**VAT Gap Model – Consumption Approach**

**Using**

**Supply and Use Tables**

**In Microsoft Excel**

**Definition of the VAT Gap:** The VAT Gap refers to the **VAT Policy Gap** or the **VAT Compliance Gap**. The VAT Policy Gap is the difference between the **Potential VAT collectible under a benchmark or standard regime**[[1]](#footnote-1) of the VAT (where there are no exemptions, lower rates or special treatment of any type of consumption or sector/class of taxpayers), and the **Potential VAT collectible under the current regime[[2]](#footnote-2)** (which includes any special treatment of consumption or sector/class of taxpayers). The VAT Policy Gap estimates the revenue foregone due to the current policy of the government. The VAT Compliance Gap is the difference between this **Potential VAT collectible under the current regime** and the **Actual VAT collection**. The VAT Compliance Gap estimates the gap in VAT due to non-compliance by taxpayers. In this note we aim to estimate both the Policy Gap as well as the Compliance Gap for Palestine.

Policy Gap = Potential VAT collectible under a Benchmark VAT system – Potential VAT collectible under Current Policy

Compliance Gap = Potential VAT collectible under Current Policy – Actual VAT collected

**Standard Methodology of estimating VAT Gap in Brief:**

In order to calculate the potential VAT, we apply the VAT policy, either benchmark or current policy to the consumption of the different commodities or services.

Potential VAT = Final Consumption \* Tax Rate -----------------------(1)

The potential VAT could also be derived alternatively which links the consumption side with the production side that generates the goods and services being consumed.

The Supply-Use Tables that forms part of the national accounts provides the information of the final consumption as well as the production and use of goods and services in the economy.

Supply Table: Supply Table shows the supply of all ‘m’ commodities into the economy with the supply of commodities shown in rows and the ‘n’ industry/sectors that supply them in columns. Hence cell [5,7] would show the supply of commodity ‘5’ by industry ‘7’. Supply could be from domestic production or from Imports. In the figure below, Domestic production/supply is shown below as a ‘m’ x ‘n’ matrix by the ‘m’ Commodities and the ‘n’ Industries that supplies these commodities. Imports (M) are shown by commodity in one column though in some countries, it may also be provided in an ‘m’ x ‘n’ matrix showing the imports of ‘m’ commodities by each of the ‘n’ industries. The Supply Table also includes by commodity, the Trade/Transport margins (R) and the tax or subsidies by commodity (T). Here too such column vectors could also be available as an ‘m’ x ‘n’ matrix.

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| --- | --- |
| **SUPPLY TABLE** | **USE TABLE** |

Use Table: The Use Table provides the use of commodities in the economy. Use of commodity is shown in the figure below as Use of commodity by Industry (Intermediate Use) represented as an ‘m’ x ‘n’ matrix , use by Final Consumers (FC), use for Gross Capital Formation (GCF) and finally use by Exporters (E) shown as column vectors. Here too it is possible that the Gross Capital Formation and Exports are shown as an ‘m’ x ’n’ matrix showing the sectors that use or export these commodities respectively.

Potential VAT = -----------------------(2)

Where is a column vector of the rates of VAT applied to the m commodities. This also allows us to obtain the potential VAT for each of the ‘m’ commodities. This is known as the **consumption approach**.

Potential VAT could also be calculated by industry **(production approach)**. However, this requires the information (2) to be converted into a ‘m’ x ‘n’ matrix form. Further, it would also be useful to also get the various components of the VAT calculation from the point of view of the business/industry paying the VAT. This requires the use of the identity that the **total Supply of a commodity should be equal to its total Use**.

From the Supply and Use Tables this implies,

Domestic Supply (S) + Imports (M) + Margins (R) + Tax (T) = Intermediate Use (U) + Final Consumption (FC) + Gross Capital Formation (GCF) + Exports (E) -----------------------(3)

Note that as the supply of each commodity shown in the Supply table includes taxes which is equal to the use of each commodity as shown in the Use table, **taxes on the commodity is included in the use of each commodity**. These taxes include the VAT. This means that the Final Consumption vector shown in the Use table includes the VAT as well as other taxes levied on commodities such as excise taxes and customs duty. As the base of the VAT includes all taxes embedded in the prices of the commodity, Final consumption in equation (2) is related to the Final Consumption vector (FC) in the user table as follows:-

Final Consumption = FC – VAT[[3]](#footnote-3) ---------------------------(4)

Where the VAT a column vector that is the embedded VAT in the Supply table by commodity.

