,427	58.3%

Source: IBES (2014)