



**Business Regulatory, Investment,  
and Trade Environment Program  
(BRITE)**

# **SUPPORT TO MOLDOVAN STATE TAX SERVICE – TAX GAP ANALYSIS AND FINDINGS**

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# ABSTRACT

This paper explores areas where Moldovan tax authorities can increase tax (revenue) collection. We find that the overall tax gap – for personal income, business, value-added, and tobacco/alcohol excise taxes – likely comes to 20 percent of GDP. We show several methods for estimating Moldova’s various tax gaps – illustrating the methods with numerous “market sizing” estimates. We particularly illustrate the tax gap methodology using company taxes, where we employ both top-down and bottom-up methods in order to illustrate the general approach to tax gap analysis.

**Keywords:** Moldova, tax gap

**JEL Codes:** H2, H21, H27

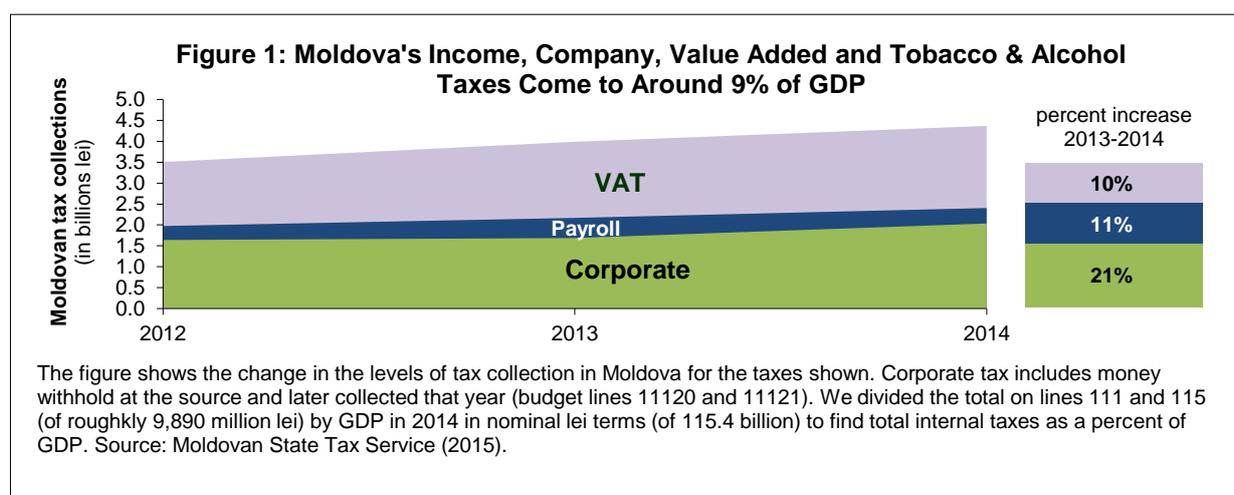
# INTRODUCTION

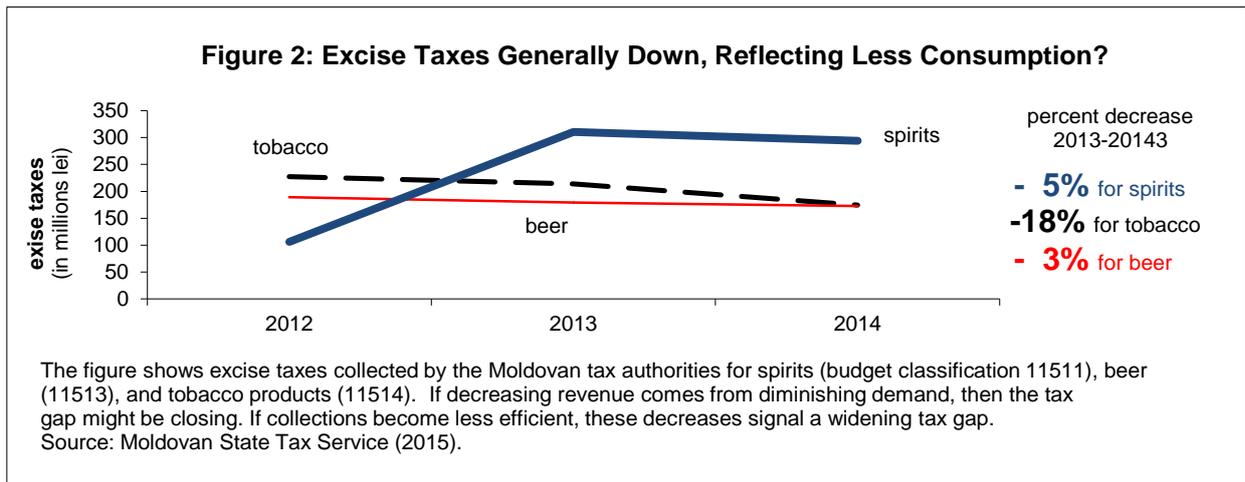
Tax authorities around the world have started to include tax gap analysis as a core activity of their risk management and revenue generation activity.<sup>1</sup> Most authorities – like Moldova’s State Tax Service – have introduced new measures aimed at collecting the information needed to make these tax gap estimates quickly and accurately.<sup>2</sup> Yet scholars and administrative officials have done little work publishing the tax gap for Moldova’s major taxes – income, business, value-added, and excise. The few existing estimates for Moldova’s tax gap (as we reference later in this paper) lie in the enormous range of between 2 percent to 20 percent of GDP, depending on who you believe. Yet numerous other countries’ own tax gap estimates provide a template for the Moldovan authorities.<sup>3</sup>

This paper shows how Moldovan authorities can employ a “tax gap mindset” – a way of thinking about estimating data like tax gaps. This paper provides a simple top-down estimate of Moldova’s tax gap, or the amount of under-collected taxes. We also compare these top-down estimates with bottom-up estimates taken from the Moldovan taxpayer’s database. The paper also provides pedagogical tools – showing how interested parties can think about the calculation of tax gaps. We find that under-collected income taxes come to about 18-20 percent of GDP. Yet, the main value of this exercise comes from the methodology rather than the quantitative estimates, which may vary enormously from the true tax gap due to inaccurate data and so forth.

## A First Look at Moldova’s Tax Gaps

Moldovan tax collections have increased, in absolute terms, over the past three years. Figure 1 shows the amount of money collected for payroll, company, and value-added (VAT) taxes. As shown, payroll, corporate, and VAT collections increased from 10 percent from 2013 to 2014 (for VAT) to 20 percent for company taxes. These tax collections came to 9 percent of GDP in 2014. Figure 2 shows excise taxes collected during the past three years – for alcoholic drinks and tobacco products. As shown, these taxes decreased from 2013 to 2014. In contrast, GDP growth, in nominal lei terms, increased by 14 percent in 2013 and by 11 percent in 2014.



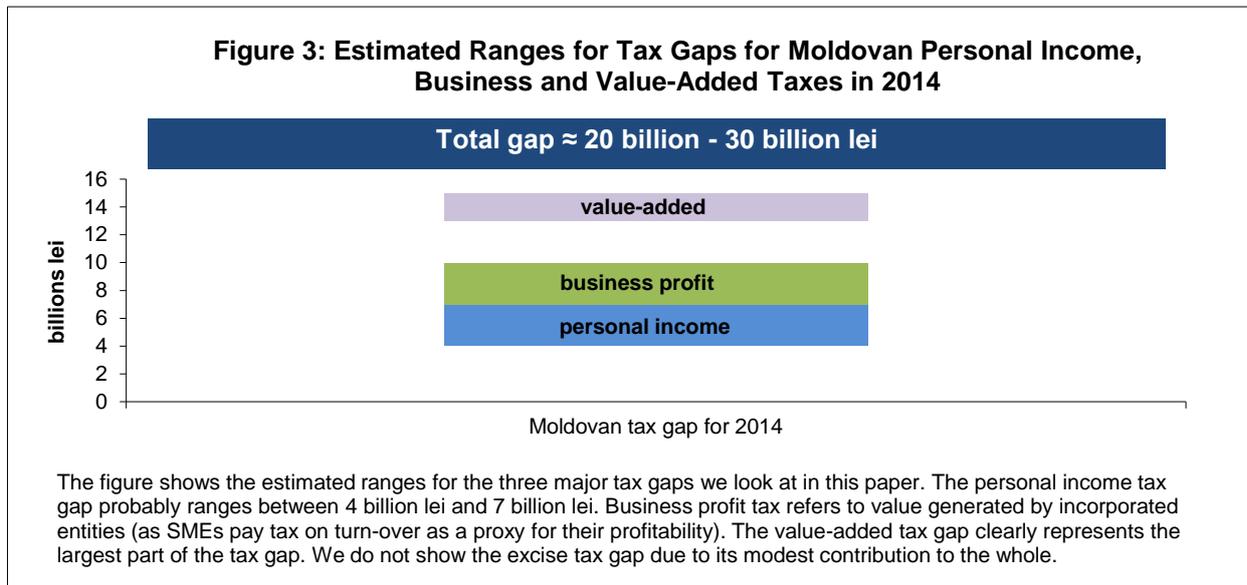


Even with this limited data, we can already make several inferences about Moldova’s tax gap. First, we can infer the existence of a significant tax gap. Recall that the tax authorities should tax all value-added in the economy at 20 percent. The weighted effective tax rate for personal income probably falls at around 7-10 percent, and the average effective corporate rate probably also comes in at around 7-10 percent of company profits.<sup>4</sup> In theory, if the Moldovan government collected all taxes due, the government should collect roughly 30-percent of GDP.<sup>5</sup> Second, tax collections generally kept up with broader economic growth. GDP grew by 11-percent, and payroll tax as well as VAT grew similarly by around 10-11 percent. Thus, the tax gap at first glance seems to have remained stable.<sup>6</sup>

We can make two other inferences about the tax gap just by looking at the big picture. First (or third, if we continue our list from the previous paragraph), we can simply subtract the tax share as a percent of GDP from what it should be to arrive at a quick-and-dirty tax gap estimate. We know that dividing taxes collected by nominal GDP gives the effective tax rates for labour, capital, and value-added taxes. Payroll taxes came out to about 2 percent of GDP, corporate about 2 percent, and VAT about 4 percent of GDP. Thus, even before looking at specific data, we can guess that the personal income tax gap comes to around 6-8 percent of GDP, company tax about 6-8 percent of GDP, and VAT about 10-14 percent of GDP.<sup>7</sup> We know these rates fall far short of the official tax rates on these types of income. Second (or fourth), by looking at the extent to which inflation, rather than productivity growth, explains Moldovan GDP growth, we can figure out the extent to which changing tax collections come from simply keeping up with inflation or from the tax base actually increasing. As we show in the Appendix, consumer price inflation and growth in real GDP grew at about the same rate. Thus, roughly half of the tax authority’s increase in tax revenue simply reflects keeping up with inflation. **Thus, even before doing any serious calculations, we obtain a ball-park figure for the size of Moldova’s tax gap at around 20 percent of GDP.**

Our common sense tax gap estimates dwarf previous estimates of Moldova’s tax gaps by several times. Authors like Khwaja and Iyer (2014) use cross-national econometric analysis to estimate Moldova’s tax gap. They place the gap at only about 2 percent of GDP (or 6 percent when including the gap as a percent of GDP that includes the shadow economy). Moldova has a non-observed economy that constitutes more than 20 percent of GDP, while the estimated tax gap is approximately 9 percent of GDP (Budianschi *et al.*, 2014). Authors like Criclivaia (2014) have shown that the higher cost of collecting taxes in Moldova has contributed to the tax gap. Yet none of these authors have dared to sound the depths of Moldova’s tax gap.

When we include important excise tax gaps (in tobacco and alcohol products) and include untaxed black market activity in our tax gap estimate, Moldova’s tax gap likely approaches 25-30 percent of the official GDP. Figure 3 shows the overview of tax gaps in each of Moldova’s major taxes, showing absolute levels of estimated taxes. As shown, VAT tax gaps likely comprise much of this gap, with income and company taxes making up much of the remainder. (Excise tax gaps in alcohol and tobacco appear in our study mostly for their interest to law enforcement and public health authorities.)



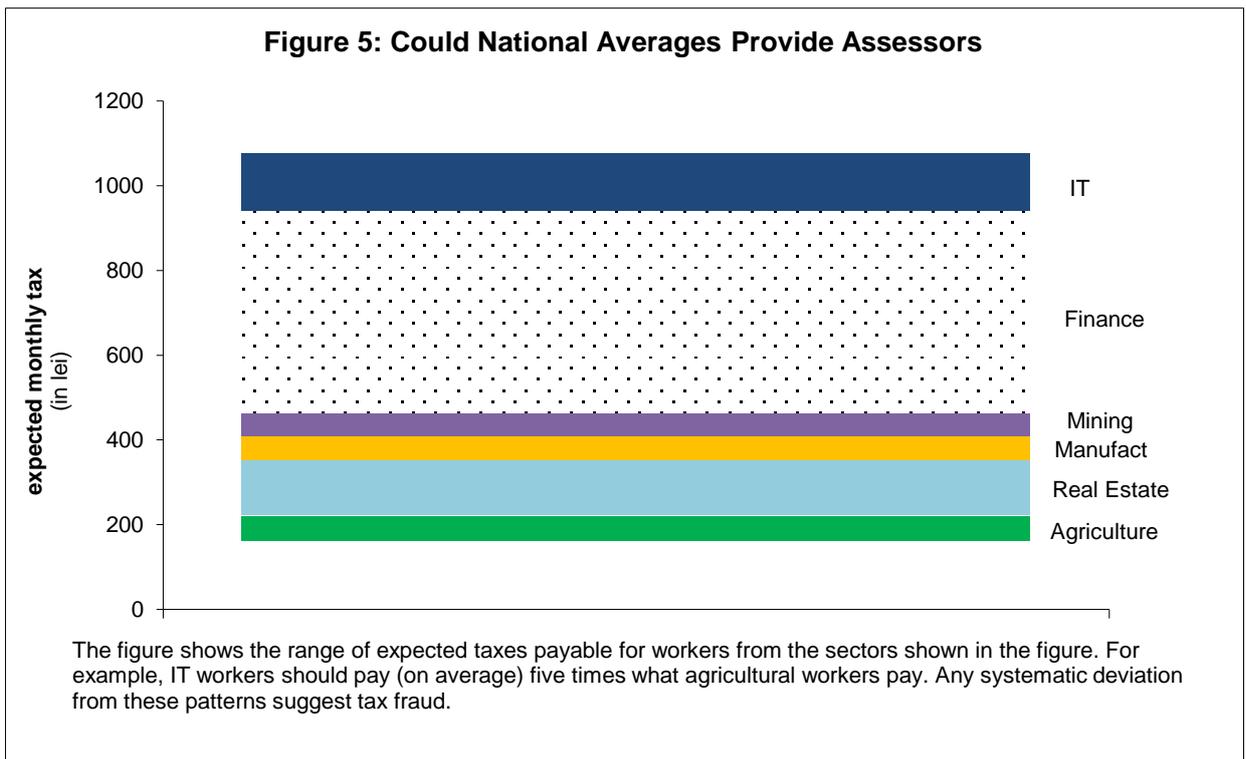
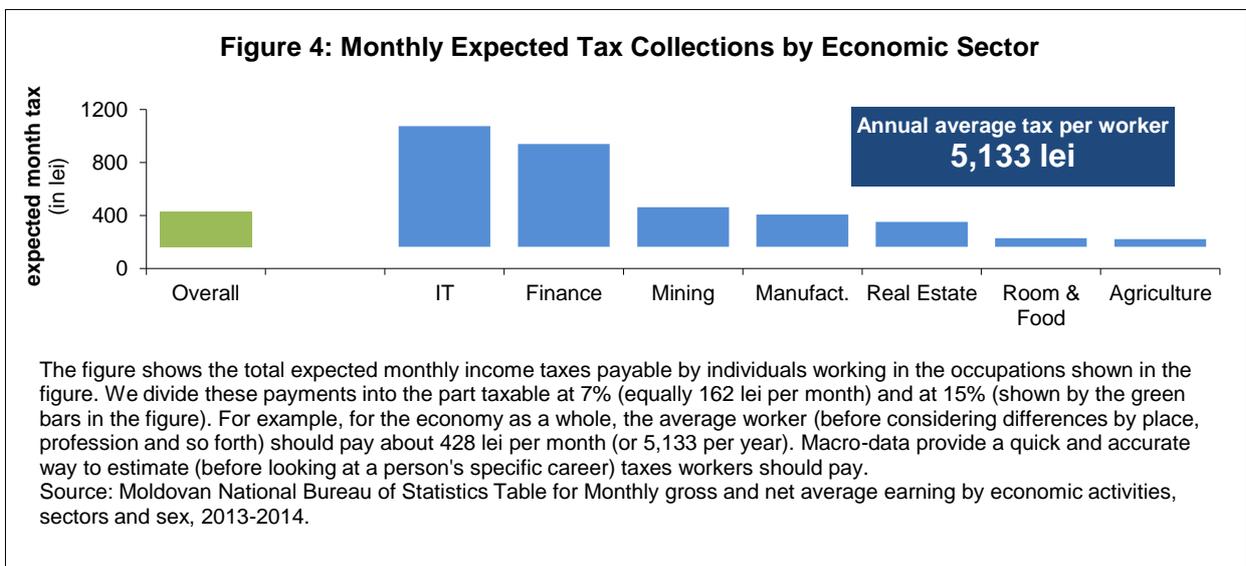
We should point out several caveats to these tax gap estimates right at the start. First, both the definition of taxes collected and GDP pose serious problems for any attempt to talk about Moldova’s tax gaps. The World Bank reports an effective tax rate in 2012 at 18 percent of GDP. We have already shown that the taxes we focus on come to around 9 percent of GDP. This discrepancy highlights the differences in taxes analyzed (for example: are social security contributions considered taxes in the Bank’s own estimate of tax to GDP)? In an economy where as much as 20 percent or more of economic transactions take place outside of official measurement, any attempt to use macroeconomic data to guess about tax gaps remains fraught with peril. Second, we observe large differences in declared taxes, taxes paid, and taxes collected, depending on which data source one uses. We describe these issues when we run across them for our own analysis. Inconsistent data and/or even inconsistent definitions of tax collections run across this kind of exercise (for example: does the data we use include corrections to previous data? Extra money collected by customs? etc.).