From equations (2), (3) and (4) we obtain,

VAT Potential = =

---------(5)

Note that the sum of Margins across commodities = 0, as any positive Trade/Transport margin paid by the non-Trade sector is balanced by positive margins earned by the Trade sectors. Hence this term does not appear in (5).

As column vectors, (GCF), (M) and (T) could be allocated to industries, they could be converted to rectangular matrices, [GCF]mxn , [M]mxn and [T]mxn . Hence the right-hand side of Equation (4) would be an ‘m’ x ‘n’ which when added across all the rows (commodities) allows us to summarize the VAT Potential by industry.

This means that the VAT potential could be obtained by industry and which allows us to compare it to actual VAT Collection which is typically available by industry from the tax administration.

**Supply-Use Tables and the treatment of Gross Fixed Capital for households:** Gross Fixed Capital (GFC) is shown as a column vector in the Use table and shows the use of various commodities to create Fixed Capital. The use of the commodity into capital is because capital lasts beyond the current year unlike consumption.

However, GFC is either used by business where it forms part of their business inputs or by governments and households. Where governments are represented as an industry referred to as ‘Public Administration…”, such capital inputs would also be costs in their budgets. Hence any entry in the GFC column could be allocated to the different industries. In the case of households however, GFC no such allocation of inputs is possible and hence GFC ‘used’ by households need to be reflected as final consumption. This is especially relevant for GFC created by the construction sector and household ‘consumption’ of the capital created by the construction sector would be houses built for households.

**Complexities associated with VAT Policies:** Under a benchmark VAT regime, equation (2) would be sufficient to estimate the VAT Potential. Estimating the VAT Potential under current VAT policy is more challenging because VAT Policy may include exemptions.

Under VAT policy, any business providing exempt supplies are not allowed to claim input tax credit to the extent of their exempt supplies. If this exempt supply is an intermediate good then it implies for example, that a business selling 40% of their supplies of this intermediate goods that are exempt are not allowed to claim credit of 40% of their input tax credits. However, this business would continue its activities which eventually result in final consumption. This means that while VAT is collected on final consumption, the disallowed input tax credit implies additional revenue for the government. Hence,

Potential VAT under current law =

+ Disallowed Input Tax Credit --------(6)

Where is a column vector of the rates of VAT applied to the ‘m’ commodities where the entries are zeros where supplies of such commodities are exempt.

Equation (6) is applicable when the supply of the commodity that is exempt is an intermediate good. However, when the commodity that is exempt is a final consumption good it only results in reduced tax without the additional tax from the disallowed input tax credit.

Notation – individual cells of the Supply (S) and Intermediate Use (U) matrices are referred to by commodity ‘c’ as well as industry ‘i’ and is denoted as and respectively. Column vectors given by commodity have the subscript ‘c’ such as for Exports, Trade/Transport Margins , Imports , Gross Fixed Capital Formation , Imports and Taxes . Row vectors are given by industry subscript have the subscript ‘i’. is the summation of intermediate use across all commodities for industry ‘i’ i.e. total intermediate use by industry ‘i’ while is the summation of supply across all commodities for industry ‘i’ i.e. total supplies by industry ‘i’. Similarly, is the summation of intermediate use across all industries of commodity ‘c’ i.e. total intermediate use of commodity ‘c’ while is the summation of supply across all industries of commodity ‘c’ i.e. total use of commodity ‘c’.

**Figure-1: Sector-wise Use: Summation across commodities of Supply Table**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Industry  Commodity | Agriculture | Manufacturing | Trade | Hotel |  |  | Investment |  |  |
| Agricultural commodities |  |  |  |  |  |  |  |  |  |
| Manufactured commodities |  |  |  |  |  |  |  |  |  |
| Wholesale Trade Services |  |  |  |  |  |  |  |  |  |
| Tourism Services |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

**Figure-2: Sector-wise Use: Summation across commodities of Use Table**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Industry  Commodity | Agriculture | Manufacturing | Trade | Hotel |  |  | Investment |  |  |
| Agricultural commodities |  |  |  |  |  |  |  |  |  |
| Manufactured commodities |  |  |  |  |  |  |  |  |  |
| Wholesale Trade Services |  |  |  |  |  |  |  |  |  |
| Tourism Services |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

**Model for estimating potential VAT and VAT Gap – Consumption approach:** The Excel Model estimates the VAT base as shown in equation 5. However before we apply the formulae we need to reallocate column vectors to the various industries.

**Re-allocating commodity vectors to industries**

While Supply and Use are available by commodity as well as industry, the other terms are sometimes only available by commodity. Hence these need to be allocated across industries. In the consumption approach we need to estimate the input tax credits for each sector. This requires the investment or Gross Fixed Capital Formation vector to be distributed across the various sectors. In order to do so we apply the following assumption,

1. VAT is a column vector by commodity ‘c’ in the Supply Table are allocated first to the components of the Use Table, Intermediate Use, Final Consumption, Investment and Exports in the ratio of the total Intermediate Use, Final Consumption, Investment (as VAT does not apply to exports we do not allocate VAT to it).

Then the VAT which are allocated to Intermediate Use which is a column vector by commodity is further allocated by industry ‘i’ in the ratio of the total intermediate use of that commodity by that industry to the total intermediate use of that commodity across all industries.

-------------------------------- (6)

|  |
| --- |
| **VAT** |
| Commodity |
| Agricultural commodities |
| Manufactured commodities |
| Wholesale Trade Services |
| Tourism Services |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Industry  Commodity | Agriculture | Manufacturing | Trade | Hotel | Total Intermediate Use | Final Consumption | Investment (GFC) | Exports |
| Agricultural commodities | I11 | I12 | I13 | I14 |  |  | I1. |  |
| Manufactured commodities | I21 | I22 | I23 | I24 |  |  | I2. |  |
| Wholesale Trade Services | I31 | I32 | I33 | I34 |  |  | I3. |  |
| Tourism Services | I41 | I42 | I43 | I44 |  |  | I4. |  |
|  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Industry  Commodity | Agriculture | Manufacturing | Trade | Hotel |  | Final Consumption | Investment (GFC) | Exports |
| Agricultural commodities | V11 | V12 | V13 | V14 | V1. |  |  |  |
| Manufactured commodities | V21 | V22 | V23 | V24 | V2. |  |  |  |
| Wholesale Trade Services | V31 | V32 | V33 | V34 | V3. |  |  |  |
| Tourism Services | V41 | V42 | V43 | V44 | V4. |  |  |  |
|  |  |  |  |  |  |  |  |  |

1. Gross Capital Formation net of VAT (as calculated above) by commodity ‘c’ are allocated to industry ‘i’ in the ratio of the intermediate use by industry (i) to the total intermediate use across all industries

-------------------------------- (7)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Industry  Commodity | Agriculture | Manufacturing | Trade | Hotel |  |  | Investment  (GCF - ) |  |  |
| Agricultural commodities | I11 | I12 | I13 | I14 |  |  | I1. – V1I |  |  |
| Manufactured commodities | I21 | I22 | I23 | I24 |  |  | I2. – V2I |  |  |
| Wholesale Trade Services | I31 | I32 | I33 | I34 |  |  | I3. – V3I |  |  |
| Tourism Services | I41 | I42 | I43 | I44 |  |  | I4. – V4I |  |  |
|  |  |  |  |  |  |  |  |  |  |

**Figure 5: Removing embedded VAT from Intermediate Use and final Consumption**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Industry  Commodity | Intermediate Consumption - VAT | | | | | Final Consumption - VAT |  |
| Agriculture | Manufacturing | Trade | Hotel |  |  |  |
| Agricultural commodities | U11 - V11 | U12 - V12 | U13 - V13 | U14 - V14 |  | FC14 - V1FC |  |
| Manufactured commodities | U21 - V21 | U22-V22 | U23 - V23 | U24 - V24 |  | FC24 - V2FC |  |
| Wholesale Trade Services | U31 - V31 | U32 - V32 | U33 - V33 | U34 - V34 |  | FC34 - V3FC |  |
| Tourism Services | U41 - V41 | U42 - V42 | U43 - V43 | U44 - V44 |  | FC44 - V4FC |  |
|  |  |  |  |  |  |  |  |

**Estimate the extent of exemptions for each industry:** In order to calculate the disallowed input tax credit, we need to calculate the proportion of supplies by each industry that is exempt. For this we need the exemptions under current law for each commodity. For example, 80% of agriculture commodities may be exempt, 10% of manufactured commodities are exempt, etc.