To keep this paper at least minimally engaging, we gloss over some of these issues – such as describing what a sub-total we used contains and so forth. We will, though, refer the reader to the original data, and he/she can chase up these inconsistencies for themselves if he/she desires. Our main goal lies in illustrating the tax gap mindset – building intuitions about the way of thinking and breaking up tax gaps into logical pieces. With this intuition, the reader will be able to extend the analysis here, making far more refined tax gap estimates in the future.

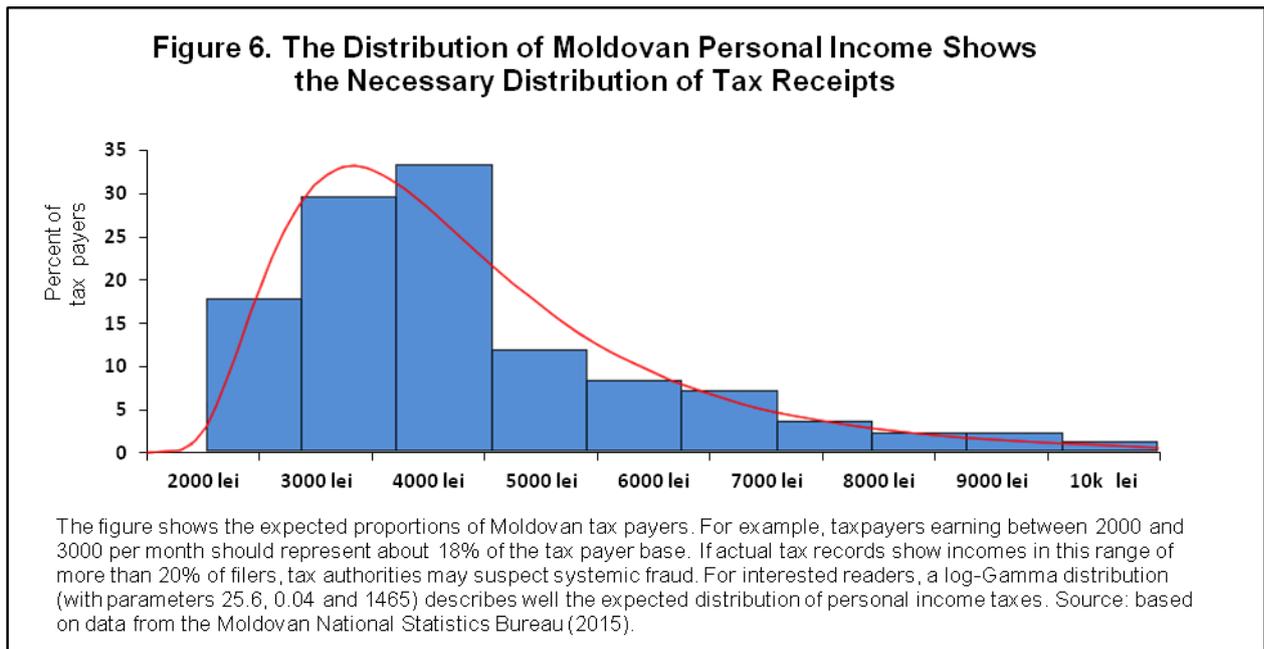
## Moldova’s Income Tax Gap

Taking the roughest estimate of personal income taxes due, in theory, provides an estimate of the maximum achievable personal income tax of roughly 6 billion lei – or 3 times the current

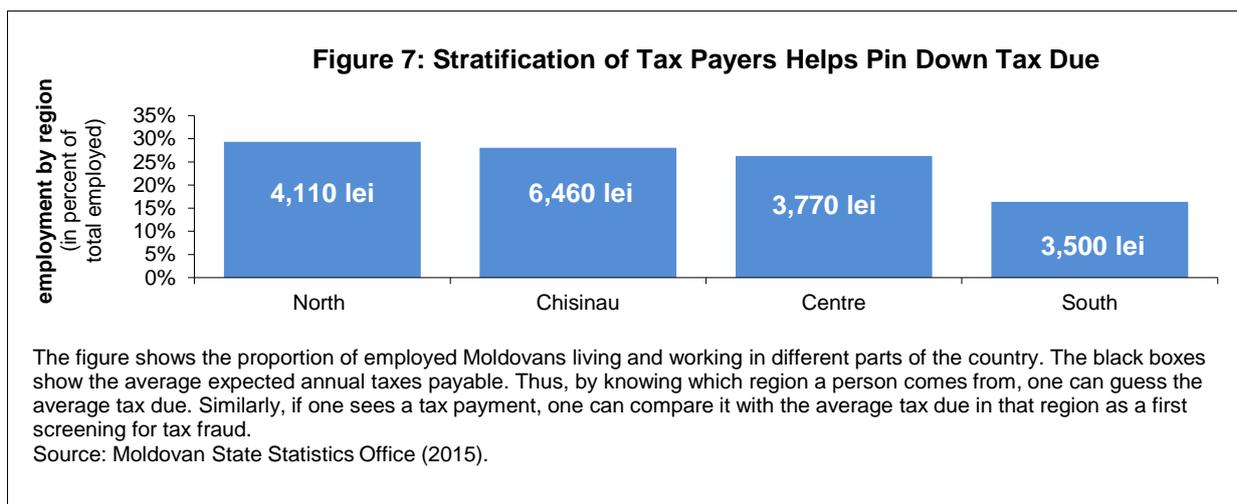
rate of payroll tax collections. Such a maximum achievable tax does not include personal deductions (for family, investment in pension funds, charitable contributions, and so forth).<sup>8</sup> Figure 4 shows the average expected tax payable by Moldovan workers.<sup>9</sup> The figure also shows the amount of marginal income earned at the 15 percent tax bracket.<sup>10</sup> As shown, the average working Moldovan should pay 430 lei per month (or roughly 5,130 lei per year), before adjusting this estimate for extra black market income. The figure also shows the large variation in these averages, when taking into account and stratifying by profession. Workers, as potential taxpayers, in the categories shown in Figure 4 earn the least in agriculture and the most in information technology (IT). As shown in Figure 5, any taxpayer in the IT profession declaring income far different than around 8,400 lei per month or paying taxes at a rate different than a 13 percent effective average tax rate should pose a risk for tax underpayment to the Moldovan tax service. **Thus, at a first glance, 428 lei per month – or its equivalent average for each specific group – represents a first guess at a taxpayer’s real income. The effective average tax rate for Moldovans thus comes in at 10-11% percent of income.**



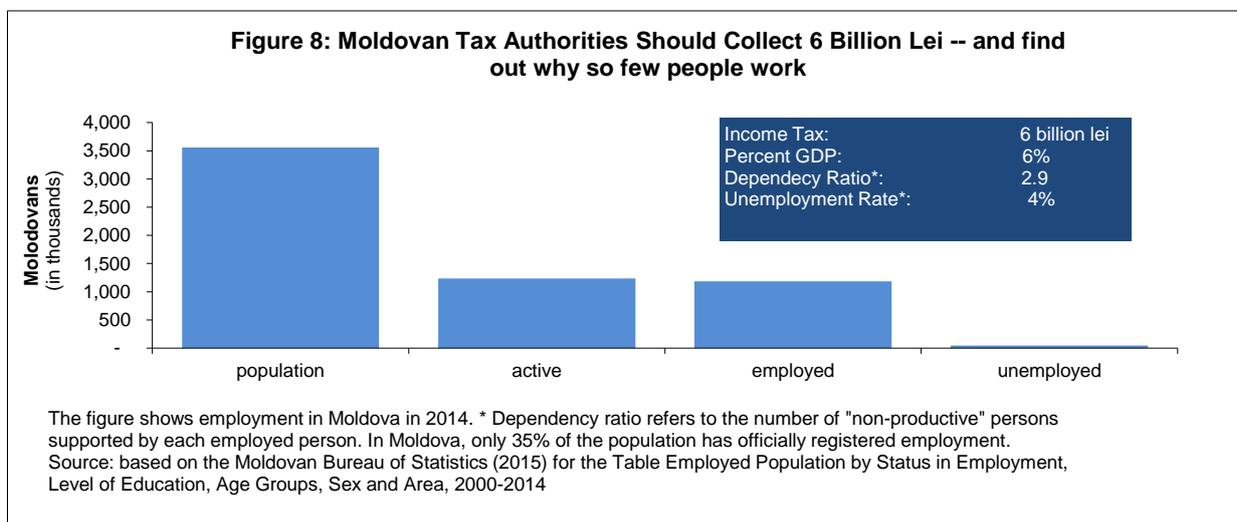
The standard deviation of **expected** monthly tax payments both helps determine the credibility of existing tax estimates and provides a way to focus further inspections/audits.<sup>11</sup> Figure 6 shows the distribution of incomes in Moldova. Given national statistical data about personal incomes, the standard deviation of incomes comes to about 1,770 lei. In other words, roughly 70 percent of all professions will have tax payers who should pay between roughly 220 lei per month and around 800 lei per month.<sup>12</sup> Yet, with this distribution, we can predict exactly what percent of taxpayers should be paying taxes in a particular tax bracket. We know that Moldovans earning 8000 lei or more per month comprise only roughly 2 percent of the population. Thus, 2 percent of the population should be paying 1,050 lei per month.<sup>13</sup> **Any distribution of tax payment different from these estimates means a tax gap exists.**



We can use other groupings of data to assess the likely tax gaps – by geographical area, by the type of company (foreign, private, public), and so forth. Figure 7 shows the very rough estimates of taxes due by workers from a range of groupings. For example, taxpayers in the Chisinau region should pay about 80 percent more in taxes than those living/working in the South. Moreover, roughly 30 percent of all taxpayers should pay sums of around 4,110 lei per year. If more than 20 percent of the population say they earned less than 3,500 lei, then we can deduce the existence of a tax gap. If any category (stratification) of taxpayers ends up paying less than the average expected amount – as illustrated for the geographical stratification shown in Figure 7 – then that group has a tax gap. As shown in the Appendix, we can calculate the tax gaps for these groups as the difference between the sum of the product of group members’ income and the relevant tax rate and actual collections from that group.<sup>14</sup> **Stratification by groups (geographical area, age, economic sector, marital status, and so forth) helps the tax authority find exactly which sub-groups of Moldovans are failing to pay their taxes and helps improve the accuracy of the tax gap estimate.**

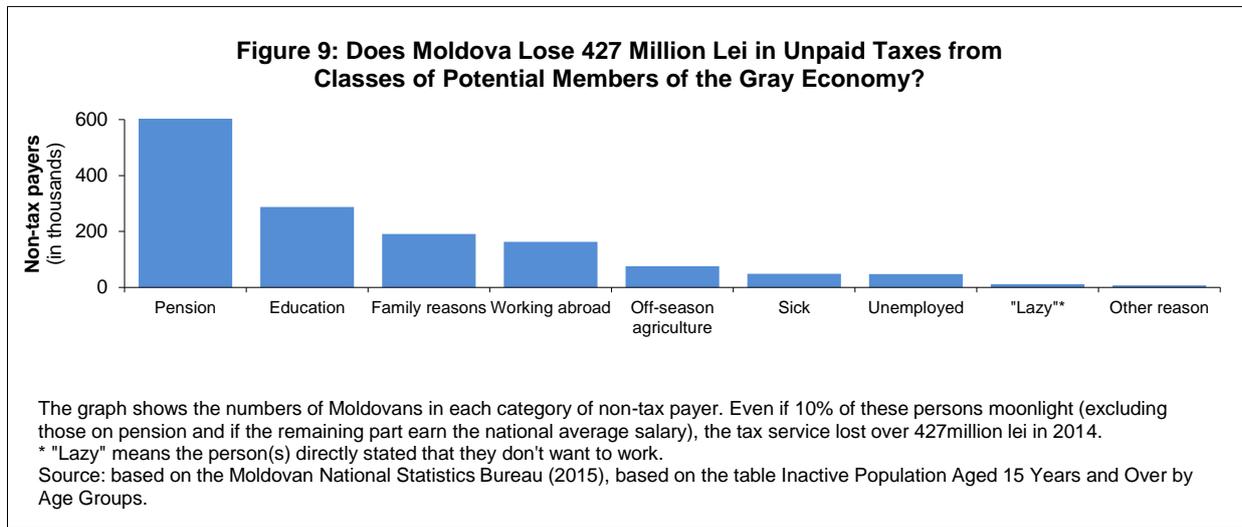


Many Moldovans who fail to register and file tax forms also contribute to the tax gap. As we show in the Appendix, the tax gap consists of underpayments by registered filers as well as non-payments by individuals (and companies) who/which are completely unregistered. Figure 8 shows the proportion of the population generating taxable income (around a bit less than half)! As we described previously, the 1.2 million active workers worked enough to accumulate 5,130 lei per year in tax obligations in 2014. If the tax service should collect around 6 billion lei in personal income taxes, and they actually collected around 2 billion, then the tax gap comes to 4 percent of GDP. Yet even the simple graph shown in Figure 8 points to another cause of the tax gap. According to official statistics, almost two-thirds (66 percent) of the population does not work. Yet unemployment only comes to 4 percent of the active labour market. **Several groups of tax filers probably hide among the technically inactive part of the population.**

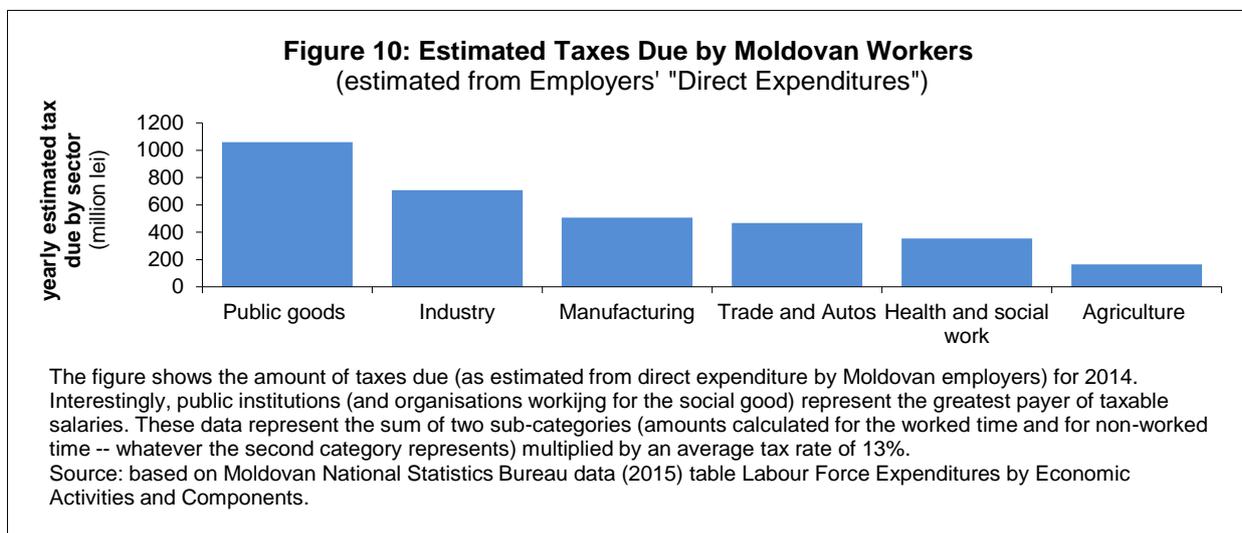


Who are these individuals who earn income and yet do not file tax declarations? Figure 9 shows the number of individuals out of work for various reasons. Pensioners likely earn little additional income on the side, but other classes of persons might. For example, individuals in education and those staying home for family reasons represent higher-risk categories of persons likely earning income. If even 10 percent of these individuals earn the average monthly income, the total lost revenue from these persons comes to around 430 million lei – or 20 percent of the payroll tax actually collected by Moldovan tax authorities in 2014. Yet several authors have estimated Moldova's black market at around 20 percent of GDP. If we apply the effective average tax rate of 13 percent on 20 percent of Moldova's 2014 GDP, we obtain a 2.9 billion lei

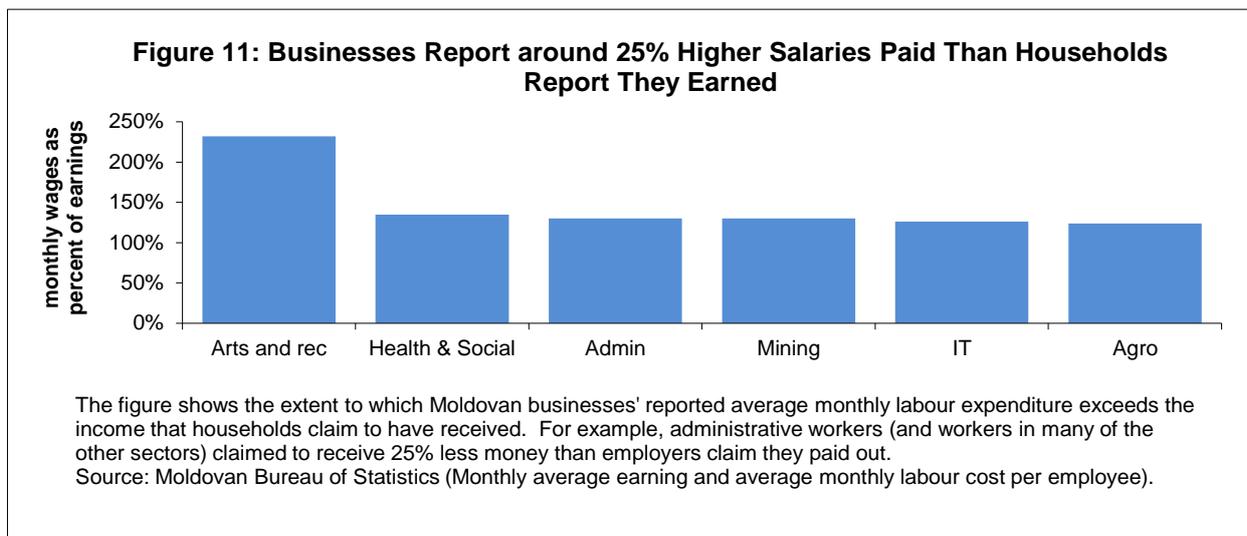
tax bill. In other words, 50 percent of the officially inactive population would have to work full-time and earn the national average wage in order to generate the taxable earnings to which Moldova’s black market figures point. How can we reconcile the two estimates for black market tax due – one at 430 million and one at 2.9 billion lei?



Triangulation helps develop intuitions around the actual tax gap. By comparing estimates done in different ways, we can close in on the most likely value. Figure 10 shows the estimated taxes due from employees of Moldovan companies (as reported by the “direct expenditures for total labour cost” of firms). As shown, estimated revenues in the largest Moldovan sectors produce a 3.3 billion lei tax bill. But if we add all direct expenditure for all economic sectors, we arrive at 65.7 billion lei in direct expenditure on amounts for working time, overtime, and in-kind.<sup>15</sup> Using the average effective tax rate of 8.5 percent, we arrive at a tax bill of roughly 8.5 billion lei. Such an estimate exceeds our previous estimate by about 2 billion lei (or almost 100 percent of the money the tax service actually collected in payroll taxes in 2014). We can explain the 2 billion lei difference between household income and wages reported by businesses in two ways. First, companies likely over-declare wage payments to decrease their profit (and thus, tax). Second, households likely under-estimate their income – again to avoid taxation. The combination of over-declaration by businesses and under-declaration by individuals likely erode tax collections. **If the business wage data were reliable, then taxes owed to the Moldovan tax authority would be 33 percent higher than if they rely on household declarations alone.**<sup>16</sup>



Industries with the largest discrepancies between incomes and wages represent prime targets for further analysis and/or audits. Other data points to the large discrepancy between business earnings and household incomes. Figure 11 shows the extent to which average monthly labour costs (per worker) reported by companies exceed the monthly incomes for individuals. Overall, these mark-ups come to around 125 percent of personal income earned. The data does not say if indirect labour costs enter into the businesses' costs per employee. Yet, even if they do, they only add 7 percent on average to the monthly labour cost per worker. We observe these mark-ups over all business sectors – with employees in the arts and recreation sector costing their employers over 2 times more than they say they earn. The different methods of arriving at the tax gap means we should talk about a tax gap range. **Thus, the data suggest an upward revision of the tax gap estimate by at least 25-33 percent, to place the tax gap between 7.5 billion and 8 billion lei.**



In theory, we could use almost any macroeconomic data to triangulate taxable earnings. For example, consumption by households in 2014 came to around 102 billion lei. Households can only spend what they earn; thus, their earnings relate to their spending. Of course, savings, gifts, and investment income (among other sources) will break the connection between spending and wages. Yet even the simplest model of the macroeconomy shows how taxes relate to aggregate consumption. If consumers spent 80 percent of their money on everything they produced as workers, they would have paid VAT taxes of 16.3 billion lei – a figure not very far off from the figure we find in the next section of this paper.<sup>17</sup> **Because the model is a closed system, even having a tiny bit of data produces reasonably reliable estimates of taxes owed.**<sup>18</sup>

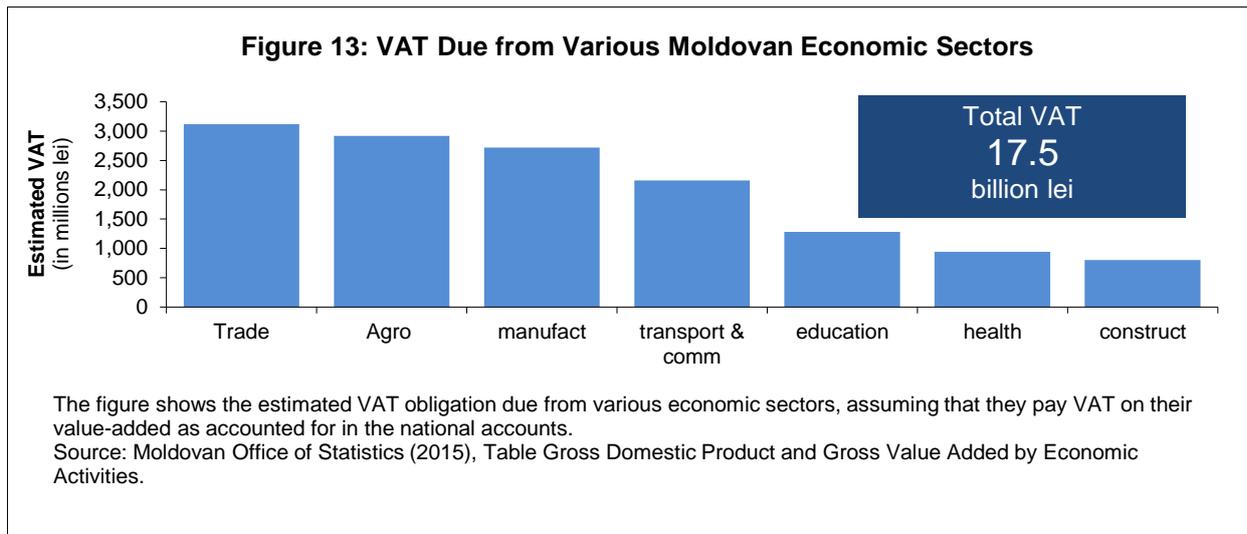
Yet, internal inconsistencies and different definitions for data make exact estimates of the tax gap unreliable for Moldova. At first glance, the tax gap seems relatively small. The World Bank reports tax collections in 2012 at roughly 18.6 percent of GDP.<sup>19</sup> Yet budget data from the Ministry of Finance put total collections above or below 18 percent, depending on what gets counted as revenue. The public sector interim financial statement (shown in Appendix II) consists of 18 budget categories, with good and bad reasons for including some items and not others. **Any calculation of the tax gap thus represents an argument, and a logical argument (formula) makes for a reasonable tax gap estimate.**<sup>20</sup> Figure 12 shows the steps for calculating the personal income tax gap.

### Figure 12: Ten Step Procedure for Finding Personal Income Tax Gap

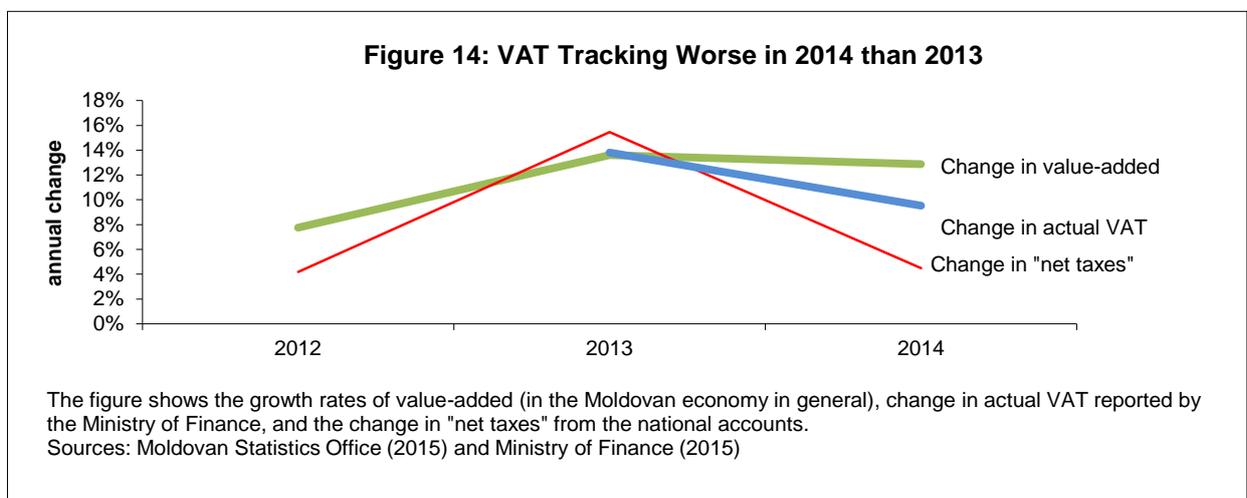
1. Download average monthly personal income data from the Moldovan Office of Statistics as well as the number of persons working (in total and in each strata or grouping of workers),
2. Multiply the average tax rate by monthly estimated incomes and multiply that figure by the number of people working in that sector to obtain a general “ball-park” estimate of individuals’ taxes due,
3. Subtract that figure from any data you have on the amounts of money you actually collected,
4. Look at differences (namely these tax gaps) in the means and standard deviations across groups. These differences tell you which groups pose more risk (using the statistical meaning of “risk”).
5. If you want to refine the estimate, simply break the data into smaller and smaller groupings, and apply the relevant tax rates (and other data like percent of working population).
6. Repeat this procedure using different data sets or sources (for example estimated wages paid by businesses rather than estimated income from household surveys),
7. Triangulate the likely tax gap from these estimates – using common sense to discard any unreasonable estimates and to average the other estimates.
8. In theory, if you know one dataset is more reliable than another, you can give results from that dataset a higher weight – resulting in a weighted average tax gap.
9. Send any metrics about maxima, minima, standard deviations and other “summary statistics” to risk analysis department as a way to guide further audit work.
10. Use if-then scenario tables to show results if you have made any assumptions about data you could not find.

## Maximum Achievable Value-Added Tax

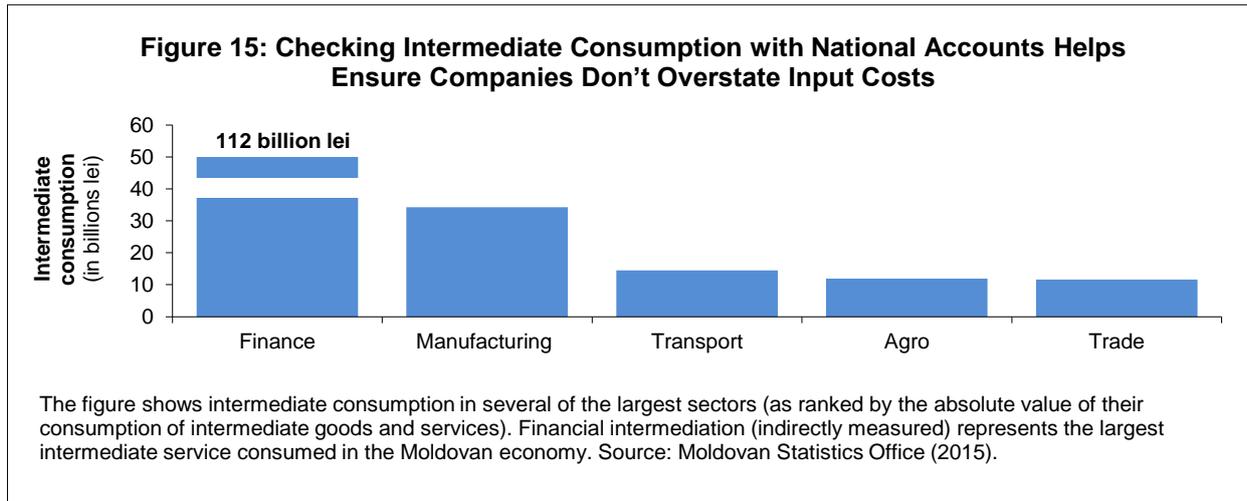
VAT payments could represent the easiest tax gap to calculate, as the national accounts provide data on value-added by sector. Figure 13 shows the amount of taxes the tax authorities would have received if all value-added was appropriately taxed at the relevant 20 percent rate. The tradable goods sector should represent one of the largest VAT payers, generating an estimated 3 billion lei in tax in 2014. Agricultural production, manufacturing, and the other sectors shown in the figure also represent relatively large contributors to Moldova’s value-added. The maximum achievable VAT equals 17.5 billion lei and dwarfs the actual collection of roughly 4.37 billion lei (or 4.4 billion, if we round up) in VAT payments received.<sup>21</sup> **The VAT tax gap under these assumptions comes in at around 13 billion lei.**



The extent to which the growth of VAT collections “track” (or keep up with) the growth of value-added in the entire economy tells us something about the tax authority’s efficiency. Figure 14 shows the growth rate of VAT collections, value-added (from the national accounts), and “net taxes,” reported in the value-added section of the national accounts. In 2013, the nominal growth in VAT exactly matched the nominal growth of economy-wide value-added.<sup>22</sup> Yet, in 2014, VAT collections failed to keep up with the growth of macroeconomic value added. **Thus, slower VAT collections in 2014 added 3 percent to the value of the value-added tax gap – or about 2.8 billion lei.**<sup>23</sup>



To triangulate the estimate for the VAT tax gap, we could look at intermediate consumption in various Moldovan economic sectors. As shown in Figure 15, agriculture, for example, uses up 11.9 billion lei in resources to generate almost 3 billion in gross value-added. Thus, in theory, we can see on the macro-scale the extent to which companies fairly report the consumption of intermediate goods and services, which reduces their estimates for taxable value-added. For example, all manufacturing companies in Moldova should claim roughly 35 billion lei in deductions (costs) from VAT. The sectors shown in Figure 15 differ from those stated in Figure 14. Thus, the tax service will need to decide if the value created in any sector gets consumed or not over the production process. Such decisions rely on judgement, as no “correct” formula exists for calculating the value-added in a sector. Yet a more robust lesson emerges from Figure 15. **If any of these sectors’ intermediate costs differ over time from those in the national accounts, the tax authority may wish to investigate further.**<sup>24</sup>



As with personal income tax, estimates of value-added – and even the amount of VAT collected – may differ according to source and data definitions. The national accounts data records “net taxes on products” of 17.55 billion lei (reported in line 2 of the table Gross Domestic Product and Gross Value Added by Economic Activities). As the 17.55 billion lei comes close to the World Bank estimate for taxes to GDP for 2014, we can only assume that “net taxes on products” actually comprises all taxes, social security payments, and so forth. “Taxes on products and import” came to 18.3 billion lei.<sup>25</sup> Thus, in theory, the difference between the two numbers represent VAT, import, and excise taxes collected by customs. The value of “paid services to the population” came to 15.42 billion lei in 2014.<sup>26</sup> Assuming that all these services resulted in value-added and service providers paid taxes of 20 percent on their value, the extra tax from these services would have equalled roughly another 3 billion lei. As the tax authority’s risk analysts gain experience calculating tax gaps and working with these data, they can decide what kind of adjustments to their initial estimates of the VAT tax gap make sense.

Just as stratification can help the State Tax Service narrow down their estimate of the personal income tax gap, stratification by economic production processes (value chains) can help arrive at more precise VAT estimates. International donors have already funded numerous studies which can help in the creation of upstream-downstream models of the incidence of VAT obligations. Stiopca and co-authors (2011) have mapped Moldova’s tomato industry. Ford and co-authors (2009) have mapped Moldova’s fruit and vegetable markets, identifying points of value-added at various steps in the growing and distribution of fruits and vegetables. Many other studies exist, too many to cite here. **With detailed models of various value chains in the Moldovan economy, the Tax Service can identify maximum achievable tax without significantly increasing monitoring/auditing costs.** Figure 16 shows the general steps in creating an estimate for the VAT tax gap.

**Figure 16: Steps for Calculating the VAT Tax Gap**

1. Download value added for each sector of the economy from the Moldovan Office of Statistics,
2. Multiply each value by 20% -- the result is the VAT that the government could collect under ideal circumstances.
3. Subtract from each sector the amount of tax actually collected – the result is the VAT tax gap for that sector.
4. Add up all the sectors' tax gaps to arrive at an economy-wide estimate.
5. (advanced) Obtain the input-output matrix for the entire economy from the Ministry of Finance (or the relevant department responsible for economic planning),
6. (advanced) add up value-added along chains of production in order to arrive at a total value added as well as value added at each step of the production process,
7. (advanced) subtract these values-added numbers by disaggregated (company level or sector-level) data.
8. (advanced) Add together all the VAT tax gaps across sectors to arrive at an economy-wide VAT tax gap.