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  | Tax Rate | Percent of Exempt Supplies |
| Agricultural commodities |  |  |
| Manufactured commodities |  |  |
| Wholesale Trade Services |  |  |
| Tourism Services |  |  |
|  |  |  |

The vector of the percent of exempt supply is applied to the Supply matrix to each industry column.

[ES]mxn = [S]mxn ------------ (8)

where is the element wise (Hadamard) multiplication operator applied to each column, i.e. for each industry ‘i’, for row 1 of the vector is multiplied by row 1 of the ‘i’th column of the S matrix.

This gives us a matrix of the exempt supplies. This when added row wise for each industry gives us the exempt supply by industry.

Ei = ------------ (9)

**The Process to estimate the Potential VAT is as follows:-**

1. Remove the embedded VAT from the Use Table including Intermediate Use, Final Consumption and Investment (GFC) as shown above.
2. Allocate the Investment (GFC) to the industries as shown above
3. Apply the benchmark/current rates (column vector of commodity rates) to the Final Consumption vector after the Tax is removed (i.e. multiply the entries of the column vectors the tax rate for each commodity with the relevant final consumption of that commodity).

[VAT(FC)]c = FCc ------------ (10)

where is the cell wise multiplication operator

1. Calculate the total inputs for each industry. This is essentially the mxn matrix of purchases net of VAT [P],

[P]mxn = [U’]mxn + [I]mxn ------------ (11)

where [U’]mxn - [V]mxn

1. Apply the benchmark/current rates to each of the columns of the total input matrix (i.e. apply the column vector of the commodity rates with its use by each industry). This calculates the input tax credit for each commodity by each industry.

[ITC]mxn = [P]mxn ------------ (12)

1. Add the input tax credit for each industry to get a row vector of total input tax credit by industry.

[ITC]i = ------------ (13)

1. Apply the percentage of exempt supply by industry ‘i’ from equation (9) to the total input tax credit by industry to obtain the ITC disallowed.

[ITC-D]mxn = Ei [ITC]mxn ------------ (14)

where is the element wise multiplication operator now applied to each of the rows.

We are now able to calculate the VAT Potential as per equation (6), using equations (10) and (14), however, [VAT(FC)]c as shown in equation (10) is a column vector by commodity while [ITC-D]i in (14) is a row vector of industries.

[VAT(FC)]c can be allocated to industry in the ratio of the supply of that commodity by each industry from the Use table. i.e.

-------------------(15)

This converts the column vector into an mxn matrix of industry and commodity.

From (14) and (15) we obtain the VAT Potential by industry and commodity.

[VAT Potential] mxn = + [ITC-D]mxn -------------(16)

Summing Equation (16) by each industry gives us the VAT Potential by industry and allows us to calculate the Policy Gap and the Compliance Gap.

1. Benchmark VAT system is a VAT applied to all domestic consumption taxed at the standard rate of the country. No exemptions, lower rates or special treatment are applied to different classes of taxpayers. The only exception is a zero-rate applied to exports as this is consumption outside the country and does not come under the benchmark VAT system which only taxes domestic consumption. [↑](#footnote-ref-1)
2. Current Policy is the VAT applied under the VAT law applicable to the country. This would include any exemptions, special rates or special treatment for different classes of taxpayers. [↑](#footnote-ref-2)
3. It may seem odd that we need the VAT data in order to calculate the VAT potential. The Supply Use Table is prepared for the purpose of national accounts and the amounts and prices that are used to construct them are derived from surveys and actual data obtained from firms and households. The VAT that is part of these tables are the actual VAT paid. We intend to use the Supply Use Table to estimate the potential VAT and hence need to strip the tables of the embedded VAT. [↑](#footnote-ref-3)