## Comparing Macro Data with Micro Data

How do tax gap estimates differ based on level of analysis? In other words, how would bottom-up tax gap estimates differ from top-down estimates? We can use individual taxpayer records to look for patterns in the data which might point to systemic areas of tax collection risk – risk of not collecting money on existing tax obligations. Figure 21 provides an overview of tax collections for 2014 at the individual taxpayer level. Excise taxes far outstripped other taxes on a per-taxpayer basis. Yet these excise taxes represented only a small part of the total taxes collected in Moldova. The average taxpayer paid around 121,000 lei in tax in 2014, while paying around 330,000 lei in value-added taxes.

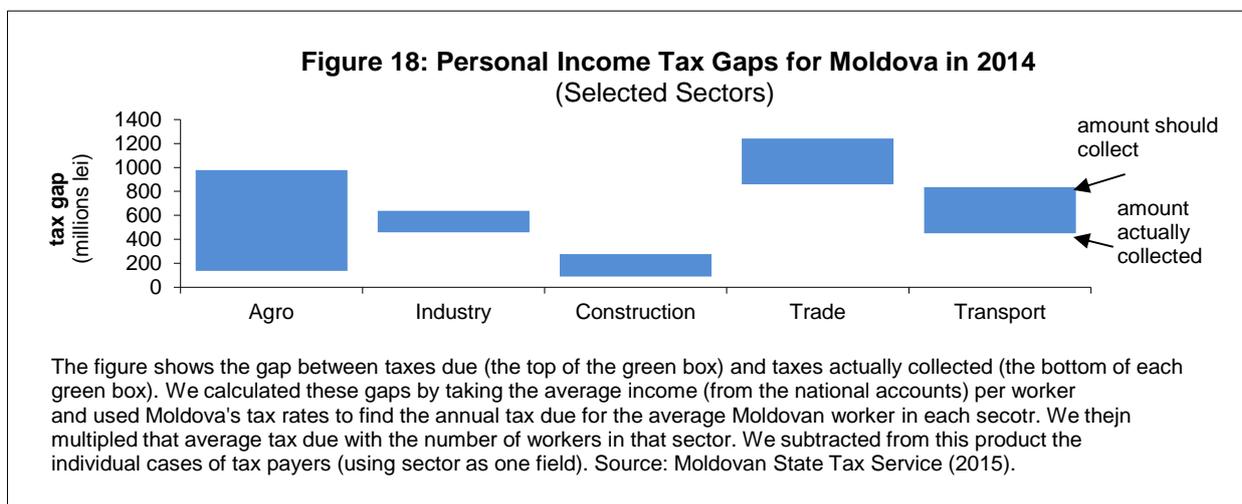
**Figure 17: Summary Statistics for Micro-Tax Collection for 2014**

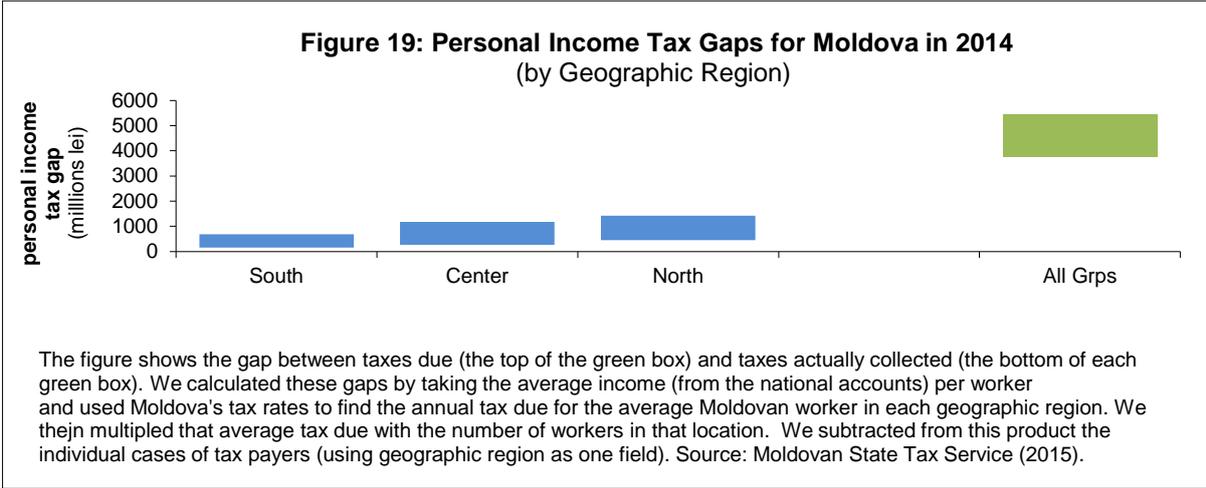
	<b>Mean</b> (thousands)	<b>Total Tax</b> (millions lei)	<b>Max</b> (millions lei)	<b>Std Dev</b> (millions lei)
<b>Income tax</b>	121.10	3,781.8	185.00	1.42
<b>Excise</b>	5,965.59	644.3	159.18	26.76
<b>VAT</b>	330.25	3,760.0	246.24	3.67
<b>Total tax</b>	<b>375.14</b>	<b>18,506.6</b>	<b>1042.06</b>	<b>6.83</b>

The figure shows data from the Moldovan taxpayer database for 2014. We do not compare with other years to keep the analysis simple. We do not discuss excise tax gaps in much detail, to focus our analysis on major revenue items. Total taxes for 2014, summing up individual taxpayers, come to around 18.5 billion lei. The income tax declared (and paid) in 2014 came to around 3.8 billion – about half the “maximum achievable” amount we calculated earlier in this paper.<sup>27</sup> Value-added taxes declared at 3.7 billion lei in the individual taxpayers' database come to far less than the 15 billion lei in tax that Moldovan companies should be paying. Given Moldova's economic data, these differences likely reflect issues with data collection more than issues related to tax gap analysis.<sup>28</sup> We cannot compare bottom-up data (from sources like the individual taxpayer's database) with top-

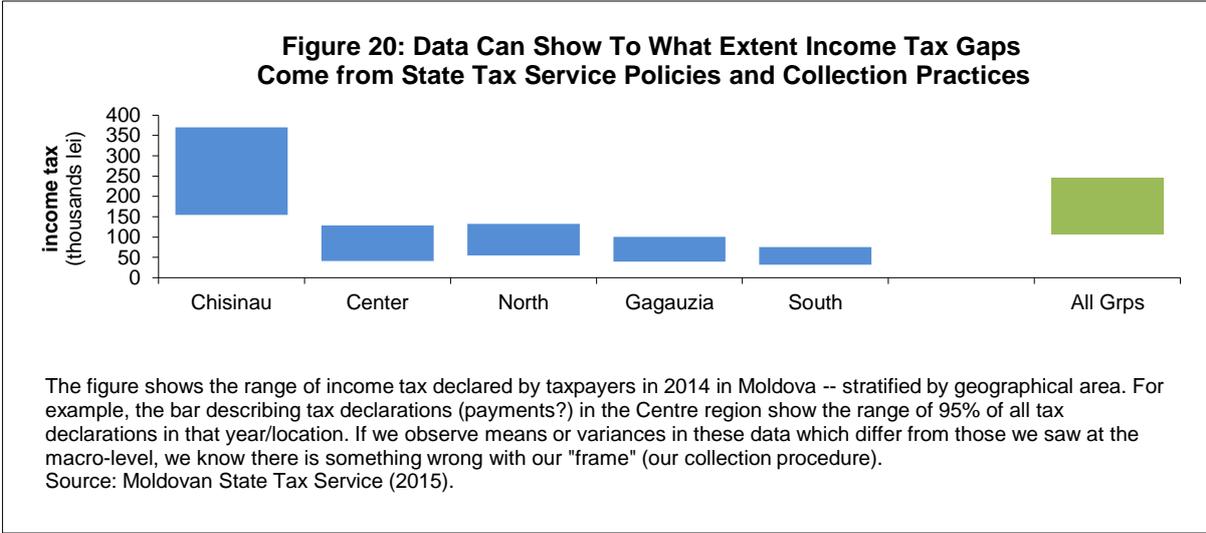
down data until we have ways of reconciling differences in total taxes collected from each source. Therefore, **attempts to compare tax gap estimates by methodology (like top-down or bottom-up) will probably prove fairly useless until data collection and reporting problems are resolved.**

Despite the data problems involved, highly detailed stratification of tax gaps by groups provides insight into weak tax collection practices. Figures 22 and 23 show income tax gap estimates derived from individual taxpayer data (rather than the macro-level data we used previously). Figure 22 illustrates how to use such detailed data to construct a tax gap estimate for particular economic sectors. In that figure, we show the same amount of money due as we previously showed, using macroeconomic data. The bottom of the gap, though, uses data from the taxpayer’s database, which shows taxes paid by each Moldovan taxpayer. Figure 23 shows a different way of slicing the data – by geography instead of by economic sector. The extra data from the taxpayer’s database allow us to stratify (group) data more finely, allowing us to zoom in on specific parts of the tax gap. In theory, these bottom-up tax gap estimates should exactly match the top-down estimates from our macroeconomic data. In practice, they do not. **The bottom-up tax gap falls short of the top-down approach by about 1 billion lei.**

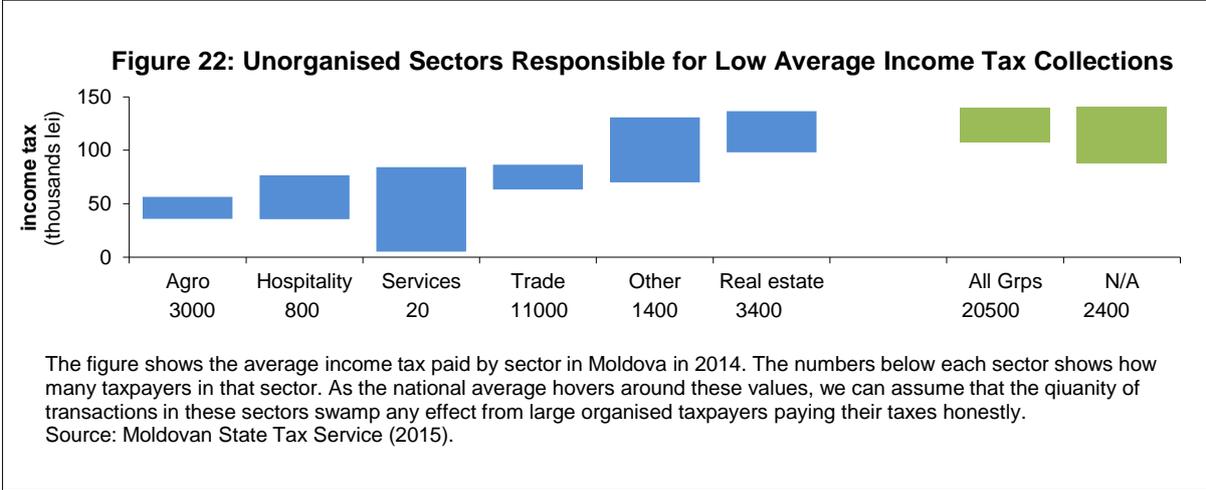
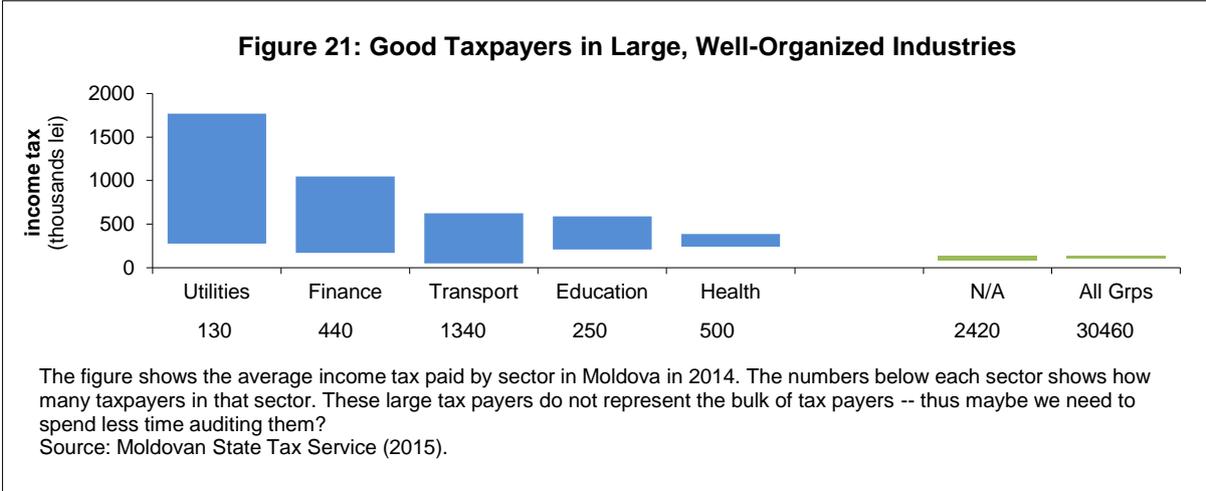




Even a cursory analysis of the individual taxpayer's database shows why tax gaps in some strata (groups) might differ from others. Figure 24 summarises income tax declarations for 2014 by geographical group. That figure only shows taxes due and does not show any kind of gap. Even eye-balling this data points to several hypotheses that risk analysts may want to explore as to why larger tax gaps exist in some areas of tax collection. First, we do not know if the variation we see in this data comes from variation between taxpayers themselves or from efforts in collecting data and money from these taxpayers. The relatively tight range of payments from companies in the South show far less variation than declarations from companies in the North. If we divided tax payments by revenue earned, for example, and looked at the variation in that ratio across time and across groups, we might see differences in collection activity attributable only to the State Tax Service's activity. Second, most of the actual auditing/inspections need to occur in Chisinau. Chisinau shows the most variation. For the other regions, we know that declarations falling outside the range shown in the figure would be suspicious. In Chisinau, though, a much larger range of variation is permissible. As such, we would need to be more cautious and do more checking. Third, the mean tax payments from regions or industries in this micro-level data should be the same as with the macro data. **Big differences in mean tax payments or variance in payments between the macro data and the taxpayer's consolidated database likely mean the State Tax Service's database (and thus, tax collection practices) are faulty.**<sup>29</sup>

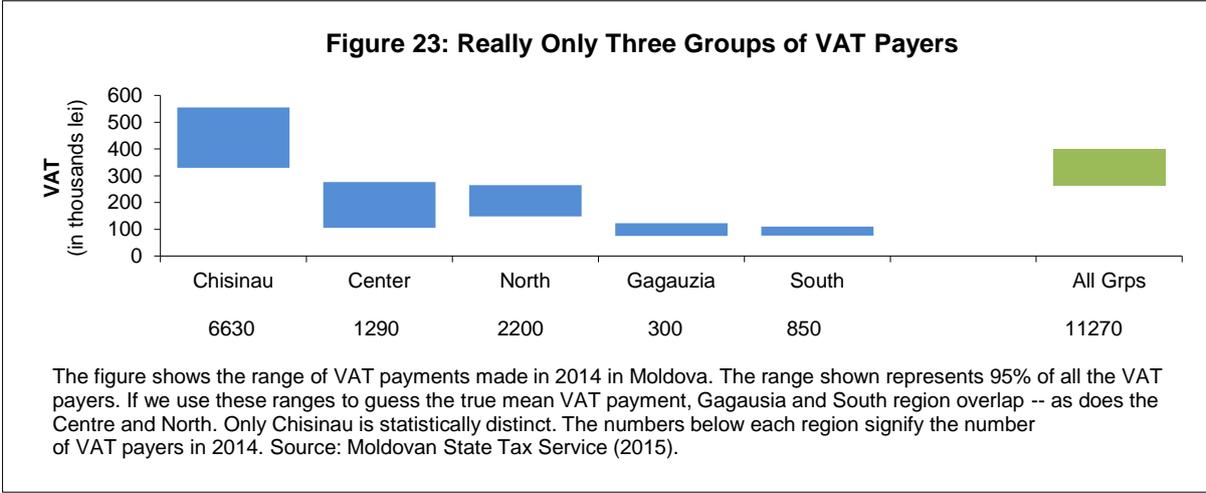


The summary data for income tax payments by economic sector points to problems with the tax database more clearly. Figures 25 and 26 shows the range of tax declarations/payments in a range of Moldovan sectors. As shown in Figure 25, utilities companies exhibit the most variance in taxes due, and health sector companies exhibit less variation. We also observe more economic concentration among utilities companies (with 130 companies showing larger mean incomes) than transport companies (with 1,340 companies showing much fewer taxes due). In contrast, we see from Figure 26 that agricultural companies – comprising the bulk of taxpayers in absolute terms – also represent some of the lowest taxpayers. **Together, these figures paint the picture of a tax base where the tax authority could increase tax collections by focusing on large taxpayers and on policies which affect the many disparate payers.**

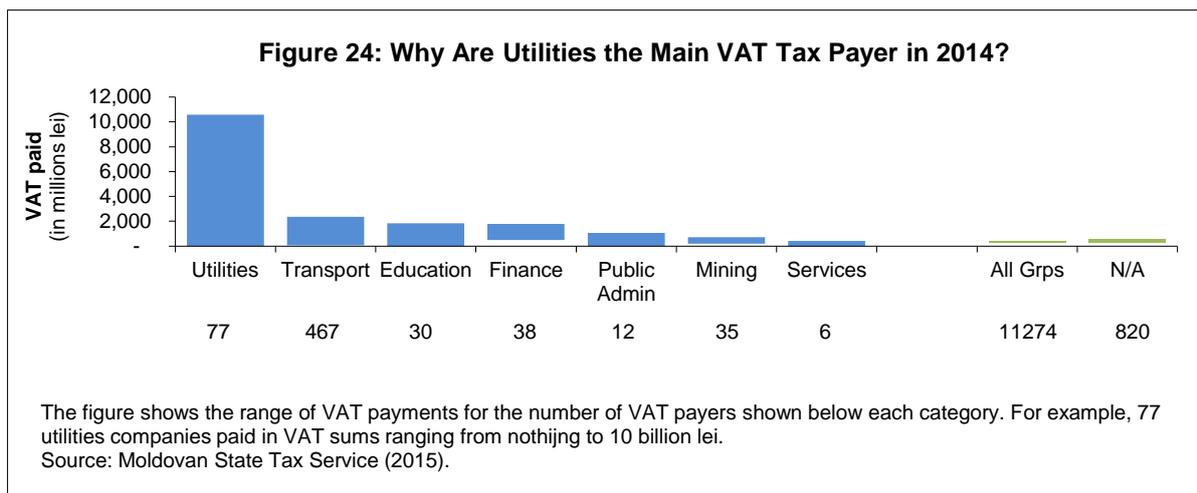


Differences in VAT collections may point to the relatively large VAT tax gap. In the Ministry of Finance’s records, total VAT payments in 2014 came to around 4.4 billion lei. VAT collections in the taxpayer database come to around 3.8 billion lei, leaving a difference of 600 million lei between these two sources. However, this detailed data can help us figure out where the VAT gap comes from. The individual taxpayer database shows 11,270 VAT payers. The register of Moldovan companies, though, puts the number of companies at around 84,500, and we do not know how many are registered for VAT. **Thus, even data as simple as the difference between total companies registered and those making declarations shows where and why Moldova’s tax gaps are so large.**

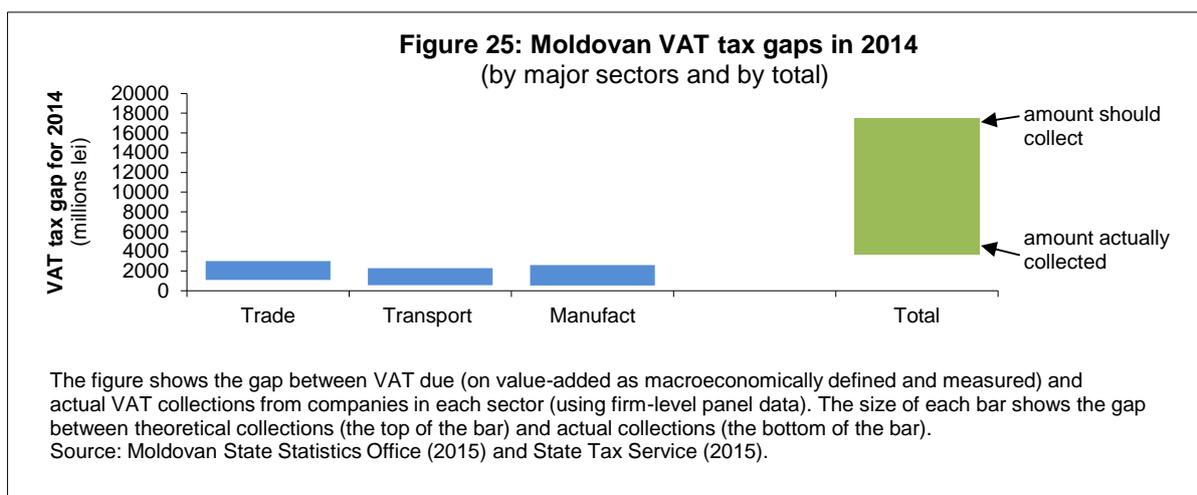
Looking at the VAT tax gap by strata (groups) also shows the “wheres” and “whys” of the Moldovan tax gap. Figure 27 shows VAT collection by region. We see, as with individual taxpayers, the larger average and variance of tax payments in Chisinau (as opposed to other areas). We see significantly more VAT collection than personal income tax collection in the Centre and North regions. Yet, looking at average VAT collection across these regions, we see only three regions from a statistical point of view. Chisinau VAT payers clearly pay higher and more varied taxes than businesses in other areas. Businesses in the Centre and North regions pay basically the same VAT, with the same type of variation in payments. Businesses in the Gagauzia and South region also look statistically indistinguishable from each other, forming the third “type” of taxpayer. **In this case, it is the lack of differentiation across geographical area which points to possible collection weaknesses.**



VAT payments by economic sector also look unusual, pointing to possible weaknesses in tax assessment (and collection) practices.<sup>30</sup> As shown in Figure 28, declarations among utilities sector firms (electricity, water, etc.) show both the highest average VAT assessments and the highest range of payments. Yet transport and education companies also show relatively large declaration averages. If we recall earlier figures showing where value-added is produced in Moldova (namely, in trade and agriculture), we can observe significant weaknesses in the micro-level data. Moreover, the micro-database only records 77 utilities-related companies, 30 education-related ones, and 38 finance-related companies. **Even a common sense comparison between the macro-data and the low firm numbers tells us that the VAT database is extremely incomplete.**



What about the magnitude of the actual VAT tax gap itself? Figure 29 shows the VAT tax gap (albeit using this very poor micro-level data), broken down by economic sector. Using firm level data, we can compare 20 percent of macro-level value-added in various sectors (namely, theoretical VAT due) and actual collections. Trade, transport, and manufacturing exhibit the largest VAT tax gaps. **The roughly 13 billion lei total VAT tax gap – using these patchy data – looks roughly as big as when we used total VAT collected from government revenue accounting.**

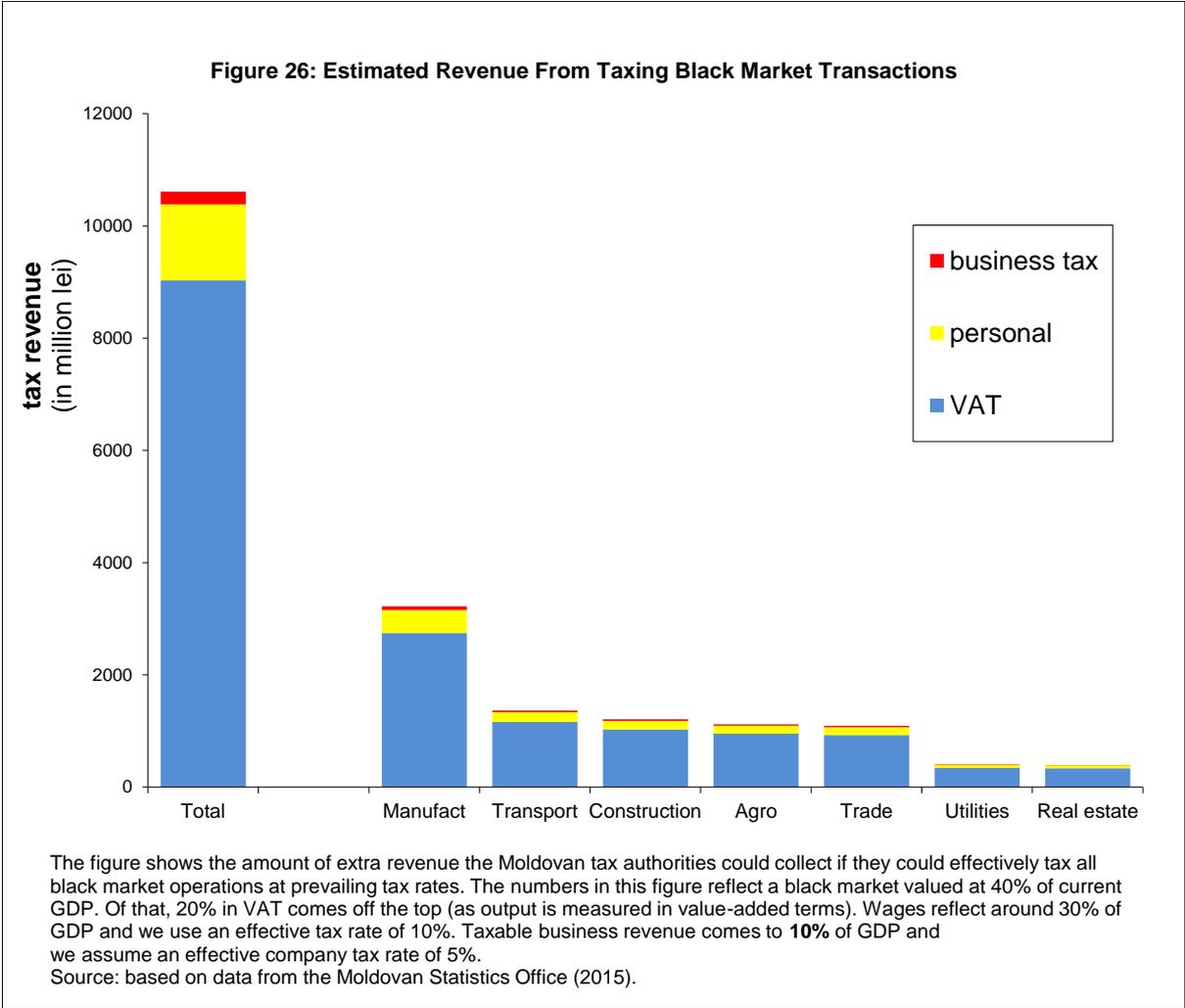


## Accounting for the Grey and Black Market

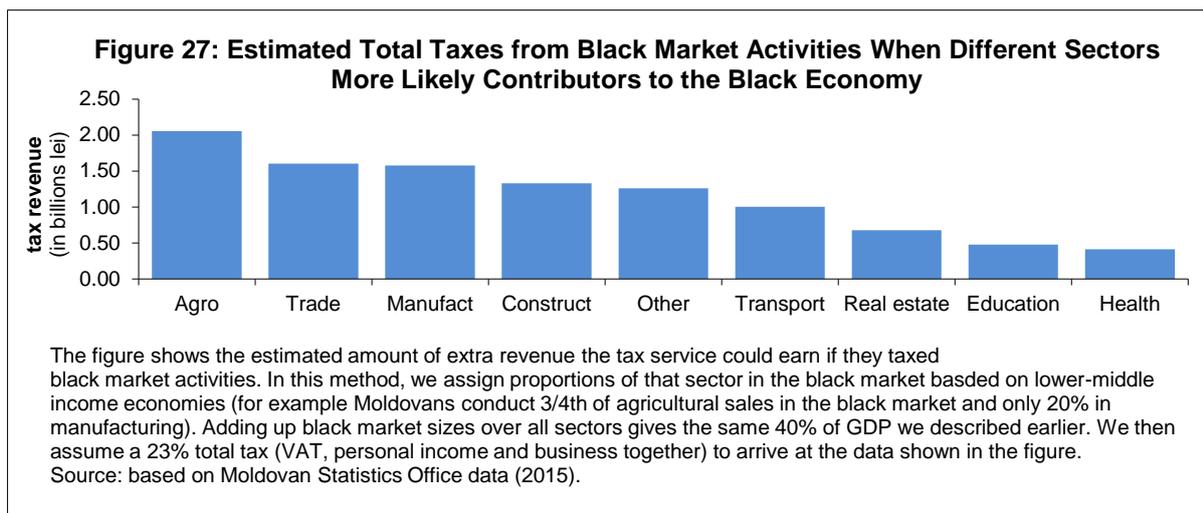
Many experts have tried to assess the magnitude of Moldova's informal markets. Havoscope (2015) estimate that Moldova's black market comes to 5.4 billion lei.<sup>31</sup> Golias (2013) quotes other research (and does his own), valuing Moldova's black market at about 44 percent of GDP. Readers interested in a more detailed methodology for assessing Moldova's informal (black market) sectors should see Charmes and colleagues (2003).

One approach consists of simply adding 40 percent (or other proportion of GDP lying in the black market) to various official statistics. If the Moldovan economy is similar to other lower-middle income economies (as defined by the World Bank's income groupings of countries), then Moldovan tax authorities could rake in 23.5 percent of that extra 40 percent of GDP.

Such tax revenues would increase collections by roughly 10 billion lei. Of this extra money, VAT collections make up the lion’s share – at around 90 percent of total revenue – an abnormally high figure that comes about due to the definition of GDP we used. Personal taxes make up most of the rest, with corporate taxes adding only about 2 percent extra.<sup>32</sup>



Another approach consists of adding different proportions of black market activity in each sector. These estimates come from detailed industry studies, previous tax audits, or other data.



## Corporate Tax Gap

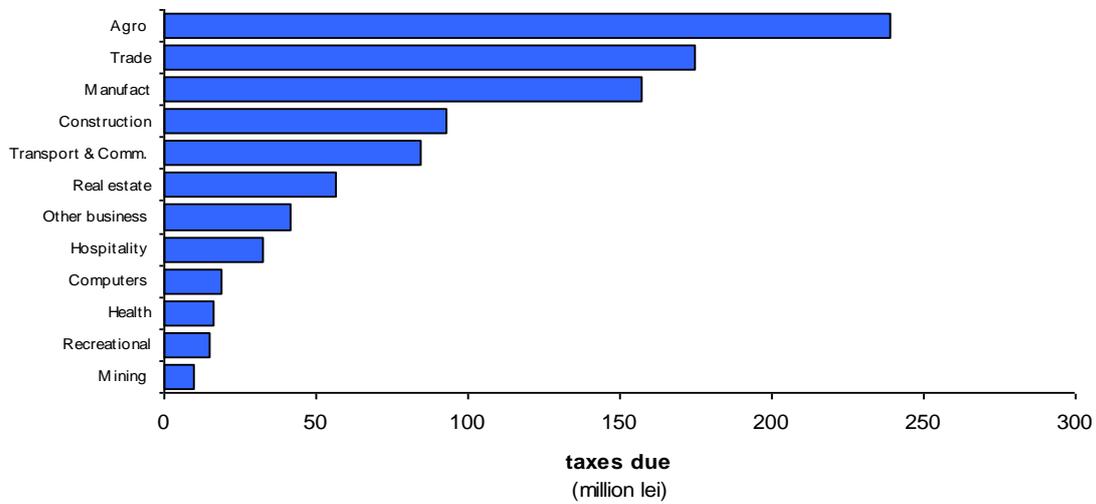
Most data point to Moldova’s corporate tax gap hovering around 2 billion lei (at least for 2014). Any tax gap calculation for Moldova’s corporate (company) profits must consist of two parts – to take into account the different tax treatment of SMEs versus larger companies. Moldova’s SMEs – with their 3% tax rate on revenue (turn-over) – likely accrued around 1 billion lei in tax liabilities in 2014 (the latest year for which data are available). Figure 28 shows the sectoral distribution of these tax obligations. Agricultural and trade SMEs revenue forms that basis for much of these taxes due. Simply summing these expected taxes over all sectors leads to estimated taxes of around 1 billion lei. Figure 29 shows a similar calculation, for larger companies. These larger companies pay a larger 12% tax (albeit on a smaller base which consists only of profits). Trade and manufacturing companies provided much of the expected profit which forms the basis of these taxes. If these companies earned a 10% profit rate on the revenue they generated, they would all owe slightly less than the SMEs – or around 650 million lei. If – as reported in Appendix II – the tax authorities raised around 1.2 billion lei in “pure” (or only) corporate taxes, the Moldova’s corporate tax gap would be very small indeed.<sup>1</sup>

Yet, when seen in conjunction with the other data we have presented, we can develop strong intuitions about the likely size of these company tax gaps. We estimated that the tax gap more or less disappears if profit rates come to around 10% (of revenue). Yet, we know from our macroeconomic data (as illustrated previously in Figure 3) that the corporate tax gap likely comes to around 2 billion lei. Yet, we see from Figure 29, that a profit rate of 20% would generate large enough expected value of taxes due to result in a 2 billion overall tax gap.<sup>2</sup> **Thus the method of triangulation clearly tells us other useful things about the Moldovan economy – in this case the overall national non-SME profit rate must come to somewhere around 20% of revenue.**

<sup>1</sup> We refer to a “pure” corporate tax, as government accounting shows several assessments under the corporate income tax rubric, which we would not consider as a profit-tax *per se*. Dividend withholding represents an example.

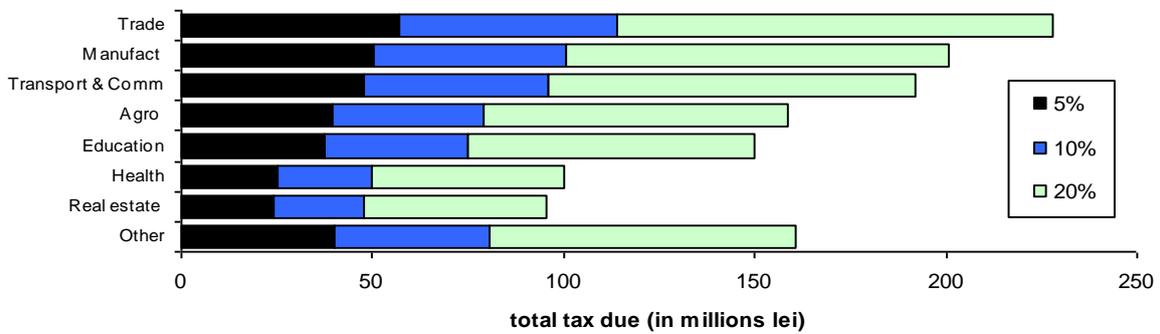
<sup>2</sup> To see this, recall that SME taxes should come to around 1 billion lei. At a 20% profit rate, non-SMEs would incur around 2 billion lei in tax assessments. If both sectors thus produce around 3 billion in tax liabilities, and the Moldovan treasury reports tax collections of around 1 billion, the tax gap must thus come to around 2 billion lei.

**Figure 28: Moldovan Agricultural and Trade SMEs Have Largest Expected Taxes Payable among SME groupings**



The figure shows the taxes due from Moldova's small and medium enterprise sector (SMEs) for 2014. We calculate these numbers by finding value added from Moldova's SME sector (reported by major sectoral classification as shown in the figure). Recalling that SMEs should pay 3% of the value of their revenues in tax, we simply find 3% of the value of such production (which must in theory equal the value of revenues for each sector).  
 Source: Moldovan Statistics Agency (2016) at production account for small and medium enterprises sector.

**Figure 29: The Trade and Manufacturing Sectors Should Pay the Most Tax in Absolute Terms Among Moldovan Corporates**

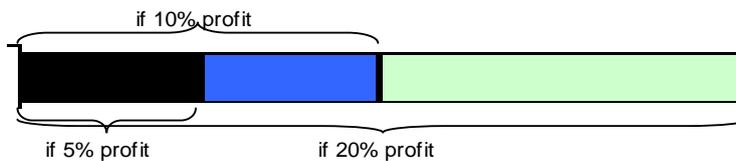


The figure shows the results of one method used to determine the amount of tax the Moldovan State Tax Service should collect under various assumptions about the profitability of these sectors (as no government body collects data on aggregate corporate profit rates). We calculated these figures by taking the proportion of the value production of non SMEs (as 100% minus the proportion of SMEs' contribution to each sectors' total value added) and multiplying the result by the value of each sector's value added (which in theory equals revenues for each sector). To find table profit, we multiplied the value of each sector's revenues by profit rates shown in the figure. Taxes thus come to 12% of the estimated value of these profits.

Source: Moldovan Statistics Agency (see description for specific tables used).

**How to read this graph**

The levels show the money which should be paid in taxes for each level of profits...



Naturally, even with the limited data available, tax gap analysts could use other methods to see how they compare with the two example methods we have illustrated above. First, we could have used intermediate consumption data, rather than value added data, to derive estimated company revenue. Recall that in the examples we used above, we assumed that revenues reflected value added (as markets determine the value of things and that no one would buy goods and services for more or less than the value contained in those goods and services). As people pay the value of the things they buy, the money they spend for things in those sectors (namely the consumption of intermediate goods and services coming from those sectors) should provide another measure of these revenues.<sup>3</sup> Second (as discussed at length during the trainings), we could have simply used total revenue generated for the entire corporate sector and a few parameters, to figure out taxes due. For example, if we use total national spending data from households and companies (deemed more reliable than income data), we could use that single number as the basis of a crude company-taxes-due estimate. If businesses and households spent 20 billion lei on domestic-only goods and services, we could assume that SMEs comprise a fixed share of economic activity (like 80%) and that profit rates in the non-SME sector come to around 20% (based on data from other countries etc.). With only these crude data (and a tax rate of 3% on SME revenues and 12% on company profits), we can already guess that taxes due in this simple example come to around \$1.5 billion. **The tax gap specialist should also use rough estimates as a guide when making more refined estimates by sector.**

What specific steps might individuals calculating corporate tax gaps in the future follow? We used macroeconomic data above to estimate corporate tax gaps. Yet, the State Tax Service can derive far better estimates from using its own database and then just using macroeconomic data to “scale up” estimates derived from its biased and partial database.<sup>4</sup> Figure 30 shows the simplest possible methodology for calculating corporate tax gaps – given Moldova’s different tax treatment of SMEs versus other corporates. You will need to find the real/true value of resources these companies have. For that, you must use independent data sources (and not the STS’s own databases). **If the STS databases were perfect, there would be no tax gap – thus the tax gap size tells us exactly how “bad” are the STS’s databases.**

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<sup>3</sup> We had to use rather fancy wording in these two sentences to describe correctly rather difficult concepts in economic theory and practice. Thus, we wanted to give an accurate explanation for the statistician using these concepts in applied computation (which the person could just read and reread until they fully understood the meaning).

<sup>4</sup> Recalling from our training, “biased” in this context refers to the fact that the STS taxpayers registry will not accurately reflect all taxpayers (many are missing, and we can not predict which parts of the taxpayer base the database omits). In other word, the database does not represent a unbiased sample to use in making generalisations about all corporate taxpayers.

### **Figure 30: Procedure for Finding Corporate Tax Gap Using STS Taxpayers Database as a Guide**

1. Download and put on one sheet data for all companies' revenues and profits.
2. Make sure that one column in the Excel worksheet indicates whether a corporate taxpayer is an SME or not.

#### **For SMEs**

3. For SMEs, sum the revenues of all companies (over particular strata like economic sector, location, etc. as well as for the country as a whole).
4. Compare these revenues with the value-added, intermediate consumption or other data from the National Statistics Agency (ie, the tax database may give revenues of  $a$  and National Accounts give a value of  $b$ ).
5. The ratio of those two values (namely  $b/a$ ) gives the extent to which SMEs under-report their revenue.
6. Use the value  $a$  to figure out the theoretical tax due from each SME sector.
7. Simply compare similar stratification of data from the National Statistics Agency and the tax database to arrive at more specific tax gaps (comparing theoretical tax due with the actual money you collected from that group of taxpayers).

#### **For “normal” corporates (ie non SMEs)**

8. Use fieldwork survey, business databases and the other methods we covered in training to find out the profit margin for companies in a sector/place/etc.
9. Use a calculation like the one shown in Figure 29 – arriving at how much taxable profit companies in particular industries should have earned.
10. Multiply the figure from step 9 (the profits these companies should have earned) by the corporate tax rate of 12%.
11. The tax gap for this group consists of the difference the taxes they should have paid (shown in step 10) and the money your taxpayers database says you actually collected from them.

#### **For all companies**

12. Add the various tax gaps described above to find the overall corporate tax gap –compare with the other estimates you have calculated.
13. You may “scale up” the gap, depending on how big other data tell you the gray and black markets are. Thus, if you calculate a tax gap of  $c$  and the value of gray and black markets are 30% of the value of “white” markets – then your corporate tax gap can be 130% of the value  $c$ .\*
14. As you data sources improve (ie you obtain INDEPENDENT) data on company revenues and profits, you will use this as the basis for your theoretical tax due calculations.

\* As you grow more comfortable with using data, you will see that better tax gap estimates do not simply scale up the value of the tax gap by the size of the black market. But using this simple method will help develop a feeling for other methods of refining your initial (without black market) estimate.

How will this method change over time? After several years, risk analysis teams will be able to use regression analysis, the results of field surveys, independent data providers and other information to guess how much revenue and profit companies earn. These data should take priority over data from the National Statistics Agency. Yet, **tax gap analysts should never forget – STS data and data from official declarations may never be used to calculate how much tax companies theoretical owe.**

## A First Run at Excise Taxes

Due to large incentives to engage in organised criminal fraud, excise taxes (particularly in areas like bootlegged alcohol, tobacco, recreational drugs and even petrol) remain the most difficult areas for tax gap analysis.<sup>5</sup> Significant differences between the populations which consume excisable goods and the countries which produce these goods require tax gap analysts to pay particular attention to whether tax authorities should assess duties at the point of production or sale.<sup>6</sup> Because production, consumption and cross-border trade patterns will differ by product (ie tobacco, spirits vs. beer, etc.), we can only provide broad outline estimates for the major excise taxes – and provide suggestions for calculating these tax gaps in the future.

Consumption-based estimates of the market size for an excisable good provide the easiest basis for figuring out an excise tax gap. Figure 31 shows the general method of calculating the taxes due on excisable goods using general macro-level data. In the case of cigarettes (which we later show concretely), domestic excise tax due on cigarette purchases in Moldova simply consists of the following. First, find the proportion of the population consuming that good and multiply the resulting number of consumers by the average daily/yearly value of cigarettes consumed (where value equals the price times the quantity consumed). Second, multiply the tax rate on the total value of cigarettes consumed. Third, if consumers must also pay taxes per unit or on a weight-related basis, simply multiply the average number or weight of product consumed by the proportion of population consuming that good and multiply that result by the relevant weight or per-item related tax rate. The second part of the equation highlights the need to include both domestic and foreign consumption (if foreign consumption taxed).<sup>7</sup> The tax gap consists of the value found in Figure 31 minus the money actually collected.

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<sup>5</sup> The US remains one of the most open jurisdictions in reporting on its tax gaps. Moldovan officials may find their analysis of tax gaps rising from organised criminal syndicates (cigarette syndicate, petrol syndicate, etc.) useful. For their tax gap analyses, and a recent audit of these tax gap estimates, see Treasury Inspector General for Tax Administration, *The Fuel Excise Tax Compliance Program Has Made Significant Progress, but Program Improvements Are Needed to Increase Highway Trust Fund Revenue*, Report Number 2009-20-051, 2009, available [online](#).

<sup>6</sup> The EU have significant experience in calculating tax gaps for black market trade in excisable goods between member states and with Neighbourhood countries (particularly in the Balkans). They have made too many studies for us to review in this practitioner report. Several of these studies look at tax revenue lost from cigarette trading between Member States or “bootlegged” from the Balkans. For several of these studies (along with calculation methods), see EU DG Tax and Customs, *Studies made for the Commission*, 2016, available [online](#).

<sup>7</sup> To keep our discussion simple, we ignore specifics about the collection of tax at the place of production, border, point of sale and so forth. Indeed, the law in force governing the assessment and collection of excise duties on goods traded abroad will likely change over time (as most countries constantly change these procedures to accommodate tax or social objectives of the government of the day). Thus, we focus our analysis on the general procedure – as one STS staff master the basics of such tax gap calculation, they can adjust it for goods traded abroad.

**Figure 31: Formula for Calculating Excise Tax Gaps Using the Consumption Method**

$$\begin{aligned}
 \text{Domestic Excise Tax Due} &= \text{number of consumers of that good} \times \left[ \left( \begin{array}{l} \text{ave. price per unit each consumer consumes} \\ \text{ave. quantity of units each consumer consumes} \end{array} \right) \times \text{tax rate on value consumed} \right] \\
 &+ \left[ \begin{array}{l} \text{ave. number (or weight) consumed per customer} \\ \text{tax per unit} \end{array} \right] \times \text{total domestic excise tax due} \\
 \\
 \text{Total Excise Tax Due} &= \text{domestic consumption} + \text{foreign consumption (unless exempt)} - \text{re-export} = \text{total excise tax due}
 \end{aligned}$$

The persons conducting these tax gap analyses should keep three points in mind. First, the calculation requires guesses about the consumption – particularly abroad. You may not rely on available statistics of any kind (you will need to make intelligent guesses about the value of demand which can not be measured). Second, as you/they feel more comfortable using this procedure, you will start to stratify your analysis of location/market/type of product (high quality/low quality) etc.. As noted above, your broad estimates for the entire market (using averages which cover the entire market) will provide a reasonableness check as you conduct the same analysis for specific markets. Analysts might stratify their analysis in the above example by types of consumers (young vs. old, smoking-lovers vs. causal smokers), by sub-market (low quality versus deluxe brand), location, and so forth.

Basic publically available data provide an adequate source for starting these calculations. Figure 32 shows basic statistics about consumption of alcohol and tobacco – which will enter into a tax gap calculation. The bottom of the figure shows the excise taxes applicable. For example, the World Health Organisation (WHO) estimates that roughly 20% of the population uses any smoked tobacco and 18% specifically smoke cigarettes – with actual population figures coming to around 10,000 children and more than 613,000.<sup>8</sup> European data (probably recycling WHO data) put tobacco smoking among adults at around 24% of the population at 2011.<sup>9</sup> Similarly, the European Health Report estimates demand for 6.1 litres of pure alcohol per year for Moldova.<sup>10</sup>

<sup>8</sup> For an example, see Tobacco Atlas: Country Fact Sheet Moldova, 2016, available at:

<http://www.tobaccoatlas.org/country-data/moldova/>

<sup>9</sup> [http://portal.euro.who.int/en/visualizations/bar-charts/hfa\\_622-age-standardized-prevalence-of-current-tobacco-smoking-among-people-aged-15-years-and-over-who-estimates/](http://portal.euro.who.int/en/visualizations/bar-charts/hfa_622-age-standardized-prevalence-of-current-tobacco-smoking-among-people-aged-15-years-and-over-who-estimates/)

<sup>10</sup> <http://www.euro.who.int/en/data-and-evidence/european-health-report/european-health-report-2015/european-health-report-2015-the-targets-and-beyond-reaching-new-frontiers-in-evidence>



1.4	average packages of cigarettes smoked (in packages <u>per day</u> )	0.8	average packages of cigarettes smoked (in packages <u>per day</u> )
365	number of days smoking	365	number of days smoking
13.4	EXCISABLE REAL price per pack of cigarettes BEFORE TAXES (lei)	30	EXCISABLE REAL price per pack of cigarettes BEFORE TAXES (lei)
<b>3697.596</b>	<b>excisable value of cigarettes</b>	<b>1576.8</b>	<b>excisable value of cigarettes</b>
<u>40%</u>	tax rate on value of tobacco	<u>40%</u>	tax rate on value of tobacco
<b>1479.038</b>	<b>theoretical excise tax due (millions lei)</b>	<b>630.72</b>	<b>theoretical excise tax due (millions lei)</b>
<b>2109.758</b>		<b>Total across sub- groups</b>	

Different assumptions naturally lead to difficult estimates – which we report by giving a range of estimates. Figure 34 shows four cases, using data taken from different sources. Some sources find (argue) that more or less of the population smokes – or that the value of cigarettes consumed may vary by type of tobacco and so forth. We can thus use different estimates in our own tax gap estimate. For the example shown in Figure 34, we might thus report that our estimates produced excise taxes due of between 1.2 billion and 3.8 billion lei per year.

**Figure 34: Running Different Scenarios to Produce Estimate Ranges**

	<b>Case 1</b>	<b>Case 2</b>	<b>Case 3</b>	<b>Case 4</b>
population (millions)	3.6	3.4	3.6	3.6
percent smoking (percent of population)	20%	18%	20%	22%
average packages of cigarettes smoked (in packages <u>per day</u> )	1	0.9	1	1.3
number of days smoking	365	365	365	365
EXCISABLE REAL price per pack of cigarettes BEFORE TAXES (lei)	20	15	22	25
<b>excisable value of cigarettes</b>	<b>5256</b>	<b>3015.63</b>	<b>5781.6</b>	<b>9395.1</b>
tax rate on value of tobacco	40%	40%	40%	40%
<b>theoretical excise tax due (millions lei)</b>	<b>2102.4</b>	<b>1206.252</b>	<b>2312.64</b>	<b>3758.04</b>

Lack of consolidated access to data between tax and customs departments can significantly impede the tax gap estimation exercise (as in our case). To take the simplest example, imagine that in our example above, we do not have demand by “normal” and “elite” – but by “local” and “foreign” consumers. We would arrive at taxes due for each group of consumers – but we would need tax collection data by product type (in our case tobacco) from both inland tax and from customs (or foreign tax authorities in the EU case). We would need (and need to trust)

revenue collection figures obtained from tax and customs at the specific product-level to calculate the tax gap.<sup>11</sup>

Several problems stymie beginning tax gap analysts during the early stages of a tax gap calculation programme. One of the problems lies in using believing too much in “significant digits” of the data put into the estimation calculations. Using a seemingly more exact estimate for the population size of 3,559,500 people may seem like a better figure than rounding this number to 3.6 million (or 3.5 million). Analysts may want to use every digit possible – thinking that estimates would become more accurate. Yet, in practice the opposite often occurs. Analysts spend so much time calculating very specific numbers – that they lose sight of the underlying logic of the calculation. Worse still, a final tax gap of 1,375,437 mistakenly seems far more precise than an estimate of 1.4 million lei. Given that even population estimates from the UN rely heavily on estimation and guessing, taking lots of significant digits from these estimates and baking into your own estimates causes errors to multiply throughout the estimation.<sup>12</sup>

Another mechanical problem simply consists of keeping units and measures straight (ie millions, thousands, packages, cartons, etc.). Even for the simple calculation shown, keeping track of whether we compute consumption figures on a daily or yearly basis present a challenge. When using very complicated formulas (using tens or hundreds of pieces of information) the complexity becomes overwhelming. As in all things, simplicity is eloquence.

A far more serious difficulty lies in the treatment of black market sale/purchase of excisable goods. If Moldova served as the centre for the manufacture and sale of illicit alcohol and tobacco products for the rest of Europe (and if Moldovan tax law required the assessment of tax on the purchases of all these products irregardless of the point of final sale and consumption), tax gap estimates made in the way shown above mislead far more than the elucidate. Yet, even one simple study showing the “real” value of demand abroad could provide a correct-enough figure to put the calculation back in the realm of reality. **Yet, given the importance of data found through intelligence collection and fieldwork, any pure top-down excise tax gap estimation remains virtually impossible. This is the reason we do not try to give a definite figure in this report.**

As a final caveat, tax gap analysts should note that policy changes may make previous estimates useless for future prediction. For example, the Moldovan authorities announced new, tough measures aimed at curbing tobacco use among the Moldovan population.<sup>13</sup> If such a policy works as quickly as in other countries, even base data used in tax gap estimations (like the 20% estimate of the population which smokes) could be far off the mark. **Tax analysts**

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<sup>11</sup> Many have written about the problems of cross-department/agency communication in/between revenue agencies (namely that tax agencies have difficulties obtaining reliable data from customs and visa-versa for areas of overlapping jurisdiction). As we do not want to discuss these problems in the Moldovan context, we leave this issue aside.

<sup>12</sup> To illustrate by example, suppose the UN estimates Moldova’s population at 3,559,500 when the real population is 3,130,000. We then use a WHO estimate of 22.5% of the population using a product, when actually 22% use. The error of 429,500 compounds gets amplified by the 0.5% of the population which use a product, creating an extra fake 2,147.5 users of a product. The error appears only due to the use of wrong significant digits. The better solution clearly consists of thinking of estimates as “ballpark figures.”

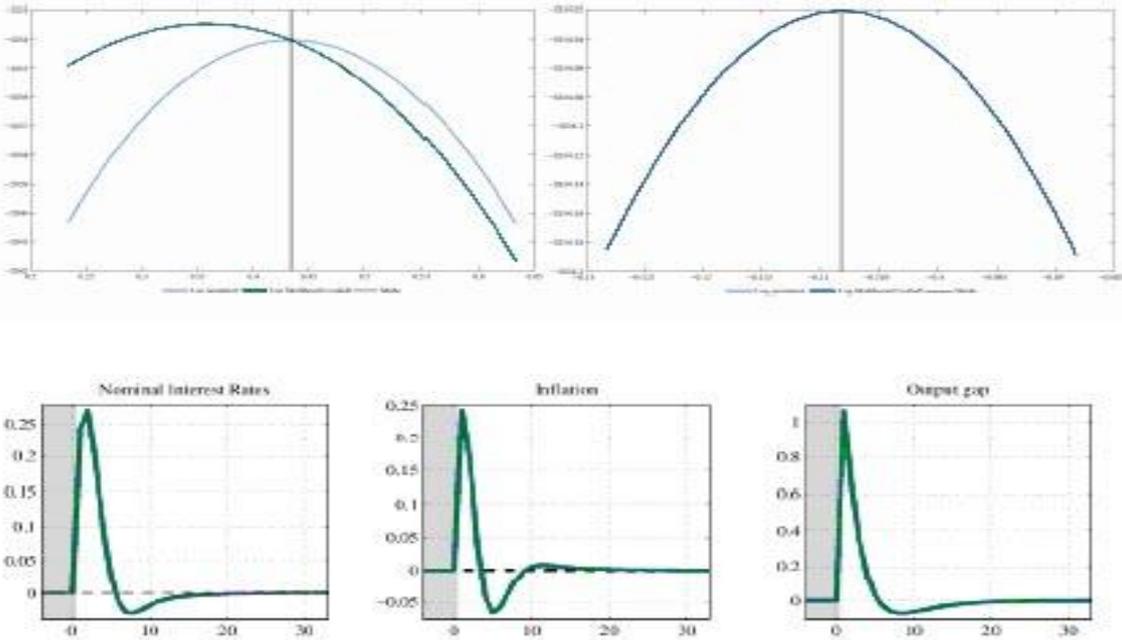
<sup>13</sup> WHO, The Parliament of the Republic of Moldova approves new tobacco control law, Press release issued on 30-05-2015, available [online](#).

should not try to create algorithms to deal with all these possibilities and complexities – they should let common sense guide their estimates.

## Looking at the Tax Gap under Different Scenarios

Once the tax service becomes comfortable with the simple approach to calculating the tax gap, it can pursue more advanced methods. The most comprehensive method consists of general equilibrium analysis. In this analysis, the tax service builds a model of the entire economy, using past relationships between economic variables or parameter estimates from partial equilibrium and other studies. With these estimates in place, the tax authority can simulate the effects of different policies (like raising taxes) or less controllable events (like an increase in inflation) on the tax gap. The tax authority does not need to start from scratch. The upper panel of Figure 28 shows the estimated effects on economic output/production of shocks to the economy. The lower panel of the figure shows the way that output reacts to factors like changes in nominal interest rates and inflation.

**Figure 34: Example of Econometric Study Showing the Effect of Tax Rate Changes on the Persistence of the Output Gap Persistence**  
(as method of guessing the effects of various policies on the tax gap)



The figure shows the effect of tax rate changes on output. As we used principally output data as the basis for our tax gap estimates, any policy affecting output will naturally affect the tax output. We do not show here, but these policy changes will affect the level and distribution of the gap (across sub-sectors). The figure also shows the simulated effects of other policies – like changing interest rates. Naturally, any policy will have repercussions on the tax gap. You don't need to be a PhD economist in the Ministry of Finance to use existing studies to form good guesses about how adjusting any policy might affect the tax gap.

Source: Partachi and Simion Mija (2015).

Existing studies can serve as the basis for estimating the effect of various policies on Moldova’s tax gap. For example, Oprunenco (2011) looks at the effects of Russia’s embargo on Moldovan wines. For a shock similar to the Russian wine embargo, Moldova’s agricultural sector would lose 1.3 percent of its value in the medium term. This will have the effect of potentially lowering the tax gap, as agricultural concerns sell fewer products.<sup>33</sup> Notice that this effect reverses in the longer run. Over a several-year period, the effect on agriculture should lead to a positive growth of 1.6 percent, presumably as less efficient producers go bankrupt, change crop mix, and so forth.

**Figure 35: Estimated Effects of a Russian Embargo on Moldovan Wines**

Product	Short-run effect	Medium term effect	Longer term effect
Agriculture	-3.2%	-1.3%	1.6%
Beverages	-9.7%	-8.9%	-9.4%
Clothing	3.0%	6.8%	4.3%
<b>Overall</b>	<b>-0.6%</b>	<b>0%</b>	<b>0%</b>

Source: Oprunenco (2011)

### Conclusions

The tax gap in Moldova likely comes to 20 percent of GDP. Value-added taxes represent the bulk of these taxes, followed by business taxes, personal income, and finally, “sin” excise taxes (on alcohol and cigarettes). In this paper, we looked at ways of identifying the tax gap based on macroeconomic and microeconomic data. We showed that simply slicing macroeconomic value by the various tax rates provides a rough estimate for maximum-achievable tax collectable in any part of the Moldovan economy. We then showed how breaking the economy down into groups (strata) and comparing value-added and paid out with tax paid by participants in those sectors provides for more accurate tax gap estimates. Namely, when we know how much value (money) the Moldovan wine industry generates, for example, we can trivially find the amount of money its businesses and workers should be paying. Once we compare those theoretical taxes due with actual taxes paid, we arrive at a tax gap estimate.

The tax gap methodology simply follows common sense – breaking down a problem into pieces and using guesses and assumptions to determine the “market size” of each taxable market. With these market sizes, tax authorities can multiply by the appropriate tax rate and then subtract the actual taxes they collected. Every tax gap estimate represents an argument rather than a scientific fact. Using very complex tax gap calculations, with many different sub-groupings, can hide and distort far more than reveal. As in all things, simplicity in tax gap calculation makes for the most convincing estimates.

**Figure 36: Final Recommendations and Tips for Persons Calculating Tax Gaps**  
(summarised from trainings)

1. Always compare numbers you work with to GDP and the population size,
2. Become comfortable with the idea of people, companies, goods and money due which we can not observe, but must theoretically exist,
3. Try to make the same tax gap estimate using different data or methods, and use triangulation to compare and choose between these estimates.
4. Your common sense provides the best tool for making and checking your calculations.
5. Never state estimates as facts – giving ranges for your estimates which reflect the different assumptions you had to make when doing your calculations.
6. If you have to choose between a complex or simple method, choose the simple.
7. Quantitatively minded individuals in the private sector and in universities will always be better at making these tax gaps that you will be – share your work and use their ideas when you can.

In the future, Moldovan authorities may wish to expand on this paper in three ways. First, they may want to try to estimate their tax gaps by themselves. As they split the economy into smaller groupings (through the stratification of data), they can build up more precise and convincing tax gap estimates than our illustrative examples in this paper. Second, as they use and compare different data sources, they will undoubtedly develop the visceral feeling for the economy and taxpayers they work with. They will learn to triangulate more believable tax gap estimates. Third, once they develop these intuitions about working with macroeconomic and micro-level data, they can try to use the results from econometric models to see how tax policies and collection practices might affect various tax gaps. The State Tax Service does not just collect taxes; its studies and work actually impact the amount of taxes people owe and pay. Hopefully this report starts the Service on an exciting and profitable line of risk analysis activity.

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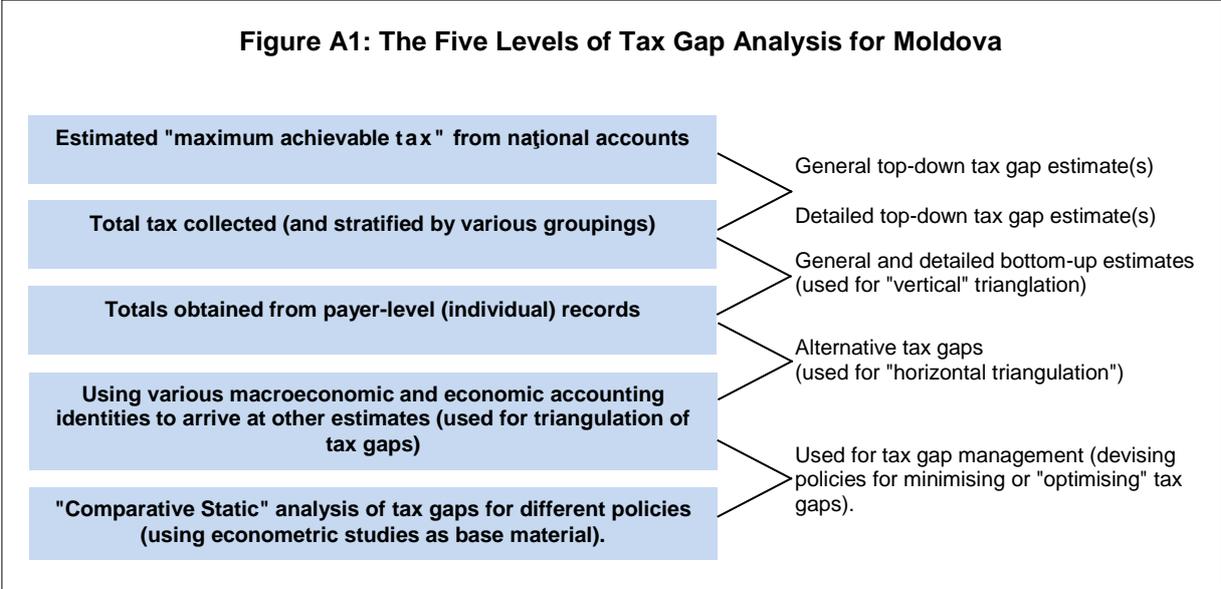
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# Appendix I: The Statistics and Mathematics of the Tax Gap and Maximum Achievable Taxes

## Overview of the tax gap approach

The tax gap approach focused on five activities or steps, as shown in Figure A1. The first step consists of finding the maximum achievable tax from national accounts data or other studies of Moldova’s broad markets. If an economic sector generates 1 million lei in value-added, and if the range of Moldova’s taxes are supposed to tax 30 percent of that sector’s value, then we can expect the theoretical maximum tax paid to hover at around 300,000 lei. The second step consists of comparing the theoretical amount of money the tax service should collect with the money it actually collected. The third step consists of comparing these macro-economically based estimates with micro-economically based estimates. We do not describe how to develop micro-level tax gap estimates but use micro data to compare with the macro-level estimates we produce. In theory, macro (or top-down) and micro (or bottom-up) tax gap estimates should approach each other as more and more details are added to particular groups of tax gap models. We showed that in the Moldovan context, data problems make comparing top-down and bottom-up estimates difficult.



We only touch on the last two elements of tax gap analysis in this paper. The fourth step consists of using different macroeconomic data to estimate a tax gap. In this paper, we used income reported by households as the basis of one tax gap estimate. We used tax payments claimed by companies as the basis of a second tax gap estimate. We used broad consumption patterns as a third basis (as households and individuals will consume a large part of the income they receive each year). We showed how common sense can help in triangulating a believable tax gap. The fifth step, upon which we only touched, uses macroeconomic and other models to show how tax policies (or collection practices) can affect the size of various tax gaps. Such “comparative static” analysis represents the most interesting part of tax gap analysis, a topic for another paper.

As a warning to the reader, we should note that other tax gap methodologies, which we do not present here, focus on the use of macroeconomic accounting identities to develop tax gap estimates. Once the State Tax Service becomes comfortable with the basic methods we describe in this paper, they can look into these other methods (based on macroeconomic accounting identities or even econometric modeling). We purposely omit any discussion of these methods to keep the focus of this paper on the intuitions of tax gap estimation.

For readers interested in other countries' tax gaps, they may look at HMRC, the UK's revenue authority, estimates provided in our bibliography. Yet numerous experts contest the methodology and content of these estimates, showing how tax gap analysis relies more on judgment than brute method. Murphy (2014,) for example, notes that the estimate fails to account for numerous factors. Toro et al. (2013), in the context of an IMF advisory mission to the UK, note the issues of using top-down tax gap approaches.<sup>34</sup>

## Tax gap equations

Our counterparts seemed excited to see the equation(s) for calculating a tax gap. The two equations below represent the broad method (formula) for calculating a tax gap(s). At their most basic, these equations simply multiply some measure of value by a tax rate and subtract that product from actual taxes collected.

Equation 1 provides the formula that can be used when using Microsoft Excel to calculate a tax gap. This equation, written in vector notation, shows how to manipulate matrices of data. Imagine an array (or column) of  $n$  members belong to a group, for example, 20,000 individuals who work in agriculture. We can multiply the tax rate they should pay ( $t$ ) by the value they generate (or the value they are paid) individually, and then sum up all these taxes due. In vector notation, we can imagine a vector  $V$  with  $n$  components (items). Taking the dot product of that Microsoft Excel array means multiplying each of these values for our  $n$  persons by a tax rate (for example, 20 percent).<sup>35</sup> The vector  $t$  in this case represents an array of  $n$  tax rates. If we look at  $m$  groups of these  $n$  taxpayers, then we can simply multiply – i.e., take the dot-product of – all the tax rates (in an  $n$  by  $m$  vector  $t$ ) by the money earned by the  $n$  persons in all of these  $m$  groups. We subtract this value by a scalar (simply a number)  $V^*$ , which we look up from the government's financial statements. Equation (1) thus says that the tax gap  $G$  consists of the dot-product of the  $n \times m$  vector of values dotted with the applicable tax rate for each element (namely, a tax vector of  $m$  groups with  $n$  members) minus the actual money collected  $V^*$ . Equation (2) shows the same method – breaking up this calculation into strata (groups). Each of  $m$  subgroups' tax gaps added together result in a scalar total tax gap.

$$G = \vec{t}_{n \times m} \cdot \vec{V}_{n \times m} - V^* \quad (1)$$

$$G = I_m \cdot (\vec{t}_n \cdot \vec{V}_n - V_n^*)_m \quad (2)$$

If we want to use convention mathematical notation, we get the same tax gap  $G$  from the sum of the sum of the products of the tax rate  $t$  and the values paid/generated  $v_i$  for each of  $i$  members of a particular economic group minus some amount of tax actually paid  $V^*$ . Equation (3) shows the basic tax gap intuition in non-vector notation.

$$G = t \sum_{i=1}^m v_i - V^* \quad (3)$$

We can thus describe the procedure used to calculate other tax gaps in this paper. For example, Equation (4) describes the procedure we used to calculate the personal income tax gap. For that tax gap  $G_{PI}$ , we can think of our previous variable  $V$  as the sum of two payments – a lower valued payment  $L$  and a higher valued payment  $H$ . For example, if a Moldovan wage earner earned 57,852 lei, we could describe that payment as the sum of 27,852 lei (the part of his/her wage taxed at the lower 7 percent tax rate) and the rest – 30,000 lei, which attracts a tax rate of 15 percent. In this example, the element  $l_i$  for taxpayer  $i$  comes to 27,852 lei, and  $h_i$  equals 30,000 lei. If  $t_1$  represents the tax rate on the first lower tranche of income – 7 percent - - and  $t_2$  represents the tax rate on extra income of 15 percent, then Equation (4) describes the formula used.<sup>36</sup>

$$\vec{G}_{PI} = \vec{t}_1 \cdot \vec{L}_{nxi} + t_2 \vec{H}_{exp} - V * \tag{4}$$

Including the effect of Moldova’s black markets can be done in two ways. First, the economy can simply be scaled up by a certain proportion  $b$  where  $1 < b < 2$ . For example, if the most reliable estimates of the black economy add an extra 20 percent to the official value of GDP, then the tax gap for Equation (5) simply increases the base value of GDP by 20 percent. As for Equation (6), we might assume that the black market includes an extra group of sectors  $v$ , so that this new economy has a total of  $m+v$  sectors. In this case, we would simply use the appropriate tax rate for these extra sectors and subtract taxes we collected.

$$G = \vec{t} \vec{b} \cdot \vec{V} - V * \tag{5}$$

$$G = \vec{t}_{nx(m+v)} \cdot \vec{V}_{nx(m+v)} - V * \tag{6}$$

Triangulation of the “true” tax gap (if such a true gap even exists) simply involves human judgment in weighing which formulas and results look more plausible. In theory, differences in tax gap estimates should come from errors in the data itself (corrupt data, making calculations by rounding figures, etc.). In practice, differences can arise for a number of reasons that are beyond the scope of this paper.

### Data overview

As shown above, any tax gap calculation relies on estimates of tax rates, data about the size of various parts of the economy, and data about actual tax collections. Figure A2 shows the tax rates we used in our calculations – for personal income tax, business tax, and VAT rates, as well as excise rates for tobacco and alcohol. We do not provide an overview of the macroeconomic data we used, as this comes from the Moldovan Statistics Bureau and can be retrieved to fit the reader’s needs.

**Figure A2: Moldova’s Major Tax Rates**

Taxes	2014	2013	2012
Personal income tax	7% (for 27,852 or less) 15% otherwise	7% for 26,700 or less 15% otherwise	7% for 25,200 or less 15% otherwise
Corporate rate	12%	12%	12%
SME rate	3%	3%	3%
VAT	20%	20%	20%
Spirits excise	77.67 lei per litre		
Beer excise	2.15 lei per litre		
Tobacco excise	40% of value		

Source: Moldovan State Tax Service and Moldovan Tax Code (Annex 1 of Title IV).

In the main body text, we referred to one other set of data used to figure out how much changes in the annual tax gap come from simple price changes as opposed to collection intensity. For example, if the tax authority collected exactly 5 percent more money over a two-year period, at the same time that GDP did not grow at all but prices grew by 5 percent, we might think the extra “revenue” actually came from changes in prices.<sup>37</sup> Figure A3 shows the data needed to assess whether any changes in tax gaps came from “real” growth or changes in prices. The growth in nominal GDP came to around 11 percent in 2014. We know that changes in the monetary value of GDP comes from two places – either growth in the real economy or growth in prices. As shown, both productivity growth and price growth roughly explain expanding GDP growth. Given that tax collections have historically grown at the same pace as nominal GDP growth, we can deduce that increased tax collections partly come from increased prices. As such, the tax base has not significantly increased. Instead, about half of growth in tax collections comes only from inflation-adjusted tax collections.

**Figure A3: Real versus Nominal Contribution to Annual Tax Gaps**

	2012	2013	2014
GDP (nominal lei terms)	88.22775	100.51	111.7574
Growth rate	7%	14%	11%
GDP in real terms	-1%	9%	5%
Consumer price index	4.6%	4.6%	5%

## Appendix II: Copy of Revenue Data Used for Study

REVENUES	2012			2013			2014		
	National Public Budget	Including State Budget	Including Local Authorities Budget	National Public Budget	Including State Budget	Including Local Authorities Budget	National Public Budget	Including State Budget	Including Local Authorities Budget
payroll tax	1,972,901		1,972,901	2,167,490		2,167,490	2,403,882	776,127	1,627,755
corporate income tax (CIT) withheld at source	243,030	101,077	141,954	263,811	109,242	154,569	324,999	242,174	82,825
CIT	1,395,627	525,433	870,194	1,422,034	536,250	885,784	1,708,785	1,280,952	427,833
dividend withholding tax	303,367	135,426	167,942	275,168	123,807	151,361	302,563	249,308	53,255
<b>Total CIT</b>	<b>1,966,734</b>	<b>770,401</b>	<b>1,196,333</b>	<b>2,052,488</b>	<b>800,959</b>	<b>1,251,529</b>	<b>2,430,470</b>	<b>1,836,871</b>	<b>593,598</b>
<b>INCOME TAX (TOTAL)</b>	<b>3,993,721</b>	<b>770,401</b>	<b>3,223,320</b>	<b>4,258,165</b>	<b>800,959</b>	<b>3,457,206</b>	<b>4,877,492</b>	<b>2,626,023</b>	<b>2,251,468</b>
<b>Total land-tax</b>	<b>179,449</b>		<b>179,449</b>	<b>185,440</b>		<b>185,440</b>	<b>179,092</b>		<b>179,092</b>
<b>Total real estate tax</b>	<b>121,012</b>		<b>121,012</b>	<b>128,553</b>		<b>128,553</b>	<b>163,284</b>		<b>163,284</b>
<b>PROPERTY TAXES (TOTAL)</b>	<b>300,461</b>		<b>300,461</b>	<b>313,992</b>		<b>313,992</b>	<b>342,376</b>		<b>342,376</b>
<b>Total VAT</b>	<b>3,505,572</b>	<b>3,472,580</b>	<b>32,991</b>	<b>3,989,752</b>	<b>3,945,143</b>	<b>44,609</b>	<b>4,369,875</b>	<b>4,332,922</b>	<b>36,953</b>
excises on vodka, liqueurs, brandy and other alcoholic beverages	106,212	105,094	1,118	310,427	304,285	6,141	293,891	293,451	440
excise on beer	189,169	189,169		178,999	178,999		173,085	173,085	
excise on tobacco products	227,274	227,032	243	213,642	213,642		174,845	174,845	
<b>Total excise duties</b>	<b>533,370</b>	<b>527,414</b>	<b>5,956</b>	<b>710,281</b>	<b>702,851</b>	<b>7,430</b>	<b>648,015</b>	<b>647,040</b>	<b>975</b>
<b>Total road taxes</b>	<b>259,113</b>	<b>154,569</b>	<b>104,544</b>	<b>496,921</b>	<b>272,991</b>	<b>223,931</b>	<b>454,772</b>	<b>235,692</b>	<b>219,080</b>
<b>Total natural resources payments</b>	<b>33,818</b>		<b>33,818</b>	<b>32,039</b>		<b>32,039</b>	<b>37,271</b>		<b>37,271</b>
license fee for specific types of activity	432,141	431,341	800	167,298	166,545	753	1,303,211	1,302,429	782
<b>INTERNAL TAXES ON GOODS AND SERVICES (TOTAL)</b>	<b>4,801,659</b>	<b>4,587,952</b>	<b>213,707</b>	<b>5,431,556</b>	<b>5,089,573</b>	<b>341,983</b>	<b>6,851,786</b>	<b>6,521,152</b>	<b>330,634</b>
dividends in respect of state share in the joint stock companies	249,185	247,227	1,958	143,378	139,896	3,482	93,270	85,983	7,287
breakdown of state/ municipal enterprise net profit	67,687	65,886	1,801	37,344	33,725	3,619	43,464	41,534	1,930
natural resources rent	3,162	36	3,126	3,994	53	3,941	3,134	-32	3,166
payment for agricultural land lease	21,446		21,446	26,409		26,409	30,873		30,873

REVENUES	2012			2013			2014		
	National Public Budget	Including State Budget	Including Local Authorities Budget	National Public Budget	Including State Budget	Including Local Authorities Budget	National Public Budget	Including State Budget	Including Local Authorities Budget
payment for lease of lands with destination other than agricultural	48,469	68	48,401	52,344	87	52,256	58,854	92	58,762
rent/lease of public property	14,389	910	13,479	15,731	64	15,668	16,786	57	16,729
other property-related revenues	5,391	25	5,365	7,412	34	7,378	7,752	9	7,743
Patent fee for entrepreneurs	34,311		34,311	36,648		36,648	37,047		37,047
<b>OTHER REVENUES FROM ENTREPRENEURIAL ACTIVITY (TOTAL)</b>	<b>444,039</b>	<b>314,151</b>	<b>129,888</b>	<b>323,261</b>	<b>173,859</b>	<b>149,402</b>	<b>291,180</b>	<b>127,643</b>	<b>163,537</b>
<b>ADMINISTRATIVE FEES AND PENALTIES (TOTAL)</b>	<b>185,265</b>	<b>143,077</b>	<b>42,188</b>	<b>193,674</b>	<b>160,407</b>	<b>33,267</b>	<b>219,177</b>	<b>177,658</b>	<b>41,518</b>
<b>TOTAL PLANNED REVENUES/PAIED TO THE SB AND BTAU BY STS</b>	<b>10,176,281</b>	<b>5,995,313</b>	<b>4,180,968</b>	<b>10,998,645</b>	<b>6,398,920</b>	<b>4,599,725</b>	<b>13,086,317</b>	<b>9,614,877</b>	<b>3,471,440</b>
mandatory social security contributions paid by employers	5,028,623			5,453,920			6,204,350		
individual mandatory social security contributions	1,497,310			1,623,325			1,764,834		
individual mandatory social security contributions paid by agricultural land owners	7,333			7,966			8,447		
interest on overdue payment (fine) calculated for the nonpayment in due term of the mandatory social security contributions by the employer	16,997			16,420			15,338		
interest on overdue payment (fine) calculated for the nonpayment in due term of individual mandatory social security contributions	6,197			7,317			6,998		
administrative fines and penalties	146			369			638		
fines in respect of state social security budget	1,155			1,700			1,673		
expenses of temporary incapacity for work	568,472			7,111,017			8,002,277		
<b>STATE SOCIAL SECURITY BUDGET (TOTAL)(5)</b>	<b>7,126,233</b>			<b>1,874,707</b>			<b>2,319,802</b>		
mandatory health insurance premiums paid by employers and employees	1,723,202			908			842		
<b>MANDATORY HEALTH INSURANCE FUND (TOTAL)(6)</b>	<b>1,725,581</b>			<b>1,876,409</b>			<b>2,321,998</b>		

<sup>1</sup> Dohrmann and Pinshaw (2009) provide an overview of work done by tax administrations around the world calculating their countries' tax gaps.

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<sup>2</sup> Phua (2011) provides an overview of the data tax authorities are increasingly collecting – and the international agreements coming into force which reduce companies’ and individuals’ ability to operate in the gray and black markets which contribute to these tax gaps.

<sup>3</sup> Gemmill and Hasseldine (2012) provide an overview of these methodologies.

<sup>4</sup> The reader only needs to employ simple common sense to arrive at these figures. As we show in the Appendix, personal income attracts 7% and 15% marginal taxation. Business taxes come to around 3% of turn-over or 12% of profits (depending on the company’s size). Even a ball-park guess at the effective tax rate – or the rate which weights the amount of money taxed at different rates – places that effective tax rate at around 8% to 10%. Of course, we show the exact calculations later in this paper.

<sup>5</sup> The intuition for this estimate is as follows. If we remove 20% of all value-added to the economy, 80% of economic value remains. If we tax another 7% -- then 93% of that first 80% remains. If we tax yet another 7% on top of that result, 70% of the original value of the economy remains. Thus, taxes have removed 30% of that original value.

<sup>6</sup> Assuming an already existing tax gap, if GDP grows faster than tax collections, the economy generates more value which does not fall into tax collectors’ hands. If GDP grows more slowly than collections, we may infer (under certain conditions) that collections are closing the already existing tax gap.

<sup>7</sup> Recall that we can not simply add up the personal income tax gap (as a percent of GDP), business and VAT gap because the total share of the economic pie shrinks as each tax is applied.

<sup>8</sup> If the reader wants to incorporate these deductions into future tax gap estimates, they may use a statistical sample of existing tax declarations to find average deductions (as a percent of income/tax declared, etc.) as the basis for writing down these tax gap estimates.

<sup>9</sup> Workers in this paper refer to Moldovans earning income taxable at the main individual income tax rates. Different rules govern the way that employees, self-employed persons and consultants accrue and pay taxes. We focus in this paper on the major intuitions of tax gap analysis (rather than specific estimates taking the contractual complexities of these workers into account).

<sup>10</sup> See Appendix I for tax brackets. Almost all categories of workers pay the 1,950 lei per year (as 7% of income earned up to the threshold of 27,852 lei per year). The green bars thus show extra tax payments resulting from a 15% tax rate on income earned. For example, taxed paid by IT workers – on average – come to 1,950 lei on their first 27,852 lei of income. They subsequently pay 15% on roughly 73,000 lei – resulting in 11,000 lei per year of payments on income taxed at the higher tax rate.

<sup>11</sup> The word “expected” in this context usually means the relevant personal income tax rate multiplied by **estimated** income. The word “estimated” refers to the amount of tax we think particular Moldovans or groups of Moldovans (like doctors, city-dwellers, etc.) should pay, based on general averages about the group(s) to which they belong. Thus, when we use the words “expected” and “estimated” in this paper, we refer to these statistical meanings.

<sup>12</sup> A standard deviation is defined by the range for which roughly 70% of the observations – in this case expected monthly tax payments – fall above or below the average. For the lower range, incomes of around 3000 lei produce tax obligations of around 220 lei and 800 lei (calculating taxes due according to the marginal tax rates described in the Appendix). Multiplying incomes of around 6475 lei per month (namely one standard deviation higher than the average monthly income) by 12%-14% produces a similar range of estimates for higher-income earners (as income increases, the effective tax rate moves from 7% toward 15%).

<sup>13</sup> For Moldovans earning 8000 lei per month, the effective tax rate comes to around 13%.

<sup>14</sup> This sentence is hard to read because it describes a process better represented by the equations shown in the Appendix. Nevertheless, the sentence correctly describes the mathematics used.

<sup>15</sup> These refer to the exact category names in the financial statements prepared by the Ministry of Finance for *Labour Force Expenditures*.

<sup>16</sup> The original data source lists various social contributions and other deductions taken from employees’ pay checks. However, deductions for income taxes (assessed by businesses rather than by individuals themselves) do not appear in the data. We thus assume that these deductions are not made.

<sup>17</sup> A major reason for the discrepancy comes from very large value of imports which comes to 33% of all consumption. If we increase our estimate of 16.3 by 133%, we arrive at 21.7 billion – a value significantly larger than our estimate. This discrepancy points to possible under-declaration of VAT of imports (assuming Moldova assesses VAT on imports).

<sup>18</sup> We purposely avoid the discussion of GDP accounting in this paper to focus on the simple mechanics of expectation-based estimates. Most tax gap methodologies we cite in this paper will describe at length how to use national macroeconomic accounting when devising tax gaps. **We purposely avoid discussing the usual macroeconomic accounting framework to focus on the more important intuition-building material in this current paper.**

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<sup>19</sup> For a graphical illustration of Moldova's tax revenue to GDP, see <http://www.tradingeconomics.com/moldova/tax-revenue-percent-of-gdp-wb-data.html>

<sup>20</sup> We put this point here, rather than in the first section to follow the flow of the paper. We present this core principle, having illustrated how to break-down tax gap estimates by sector/strata and then add them together.

<sup>21</sup> For the VAT estimate we use, see budget line 115(1-2). We assume the figures on the budget line represent payments rather than receivable obligations.

<sup>22</sup> As previously mentioned, we describe nominal values of taxes as these are the values the tax authority actually deals with. If we used real values (adjusted for changes in prices), we would generate figures which tax specialists in the State Tax Service would have difficulty calculating by themselves.

<sup>23</sup> We found the difference in growth rates for 2014 from 2013 of 3%. We then multiplied the extra nominal value-added by 3% to arrive at the amount of money VAT collections failed to keep up with macroeconomic value-added.

<sup>24</sup> We use the phrase "over time" as the accounting for certain goods and services may differ in any specific time period, depending on whether the company uses cash or accrual basis. A company might contract to buy a good in November 2014 (for example) but pay in February 2015. Over time, these lagged payments will cancel out (as everything bought is eventually paid for). But over the one year horizon, these payment lags may cause slight problems in reconciling the value of inputs paid for with a sector's value-added which the tax authority shaves 20% off the top of.

<sup>25</sup> Reported in sheet Allocation of Primary Income Account by Indicators and Years.

<sup>26</sup> From the table *Paid Services Rendered to Population by Officially Registered Firms* from the Moldovan Statistics Office.

<sup>27</sup> We put the phrase "and paid" in brackets – as we were informed that the database shows tax incidence (amount of money the tax payer owes) rather than the amount of cash actually received.

<sup>28</sup> Maybe the Moldovan authorities are aware of these differences and only the outside observer is not aware of them. In which case, the reporting of individual and aggregate tax data may wish to include explanations to describe the reason for these differences across data source.

<sup>29</sup> We don't have the space here to describe exactly why this is so. Readers familiar with macroeconomic data will know about the estimations and problems inherent in those data as well. In theory, a micro database should be more reliable than a macro-economic database full of assumptions and estimates. Yet, because the macroeconomic database provides an "envelope" (or final result for the entire economy), these macro-data provide a better point to end with than the micro-data.

<sup>30</sup> As the data from the taxpayers' database reflect declarations (rather than cash payments), the weaknesses we describe focus on tax assessments. A different set of issues could affect cash collection – if we could find a database which compared declarations versus payments at the individual or group level.

<sup>31</sup> see <http://www.havocscope.com/country-profile/>

<sup>32</sup> The 2% figure does NOT include under-declaration or tax avoidance by companies already registered and/or paying tax. This estimate comes from the black economy, a segment of the economy where few large scale (or groups of small-scale) companies can operate profitably.

<sup>33</sup> This assumes that tax payers do not try to compensate for lost revenue by avoiding previously paid taxes.

<sup>34</sup> A simple Google search of "tax gap" will yield studies from over 10 countries – including the US, Sweden and even countries in areas far more under-developed than Moldova. Instead of providing a summary of this literature, we invite the reader to find the ones they find most useful.

<sup>35</sup> The interested reader can simply Google "Excel and matrix math" or "dot product" to see how to use vector math in an Excel environment.

<sup>36</sup> This is called a ceiling function. The variable is allowed to take values up to a certain ceiling – after which any overflow is dumped into another variable.

<sup>37</sup> As explicitly mentioned throughout this paper, we refer to nominal rather than real variables. This discussion gives the reader a sense for the difference between real and nominal variables.